JSLHR

Research Article

Feasible Implementation Strategies for Improving Vocabulary Knowledge of High-Risk Preschoolers: Results From a Cluster-Randomized Trial

Elizabeth Spencer Kelley,[a] R. Michael Barker,[b] Lindsey Peters-Sanders,[b] Keri Madsen,[b] Yagmur Seven,[b] Xigrid Soto,[b] Wendy Olsen,[b] Katharine Hull,[b] and Howard Goldstein[b]

Purpose: Many children begin school with limited vocabularies, placing them at a high risk of academic difficulties. The goal of this study was to examine the effects of a vocabulary intervention program, *Story Friends*, designed to improve vocabulary knowledge of at-risk preschool children.
Method: Twenty-four early-childhood classrooms were enrolled in a cluster-randomized design to evaluate the effects of a revised *Story Friends* curriculum. In each classroom, three to four preschoolers were identified as having poor language abilities, for a total of 84 participants. In treatment classrooms, explicit vocabulary instruction was embedded in prerecorded storybooks and opportunities for review and practice of target vocabulary were integrated into classroom and home practice activities. In comparison classrooms, prerecorded storybooks included target vocabulary, but without explicit instruction, and classroom and home strategies focused on general language enrichment strategies without specifying vocabulary targets to teach. Intervention activities took place over 13 weeks, and 36 challenging, academically relevant vocabulary words were targeted.
Results: Children in the treatment classrooms learned significantly more words than children in the comparison classrooms, who learned few target words based on exposure. Large effect sizes (mean d = 1.83) were evident as the treatment group averaged 42% vocabulary knowledge versus 11% in the comparison group, despite a gradual decline in vocabulary learning by the treatment group over the school year.
Conclusions: Findings indicate that a carefully designed vocabulary intervention can produce substantial gains in children's vocabulary knowledge. The *Story Friends* program is feasible for delivery in early childhood classrooms and effective in teaching challenging vocabulary to high-risk preschoolers.
Supplemental Material: https://doi.org/10.23641/asha.13158185

Early language skills are important and reliable predictors of later reading ability (National Early Literacy Panel, 2008; National Institute of Child Health and Human Development, 2000). In particular, vocabulary knowledge is a strong contributor to reading comprehension (Language and Reading Research Consortium & Logan, 2017; Quinn et al., 2015). Children with limited language skills in preschool and kindergarten are at a high risk of later reading failure and diagnosis with reading disability (Catts et al., 2002; Scarborough, 1998; Sénéchal et al., 2006), and children with limited vocabulary knowledge are likely to have comprehension deficits (Elwér et al., 2013; Nation et al., 2010).

Although substantial efforts have been devoted to improving oral language skills of young children, there continues to be concerning evidence that many early childhood settings do not provide adequate support for early language development (Carta et al., 2014; Dickinson, 2011; Greenwood et al., 2013; Wright, 2012). In a descriptive study of 65 early childhood classrooms, less than 10% of observed intervals involved language-focused teacher talk, and even fewer intervals involved vocabulary-focused teacher talk (Carta et al., 2014). Similar findings were reported by Dwyer and Harbaugh

[a]Department of Speech, Language and Hearing Sciences, University of Missouri, Columbia
[b]College of Behavioral and Community Sciences, University of South Florida, Tampa
Correspondence to Elizabeth Spencer Kelley: kelleyej@missouri.edu
Editor-in-Chief: Stephen M. Camarata
Received June 4, 2020
Revision received July 21, 2020
Accepted August 17, 2020
https://doi.org/10.1044/2020_JSLHR-20-00316

Disclosure: *Elizabeth Spencer Kelley and Howard Goldstein are authors of Story Friends published by Paul Brookes and receive royalties. The other authors have declared that no competing interests existed at the time of publication.*

 • Copyright © 2020 American Speech-Language-Hearing Association

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

(2018); in low-income preschool classrooms, teachers occasionally provided explicit vocabulary instruction when delivering science content but never during time focused on reading. Wright (2012) reported that explicit vocabulary instruction occurred only rarely across kindergarten classrooms and less often in classrooms serving low-income students.

Vocabulary Intervention in Early Childhood

There is compelling evidence that well-designed vocabulary interventions can improve the oral language skills of young children. In a meta-analysis of 67 vocabulary intervention studies with preschool and kindergarten children, Marulis and Neuman (2010) reported large effects for vocabulary learning ($g = 0.88$), although effects were much smaller for at-risk children from low-socioeconomic status families ($g = 0.77$) than for children from middle- to high-socioeconomic status families ($g = 1.35$). In many studies, vocabulary interventions have been delivered in shared reading activities with embedded, explicit lessons and have improved vocabulary knowledge of children with large effect sizes (Coyne et al., 2007; Justice et al., 2005; Loftus et al., 2010).

Although effect sizes have been moderate to large across studies, an examination of vocabulary gains in terms of number or percentage of words learned reveals only modest increases in vocabulary knowledge. For example, in Justice et al. (2005), children learned 2.3–2.7 new words on average of the 30 words included in the explicit teaching condition, and Penno et al. (2002) reported gains of 2.7 of 10 explicitly taught words. Coyne et al. (2010) reported gains of 23% of possible word points, and Neuman et al. reported gains of between 9% and 14% of words taught per unit (Neuman et al., 2011). In studies of kindergarten children with developmental language disorders, Storkel and colleagues (Storkel et al., 2019, 2017) reported learning of 17%–30% of words when dosage and frequency of exposure were optimized. When vocabulary intervention studies have included a delayed posttest, treatment effects are often maintained (Loftus et al., 2010; Neuman et al., 2011), but children retain only a portion of learned words (e.g., 70% in Coyne et al., 2007; 47% in Kelley et al., 2015). Although these gains are significant and meaningful, there is a need for interventions that can produce more robust effects, especially for at-risk children with limited oral language skills.

Increasing Effects on Vocabulary Knowledge

To increase effects of interventions on vocabulary knowledge, one approach is to simply teach more words. However, research has yet to resolve which words to teach or the optimal number of words to target simultaneously. Some intervention programs teach a wide variety of word types and purposefully include a substantial proportion of words that children are likely to know already. For example, Neuman et al. (2011) selected sets of vocabulary targets in which more than 40% of the words were likely to be familiar to preschool children. In each 24-day unit, teachers targeted between 50 and 80 words; thus, approximately 20–30 new words were taught in a month. Other programs have focused on challenging words unlikely to be known by preschool children. These programs often have followed guidelines by Beck et al. (2013) that argue that explicit instruction should focus on sophisticated vocabulary words with high utility for conversation and later reading. Within these programs, there is some variability in the number of words selected for instruction with a range typically between two to six per book and one book per week (e.g., Coyne et al., 2010; Loftus et al., 2010).

Outcomes of vocabulary interventions also can be improved by increasing how many of the taught words are learned. Characteristics of effective vocabulary intervention include explicit instruction, active engagement, and repeated exposure to instructional targets. In comparison to indirect teaching or incidental exposure, explicit teaching produces much larger gains on vocabulary learning (Coyne et al., 2007; Justice et al., 2005). Although some vocabulary learning takes place from incidental exposure (e.g., receptive knowledge of object labels; O'Fallon et al., 2020), children are rarely able to define or produce words for which they have had only incidental exposure (Coyne et al., 2009; Goldstein et al., 2016). Active engagement and giving children many chances to respond help children learn new words (Dickinson & Smith, 1994; Sénéchal, 1997). Repeated exposure to instructional targets by repeated readings of the story or discussion of the vocabulary words increases the likelihood that children will learn those words (Flack et al., 2018; Penno et al., 2002; Sénéchal, 1997; Stahl & Fairbanks, 1986). Repeated exposures can also be achieved within embedded lessons; in a recent study of a vocabulary intervention for kindergarten children with language disorders, Storkel et al. (2017) identified 36 as the number of exposures to target vocabulary necessary to provide maximum gains.

Implementation in Educational Settings

One challenge to effective oral language intervention is implementation in authentic education delivery settings (Foorman & Moats, 2004). High-fidelity implementation is critical to the effectiveness of interventions and, consequently, the improvement of educational outcomes (Justice et al., 2008; Kaderavek & Justice, 2010; O'Donnell, 2008). Efficacy studies in which researchers are involved to ensure high implementation fidelity allow interventions to be implemented with precision and rigorous standards. However, when interventions move to teacher-implemented settings, implementation fidelity can be reduced (Hulleman & Cordray, 2009). To address this challenge, it is important to consider feasibility of implementation from the earliest stages of development and identify flexible, effective strategies that are useful and feasible for teachers and families in early childhood settings.

To increase feasibility of implementation in early childhood classrooms, interventions have often been designed to fit into existing routines and practices of early childhood

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

classrooms. Many successful interventions have taken advantage of the widely used practice of shared storybook reading (e.g., Beck & McKeown, 2007; Coyne et al., 2007; Dickinson et al., 2019). Other common routines of the early childhood classroom (e.g., rotations through learning centers, morning meetings, teacher-led small group activities) provide opportunities to deliver practice or repeated exposure to instructional targets. For example, Neuman et al. (2011) included journal writing activities as part of a vocabulary intervention program. Hadley et al. (2019) embedded vocabulary instruction into directed play activities and reported large treatment effects.

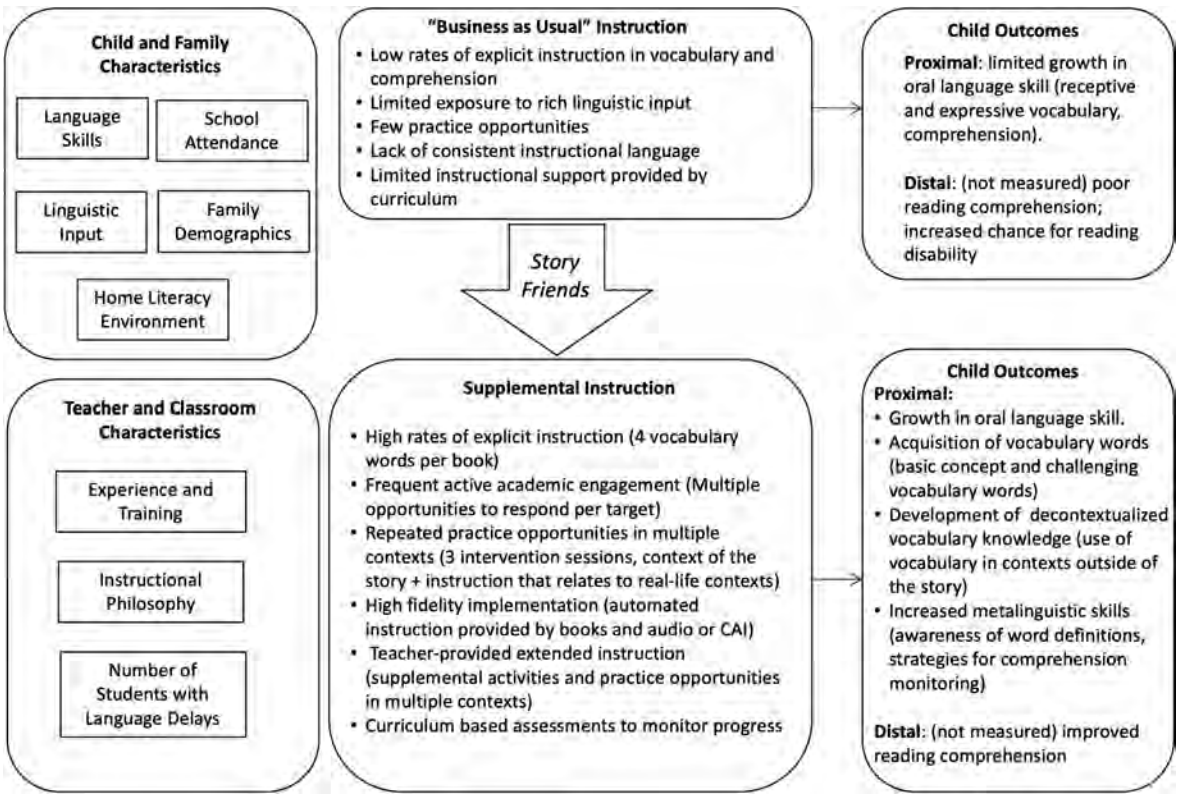
Because the language experiences of young children at home are important contributors to language and literacy development (Dickinson & Tabors, 1991), effective interventions can extend beyond the classroom and include the families of young children. Similar to the classroom, feasibility of implementation can be improved by consideration of contexts, practices, and routines of families. Intervention programs that are carefully designed can be effective for families with limited resources (e.g., Smith et al., 2005; Soto et al., 2020).

Story Friends: Theory of Change and Previous Studies

The *Story Friends* program is a supplemental vocabulary program designed for implementation in early childhood classrooms. The theory of change for the *Story Friends* program was formulated through previous research and an iterative development process informed by multiple stakeholders (see Figure 1 for theory of change). Contextual factors (e.g., demographics of children and teachers) as well as characteristics of preschool classrooms and instruction guided decisions about the design and delivery of instruction. The storybook context was selected based on previous research for vocabulary instruction and as a practice that would be readily accepted by preschool teachers and incorporated into classroom routines. We designed an automated format for delivery of instruction, with prerecorded storybooks and vocabulary lessons, to be easy to implement by educational staff and not requiring extensive preparation or training. To increase the potential for high-fidelity implementation, we also tailored the structure and length of the sessions to a typical 15-min, small-group center rotation. Key stakeholders were engaged in both the design and revisions to the program. By focusing on feasibility of implementation, this development approach was designed to produce an intervention that would be readily adopted and sustained in a variety of early childhood settings (Kelley & Goldstein, 2015).

The *Story Friends* program has been developed and evaluated in a series of studies (summarized in Kelley & Goldstein, 2015). The findings from early efficacy studies using single-case experimental designs (Kelley et al., 2015; Spencer et al., 2012) and cross-site replications (Greenwood

Figure 1. Theory of change for the *Story Friends* program.



Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

et al., 2016) informed revisions and refinements to the program, which was then evaluated in a cluster-randomized trial in 32 classrooms with 195 participants (Goldstein et al., 2016). In the cluster-randomized trial, large, significant treatment effects were observed for the learning of target vocabulary words. Participants in the treatment classrooms learned an average of 3.4 word points of a possible 12 per unit, with large effect sizes of 0.70 (Cohen's f^2). Fidelity of implementation was high, and teachers rated the program highly for acceptability and feasibility of use.

In the randomized controlled trial (RCT), participants in the experimental condition learned an average of 28.3% of target vocabulary. Although this percentage is higher than in other similar studies of vocabulary intervention, it is consistent with the common finding that children learn only a small percentage of vocabulary words taught. Thus, we resolved that the next iteration of the *Story Friends* program should focus on instructional strategies that could improve student learning. Two specific areas of improvement were targeted: increasing the number of words taught (Peters-Sanders et al., 2020) and providing opportunities for review and practice in the classroom (Seven et al., 2020) and at home (Soto et al., 2020). As with previous *Story Friends* work, the development efforts continued to focus on high-fidelity implementation in authentic educational settings.

The Current Study

The purpose of the current study was to evaluate the effects of the revised *Story Friends* program on vocabulary knowledge of preschool children. We sought to address two important challenges identified in previous research: the modest number of words learned and the feasibility of implementation in educational settings. Our previous studies have established the efficacy of the automated listening centers. In this study, the revised *Story Friends* program doubled the number of vocabulary targets per book and included materials to facilitate review and practice strategies across the day in the classroom and at home.

The following research questions were addressed:

1. What are the effects of the *Story Friends* program on preschoolers' learning of target vocabulary words?
2. Are observed treatment effects moderated by preintervention language scores or intervention dosage?
3. To what extent is vocabulary knowledge retained after intervention?
4. To what extent is the program implemented as intended, and what are parent and teacher ratings of the program?

Method

Experimental Design

This study represents a Hybrid Type 2 study (Curran et al., 2012) in which we combined an examination of both treatment efficacy and implementation of the *Story Friends* intervention package. The foundation of the efficacy component of our study was the automated listening center conditions that sought to control the dosage of exposure to prerecorded story books with and without explicit vocabulary instruction. The implementation component focused on strategies that could be implemented flexibly across the day in the classroom and at home. Materials and training sought to facilitate those interactions between children and adults, but dosage varied largely under the control of the adults.

The study used a cluster-randomized design with children nested in classrooms. Preschool classrooms were randomly assigned to the treatment or comparison condition using ranked pairs. Participating classrooms were rank-ordered by research staff familiar with the classrooms on three criteria: (a) the extent to which the classrooms were responsive and facilitative of the *Story Friends* program, as well as general administrative infrastructure and resources; (b) proportion of low-income families served at the center; and (c) the quality of the classroom structure including the presence of planned activities and routines. Using the ranked list, classrooms were paired (e.g., 1 and 2, 3 and 4) and members of each pair were randomly assigned to treatment or comparison conditions.

Setting

Participants were teachers and children in 24 early childhood classrooms in two states (seven classrooms in Missouri and 17 in Florida). Classrooms selected served primarily children from families with low incomes and included full-day and half-day programs in session 4–5 days per week; 19 classrooms were 5 days per week, and five classrooms were 4 days per week.

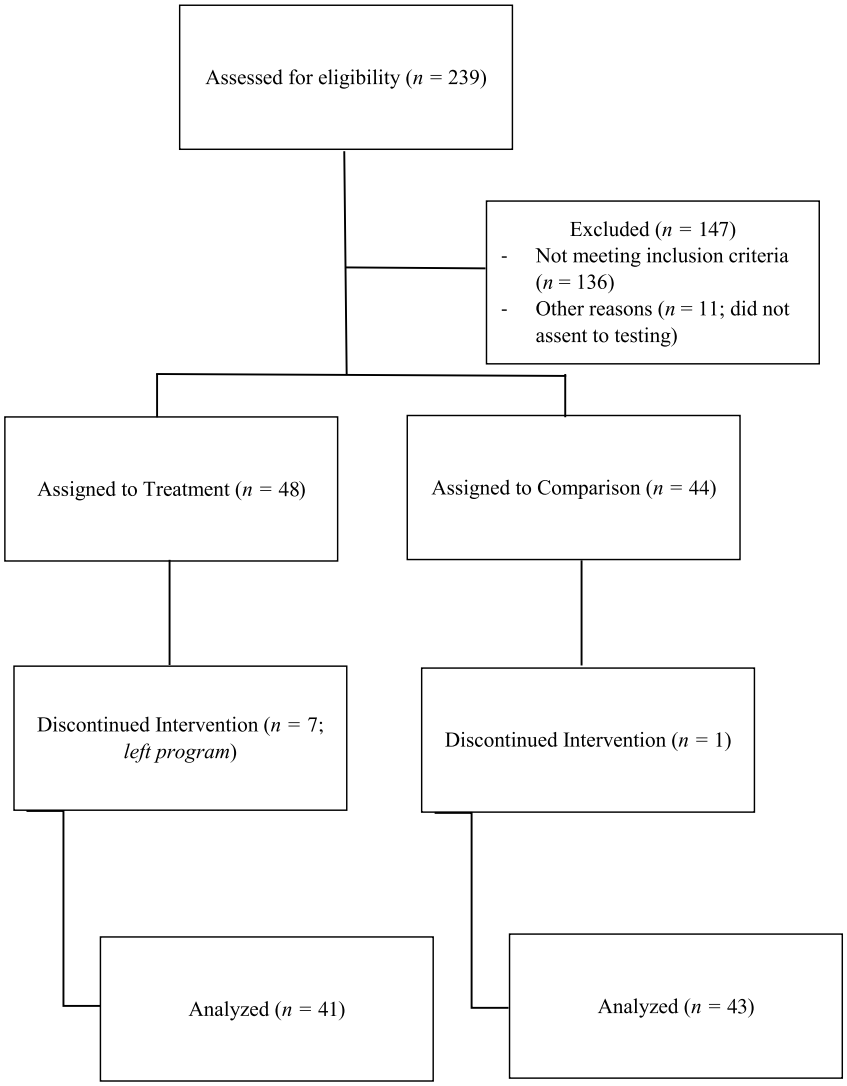
Participants

Informed consent documents were shared with families in the 24 classrooms. Because the family strategies were available only in English, children in families who did not speak some English were not included. We used teacher report to identify families who spoke sufficient English to participate. We sought to identify children with oral language skills below age expectations who could benefit from the *Story Friends* intervention. Based on our previous research, we determined that children with low to below-average oral language skills were good candidates, whereas children with very limited oral language were unlikely to learn from listening to stories and instruction that they did not fully comprehend.

For participants who returned signed consents, we considered information from the Oral Language screening measures of the Individual Growth and Development Indicators (IGDIs; Bradfield et al., 2014); a measure of receptive vocabulary, that is, the Peabody Picture Vocabulary Test–Fourth Edition (PPVT-4; Dunn & Dunn, 2007); and an omnibus measure of oral language, that is, the Clinical Evaluation of Language Fundamentals Preschool—Second Edition (CELF-P2; Wiig et al., 2004), to identify participants

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

Figure 2. CONSORT diagram showing the flow of participants throughout the experiment.



(see CONSORT table, Figure 2). First, all eligible children completed the two IGDI Oral Language screening measures: Picture Naming and Which One Doesn't Belong. IGDIs were administered individually to children using tablet computers. On the Picture Naming IGDI, children were asked to verbally label a set of 15 pictures. On the Which One Doesn't Belong IGDI, children were presented with three pictures (e.g., *bus, butterfly,* and *car*) and asked to select the picture that did not belong. Children who scored below benchmark on either of the two measures remained in the pool of potential candidates.

Next, children were given the PPVT-4 and CELF-P2. Our inclusionary criteria were standard scores on either the PPVT-4 or CELF-P2 between 0.5 and 2 *SD*s below the normative mean (70–92). In each classroom, three to four children who met these criteria were selected as participants. In most classrooms, the first children who met these criteria were selected. In some cases, when more than four children scored in this range, we asked teachers to give input on which children would be the most appropriate candidates (e.g., children with regular attendance). In rare cases, we extended the range slightly higher to identify a sufficient number of children in a classroom (i.e., two children were included with scores between 93 and 106). Table 1 includes sample characteristics.

The selected group of participants included 84 children, 43 boys and 41 girls, with an average age of 54 months (range: 45–63 months). Families were asked to complete a brief survey to provide demographic information; 75% of families returned the survey, but not all families completed all items. The majority of children were Black (47%, $n = 30$) or White (21%, $n = 13$); the remaining children were reported to be Asian, American Indian, Native Hawaiian, or Other Pacific Islander; 30% were reported to be Hispanic

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

Table 1. Sample characteristics by experimental groups.

	Group	
	Treatment	Comparison
Variable	*M* (*SD*)	*M* (*SD*)
Children (*n*)	41	43
Age at start (months)	55.32 (4.30)	53.79 (4.29)
CELF-P2 pretest	80.45 (8.61)	79.72 (10.02)
PPVT-4 pretest	89.90 (8.44)	87.72 (7.23)
PPVT-4 posttest	93.32 (9.85)	92.23 (9.16)

Note. CELF-P2 = Clinical Evaluation of Language Fundamentals Preschool—Second Edition (Wiig et al., 2004); PPVT-4 = Peabody Picture Vocabulary Test–Fourth Edition (Dunn & Dunn, 2007).

or Latino; and 35% indicated that a language other than English was spoken in the home, with 17% of families reporting that Spanish was spoken. Three families reported that their child had an individualized education plan, and eight families reported having concerns about their child's development.

Of the families who reported annual household income (n = 60), 30% reported income below $20 000, 47% reported income between $20 000 and $50 000, and 23% reported an income of more than $50 000. Just 32 families provided information about education of the primary caregiver, which ranged from some high school to a graduate or professional degree, whereas 53% of primary caregivers had education of high school or less, 19% had some college or an associate's degree, 16% had a bachelor's degree, and 13% had a graduate or professional degree.

The Story Friends Program

In the current study, the *Story Friends* program included three components: automated listening centers, classroom strategies, and home strategies. Procedures and materials for each component are described below (see Supplemental Material S1 for figure of listening center arrangement, example story books, classroom, and home strategy materials). Each classroom was provided with a binder that included a teacher's manual and attendance and fidelity checklists.

Study Activities

Teachers and other educational staff were responsible for delivering the intervention. Research staff assisted teachers by providing materials, helping with scheduling, and troubleshooting equipment. Research staff were responsible for administration of all assessments and conducted periodic observations of the classroom and listening centers. Research staff delivered materials for each unit (approximately monthly).

Introduction to the Program

Teachers and other educational staff participated in a brief (less than an hour) meeting with research staff to learn about the program. These meetings were conducted with small groups of teachers or individual teachers at convenient times. Research staff used the teacher's manual to guide a conversation that included a brief overview of the purpose of the program, procedures for the listening centers, use of classroom strategies, and delivery of home strategies. Research staff and teachers also discussed strategies for implementation, such as finding a location and time for the listening center.

Treatment Classrooms

Automated listening centers. The primary instruction of the *Story Friends* program was delivered in small-group listening centers. Listening center materials included sets of *Forest Friends* storybooks, headphones, an mp3 player with *Story Friends* audio files, and a splitter. The *Forest Friends* book series includes 13 books: one introductory book, nine instructional books, and three review books. The books are organized into units of three instructional books and a review book. Each book features the same animal characters with colorful illustrations and rhyming story text. The books are 9–11 min long. Children listened to prerecorded storybooks with embedded lessons for four challenging vocabulary words, doubling that of our previous RCT. Challenging vocabulary words were 19 verbs (e.g., *agree, protect*), 16 adjectives (e.g., *powerful, delighted*), and one noun (i.e., *accident*). Words were selected to be new words for preschool children with limited vocabulary, to be relatively high-frequency words that would likely occur again in conversations with adults, and to be able to be taught well in the prerecorded lessons (i.e., could be defined in simple, child-friendly terms).

In the instructional books, each vocabulary word was taught in two embedded lessons, first when the word occurred in the story text and the second immediately after the story ended. For the challenging vocabulary words, each embedded lesson included explicit teaching of the word and a simple definition, a supportive story context, child-friendly examples, and multiple opportunities to respond. Sample lessons are provided in Table 2. The pattern of instructional language was consistent across embedded lessons; some variation was necessary to accommodate teaching of different vocabulary targets. In the instructional books, each target vocabulary word was presented 13–15 times and the simple definition was presented 7–8 times. In each review book, the target vocabulary word was presented 3 times and the definition was presented 2 times. Thus, a child who received the intended dosage of three listens to each instructional and review book heard each target vocabulary word 48–54 times and each definition 27–30 times.

Children listened in small groups of three to four children under headphones with an adult facilitator present. The facilitator was not expected to provide additional instruction; instead, the role of the facilitator was to help guide children at the listening center (e.g., keep headphones on, stay on the correct page). In some classrooms, the teacher was the facilitator. In other classrooms, teacher assistants or classroom volunteers facilitated the listening center.

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

Table 2. Sample explicit, embedded lessons for vocabulary words.

Lesson	Example	Explanation
Embedded lesson – during story	*Pablo must prepare to leave. He has to get ready. Prepare. Say prepare.* [pause] *Prepare means to get ready. Tell me, what word means to get ready?* [pause] *Prepare. Great work! I bet you have to prepare to go to school in the morning. Maybe you get ready by eating breakfast and getting dressed. Now lift the flap.* [Picture of a boy putting school supplies in his backpack] *Look at this boy putting his supplies in his backpack. He is getting ready to leave school. He is preparing to go home. Tell me, what does prepare mean?* [pause] *To get ready. Awesome job!*	Each embedded lesson includes multiple opportunities to respond, indicated by pauses in the script. Children were given an opportunity to repeat the word, say the word in response to the definition, and provide the definition. Story context, a simple definition, and multiple child-friendly examples were included in each lesson.
Embedded lesson – after story	*Look at the picture of the woman preparing food.* [Picture of a woman chopping vegetables] *She is getting ready for dinner. She is preparing food for her family. Say prepare.* [pause] *Prepare. Tell me, what does prepare mean?* [pause] *To get ready. Way to go!*	The second embedded lesson was presented immediately after the story and included an additional child-friendly context. Children were given an opportunity to repeat the word and to provide the definition.

Classroom strategies. The purpose of the classroom strategies was to encourage teachers to provide opportunities for instruction and practice of targeted vocabulary words during daily classroom routines. We anticipated that children's learning would be increased if teachers and children used the words taught in the automated listening centers in meaningful classroom contexts. Classroom strategies were developed in an iterative process using information from teacher focus groups and development studies (Seven et al., 2020). The classroom strategies were designed to be easy to use, adaptable, and readily incorporated into typical classroom routines with minimal demands on teachers.

The classroom strategy materials included Teacher Prompt Cards, a *Story Friends* Weekly Word Chart, and a *Story Friends* Review Board. The goal of the Teacher Prompt Cards and the *Story Friends* Weekly Word Chart was to increase the frequency of practice opportunities for the words taught that week. For each book, teachers received a prompt card for the four words taught that week. The prompt card included the taught, child-friendly definition and five examples of sentences that teachers could use to practice the words in daily classroom conversations. For example, for the word *delighted*, the prompt card included sentences such as "I am *delighted* to see you doing a good job." and "You are smiling because you are *delighted.*" The *Story Friends* Weekly Word Chart was a poster and Velcro-backed cards for each word with the taught definition and an illustration from the book. Teachers could track when a teacher or child used the word in classroom conversations by adding a card to the column for that vocabulary word. The *Story Friends* Review Board was designed to function as a "word wall" to promote review and practice of all the words taught. Teachers received a poster and Velcro-backed cards for each word in the *Forest Friends* series with the taught definition, an illustration from the book, and a photograph of a real-life context.

Teachers learned about the classroom strategies during training and from the teacher's manual. We provided recommendations for how teachers would use the materials, including guidance about how often to practice words. For example, we suggested that teachers use the *Story Friends* Weekly Word Chart to practice each word at least once per day and use the *Story Friends* Review Board to review all previously taught words once a week. However, teachers were encouraged to use the materials in the ways that worked best for their classroom routines. The intention was to provide teachers with a variety of materials and strategies that could be readily incorporated into classroom routines and easily shared with families.

Home strategies. The goal of the home strategies was to encourage families and children to talk about and use the targeted vocabulary words at home, and they were intended to be feasible for use by families as part of daily conversations or brief activities. Similar to the classroom strategies, we anticipated that learning would be improved if children had frequent opportunities to hear and use the words. The home strategies and materials were developed in a series of single-case design studies (Soto et al., 2020).

Home strategy materials included a family training video, take-home materials, and communication via Bloomz, a web-based communication platform. The family training video presented a brief overview of importance of vocabulary in children's future academic success and provided information about the *Story Friends* program. Examples of the home strategy materials were presented along with video examples of an adult practicing the target vocabulary. The video was approximately 8 min long and was shared with families in a number of ways. Families could receive a link to the video via Bloomz, and the link was included on flyers given to parents and posted in the classroom. The video also was downloaded onto tablet computers and shared with families at pickup and drop-off and home visits.

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

Take-home materials were designed to encourage families and children to use the taught vocabulary words. Materials included stickers, necklaces, and family diary forms. Stickers included an illustration from the story and a prompt for one target word (e.g., "*Ask me what brave means*"). Necklaces included a laminated card with story illustrations for each of the four words taught that week and the words and taught definitions printed on the back. Family diary forms were laminated cards designed to hang on doors or the rear view mirror of cars. Each form included 12 boxes that families could mark each time they practiced a vocabulary word.

To facilitate communication with families, teachers and parents were encouraged to set up a Bloomz account that could be accessed on a computer or a phone with Internet connection. Teachers created a virtual classroom and shared an electronic link with families. Families who joined the virtual classroom could receive automated daily reminders that said, "*Don't forget to practice your children's words today*." Teachers also used Bloomz to share a library of brief video clips designed to extend the vocabulary instruction for each book. Three videos were created for each book; each video included a storybook illustration or photograph related to a target vocabulary word. The first video included prompts for yes/no questions related to the word's meaning (e.g., *When you watch your favorite cartoon, are you* ***delighted****?*). The second video included prompts for activities or open-ended questions related to the target vocabulary (e.g., *Ask your child to give you a big smile. Say "Wow! You look* ***delighted****. You look really happy.*). The third video included prompts for using the target vocabulary word in a sentence (e.g., "*Ask your child to use* ***delighted*** *in a sentence. If your child does not know a sentence say*"; "*The boy was* ***delighted*** *to eat yummy cake!* ***Delighted*** *means really happy!*"). Then, they must work together to make another sentence.

The original plan was for families to receive text messages and access video clips via Bloomz. However, within the first month of intervention, it was apparent that few families chose to enroll in Bloomz. To provide an alternative to Bloomz, we prepared brief e-mail templates with prompts and links to the video clips that teachers could send to families.

Classroom teachers distributed the home materials. Similar to the classroom strategies, teachers received training and information in the manual that described the intended use, as well as strategies for distributing the materials. Research staff worked with teachers to ensure that all families had an opportunity to watch the training video and encouraged teachers to distribute the home materials to families by sending home stickers or necklaces each day. However, teachers were free to adapt use of home materials according to what worked best for their classroom.

Comparison Classrooms

Rather than a business-as-usual control condition, the comparison condition in the current study was designed to provide an active control and robust comparison to the *Story Friends* program. Teachers in comparison classrooms received training and materials designed to promote overall language enrichment, as opposed to the emphasis on explicit vocabulary instruction in treatment classrooms. In the comparison classrooms, children participated in small-group listening centers and listened to *Story Friends* books, but without explicit, embedded lessons. Thus, children in the comparison classrooms were exposed to the same targeted vocabulary in the context of a story, but not augmented with explicit instruction. Classroom and home strategies emphasized language enrichment via interactive, shared storybook reading. Teachers and families were provided with a brief video presentation, available in multiple formats (i.e., PowerPoint presentation file, a handout, and a YouTube video) that taught interactive, shared reading strategies. Content for the presentation was adapted from research on dialogic reading (Whitehurst et al., 1988; Zevenbergen & Whitehurst, 2003) and emphasized strategies such as asking questions and providing opportunities for children to respond during shared reading. Families in comparison classrooms were invited to participate in Bloomz to receive automated messages (e.g., reminders to read with their child). Similar to treatment classrooms, very few families participated in Bloomz. We created e-mail templates for teachers to send to parents that focused on interactive book reading.

Outcome Measures

The primary outcome measure was a researcher-created proximal measure: the Unit Vocabulary Test. The Unit Test assessed definitional knowledge of target vocabulary using a rigorous test of children's vocabulary knowledge. The definitional task provides several advantages to a picture-pointing or other receptive measure. First, the definitional task assesses rich, decontextualized word knowledge that contributes to a variety of language skills (e.g., reading comprehension). Second, the definitional task has been widely used in previous research, including our own, allowing for comparisons of treatment effects across studies. Third, the definitional task was a straightforward, feasible measure for use by teachers in future scale-up use of the program. Finally, the definitional task was most appropriate for the type of words targeted; most *Story Friends* vocabulary words (e.g., *protect, brave, search*) were not easily represented by pictures that could be reliably recognized by preschoolers.

Participants were asked to respond to an open-ended definitional item (*Tell me, what does lost mean?*). If children did not respond correctly, a sentence-length prompt specific to the target vocabulary word was administered (*In the story, the Forest Friends were lost. Lost means…*). Responses were scored on a 3-point scale: 2 points were awarded for a complete definition, either the taught definition or a reasonable definition in the child's own words, or for an accurate synonym; 1 point was awarded for a partial definition, for using the target word in a meaningful sentence or phrase, or for providing an example of the word; and 0 points were awarded for an incorrect, unrelated, or "I don't know" response. Children who repeated the sentence-length prompt

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

were given a score of 0. For example, for the word *delighted*, responses of "*really happy*," "*happy*," or "*thrilled*" received 2 points. Responses of "*I was delighted at that party*" or "*delighted to eat that cupcake*" received 1 point. Responses of "*be delighted*" or "*I like it*" received 0 points. Our scoring approach was designed to provide a conservative estimate of children's knowledge. For example, a child who responded "*I like it*" may have had some partial knowledge of *delighted* that was not captured in our scoring.

At pretest, all 36 challenging vocabulary words were assessed. At the end of each unit, approximately monthly, learning of the 12 taught vocabulary words from that unit was assessed. The maximum score for each end-of-unit test was 24 (2 points per 12 words). To assess retention, six vocabulary words from Unit 1 were included at the Unit 3 posttest. To identify items for the retention test, we examined learning from Unit 1 and chose the words most frequently learned. On each posttest assessment, words were presented in two counterbalanced orders and participants were randomly assigned to each form.

Postintervention Measures

At the end of intervention, children were administered the PPVT-4. Although we did not anticipate treatment effects on the PPVT-4 because it did not test words that we taught, the measure provided an opportunity to describe the receptive vocabulary skills of children at the end of the study.

Dosage and Implementation Fidelity

In the current study, the *Story Friends* program was implemented as an intervention package that included the automated listening centers, classroom strategies, and home strategies. We set clear expectations for implementation of the listening centers; the intended dosage was for a child to listen 3 times in a week to each instructional or review book, for a total of 12 listens per unit (three listens each to three instructional books and one review book). During teacher training, research staff emphasized the importance of the repeated readings. Teachers were asked to complete daily attendance and procedural fidelity checklists. The fidelity checklist included six items related to the delivery of the listening centers (i.e., each child had a book, each child had headphones, correct audio was played, entire audio was played, children were provided with reinforcement, and an adult was present in the listening center). The fidelity checklist is available in Supplemental Material S3.

Research staff observed listening centers approximately once per month (~3 times per classroom) to assess procedural fidelity and to describe the listening centers. Observations lasted between 20 and 30 min and were scheduled at times convenient for the teachers. The observation form included items related to procedures (e.g., each child used headphones, correct audio was played, environment was quiet with few distractions). Observations also provided information to describe the listening centers, including use of positive feedback or additional instruction provided by the teachers and interruptions to the listening center in treatment classrooms. The observation form is available in Supplemental Material S2.

For the classroom strategies and home strategies, the manual and training provided general guidance on a variety of ways to review the target words and their meanings. However, we did not provide specific expectations (e.g., requiring a regularly scheduled classroom activity or a frequency of review). Thus, rather than fidelity, we sought to gather information about feasibility and use. For the classroom strategies, we asked teachers to self-report their practice events daily on the *Story Friends* chart, to take a picture of their chart each week, and to share it with us. Research staff also kept a record of any use of classroom strategies observed during fidelity observations as well as during other visits to classrooms or included in communication with teachers.

Social Validity Assessment

At the end of the study, we gathered feasibility and implementation information from participating teachers and families through social validity surveys. Teachers rated their level of agreement with statements that pertained to their perception of the *Story Friends* program (e.g., "The intervention is a good way to address language delays"), the ease of implementation (e.g., "The amount of time required to use *Story Friends* is reasonable), and the frequency with which they utilized the classroom and home extension materials (e.g., "I sent vocabulary necklaces home weekly"). Teacher responded on a scale of 1 (*strongly disagree*) to 6 (*strongly agree*). The survey included open-ended questions about experiences with the listening centers, classroom and home strategies, and what teachers might change about the program.

For the home strategies, parents were asked to respond to similar types of questions rating their level of agreement about their perception of the *Story Friends* program (e.g., "My child is motivated to participate in the *Story Friends* home activities"; "I would be excited to use *Story Friends* in the future") and about the frequency of implementation (e.g., "My child came home wearing *Story Friends* necklaces"). The survey included several open-ended questions about the home program (e.g., frequency of practice) and ways we could improve the home extension component.

Scoring Reliability

A trained member of the research team scored all measures. For the CELF-P2 and PPVT-4, each protocol was scored by a primary scorer and then checked by a second scorer. The small number of disagreements was resolved by a third scorer.

For the Unit Vocabulary Test, a primary scorer at each site scored all measures and a second scorer independently scored approximately one third of all measures to

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

evaluate scoring reliability. Scorers were blinded to condition (treatment, comparison) and to time (pretest, posttest). Detailed scoring guides for each unit were created to facilitate reliable scoring. The scoring guide included detailed criteria for assigning a score as well as multiple examples for each word and each scoring category. Prior to scoring, research assistants at both sites reviewed scoring criteria and scoring guides and completed a training set.

Item-by-item comparisons were conducted to determine agreement. Scoring reliability was calculated by dividing the total number of agreements by the sum of agreements plus disagreements and multiplying by 100. At pretest, there were a high number of 0-point answers (e.g., "I don't know"), making scoring agreement more likely. Thus, agreement for pretest and posttest was examined separately. At pretest, mean agreement was 97.8% (range: 96%–100%). At posttest, mean agreement was 92.9% (range: 87.5%–100%).

Data Analysis

The purpose of the current study was to examine the effects of the revised *Story Friends* program on the vocabulary knowledge of preschool children. The primary outcome was word score earned by each participant at pre and post for each book taught, derived from Unit Tests. For each book, children could earn a maximum of 8 points (2 points per word for four words). Each participant had a pre and post score for each book, for a total of 18 scores. Moreover, in addition to the repeated measures of pre and post across the nine books, the data were multilevel, with children nested within classrooms. As such, we employed a multilevel modeling (MLM) approach to analyze the data that allowed for accounting of the clustering of data (i.e., children nested within classrooms). This approach allowed us to analyze all available data without removing individual children or observations when one or more data points may have been missing. All data analyses were conducted using JMP Pro 14.3.

Results

Missing Data

Prior to MLM analysis, missing data patterns, broken down by intervention group, were examined using the Missing Data Pattern routine in JMP Pro 14.3. For the *Story Friends* treatment group, 35 of 41 students (85%) had complete data at pre and post. At post, one student was missing data for the last three books (7, 8, and 9), and a second student from a different classroom was missing data for the last six books (4, 5, 6, 7, 8, and 9). At pre, three students from two different classrooms were missing for all nine books, and a fourth student from a third classroom was missing data for the last four books (6, 7, 8, and 9). Overall, however, the missing data rate for the *Story Friends* treatment group was very low. Data were missing for only 40 of the 738 observations (5.4% of 9 books × 2 observations each × 41 participants in the treatment group).

For the comparison group, 35 of 43 students (81%) had complete data at pre and post. Four students from two different classrooms were missing pre and post data from the last three books (7, 8, and 9), and four students from three different classrooms were missing pre and post data from six books (4, 5, 6, 7, 8, and 9). Again, however, the overall missing data rate was low. Data were missing from only 72 of the 774 observations (9.3% of 9 books × 2 observations each × 43 participants in the comparison group).

We conducted a series of *t* tests to test for differences between children who were missing data and children with complete data on key variables, reported in the Appendix. There were no significant differences between the children with missing data and those with complete data on the IGDI Picture Naming, PPVT-4 prior to intervention, PPVT-4 following intervention, or the average word scores across the nine books at pre- or postintervention, and effect sizes were small or less. There was a significant difference on the CELF-P2 prior to intervention, $t(79) = -2.16$, $p < .05$, with the children with complete data having a slightly higher score ($M = 80.71$, $SD = 9.03$) than children who had missing data ($M = 74.36$, $SD = 9.25$), representing a medium to large difference, $d = 0.69$. Importantly, there were no significant differences in terms of word scores as a function of missing data.

Data Screening and Descriptive Results

Independent and dependent measures were evaluated to determine appropriateness for the proposed data analyses. A visual inspection of the distributions of the IGDI Picture Naming, CELF-P2, pre-intervention PPVT-4, pre-intervention word score, and postintervention word score indicated that all variables were approximately normally distributed. Means, standard deviations, medians, and skew statistics for these variables are presented in Table 3. Again, these statistics confirm the results of the visual inspection; a high degree of skew is indicated by skewness values less than −2 or greater than 2 (George & Mallery, 2016).

Next, we conducted a series of between-subjects *t* tests to test for differences between the treatment and comparison groups prior to intervention, reported in Table 4. There were no significant differences between treatment and

Table 3. Distributional characteristics of independent and dependent variables.

Variable	*M*	*SD*	*Mdn*	Skew
CELF-P2	79.85	9.26	81	–0.10
Pre PPVT-4	88.72	7.86	88	0.26
Pre word score	0.36	0.40	0.22	1.65
Post word score	2.04	1.87	1.28	1.02

Note. CELF-P2 = Clinical Evaluation of Language Fundamentals Preschool—Second Edition (Wiig et al., 2004); PPVT-4 = Peabody Picture Vocabulary Test–Fourth Edition (Dunn & Dunn, 2007); Pre word score = pretest score per book out of 8 possible points; Post word score = posttest score per book out of 8 possible points.

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

Table 4. Group comparisons for independent variables.

Variable	Treatment		Comparison				
	M	*SD*	*M*	*SD*	*t*	*p*	*d*
IGDI PN	47.4	2.43	47.29	1.71	−0.33	.74	0.07
CELF-P2	79.95	8.48	79.77	10.00	−0.09	.93	0.02
Pre PPVT-4	89.68	8.37	87.79	7.30	−1.10	.27	0.24
Pre word score	0.40	0.42	0.31	0.38	−1.02	.31	0.23

Note. IGDI PN = Individual Growth and Development Indicators (Bradfield et al., 2014); CELF-P2 = Clinical Evaluation of Language Fundamentals Preschool—Second Edition (Wiig et al., 2004); PPVT-4 = Peabody Picture Vocabulary Test–Fourth Edition (Dunn & Dunn, 2007); Pre word score = pretest score per book out of 8 possible points.

comparison groups on the IGDI Picture Naming, CELF-P2, pre-intervention PPVT-4, or pre-intervention word score. There was a small effect size for the pre-intervention PPVT-4 and the pre-intervention word score. Thus, we included pre-intervention PPVT-4 scores as a covariate in our subsequent models. There was no need to include pre-intervention word score as a covariate, as this variable was an outcome in all of our models.

Story Friends Effects on Vocabulary Learning

A 2 × 2 × 9 mixed between- and within-subjects analysis was conducted within the MLM framework to determine the impact of the *Story Friends* intervention on word scores. The following variables were modeled as fixed effects. The first factor was between subjects and evaluated differences between the treatment and comparison groups. The second factor was within subjects and modeled participants scores pre- and postintervention. The final factor was within subjects and modeled differences between the individual books used in the study. Finally, as described previously, pre-intervention PPVT-4 scores were modeled as a covariate to control for the impact of the small differences we observed between the two groups at the beginning of the study.

In addition to fixed effects, the random effect for differences between children and for differences between classrooms were included in the analysis to account for the clustered structure of the data. The intraclass correlation (ICC) for differences between children was .250, indicating that 25% of the differences in word scores were attributable to individual children. The ICC for classroom was .063, indicating that 6.3% of the differences in word scores were attributable to differences between classrooms. Importantly, after accounting for these influences on word scores, an additional 68.6% of the variance was left to be explained by the fixed effects entered into the model next.

The model containing fixed effects accounted for a total of 58.7% of the variance in observed word score outcomes. Pre-intervention PPVT-4 score was a significant predictor of outcomes, $b = 0.04$, $SE = 0.01$, $t = 3.78$, $p < .01$, justifying its inclusion as a covariate in the model. Each of the main effects for treatment condition, book, and time were significant predictors. Moreover, all of the main effects were qualified by significant two-way interactions for each possible combination of factors. Finally, there was a significant three-way interaction between condition, book, and time. These results are presented in Table 5.

The estimated marginal means, controlling for pre-intervention PPVT-4 performance, for each group at pre- and postintervention across all nine books are presented in Figure 3. Each mean is presented with a 95% confidence interval. As clearly depicted in this figure, the significant three-way interaction was best characterized by the fact that, following treatment, children in the *Story Friends* treatment group showed significantly higher word scores, ranging from 4.43 to 2.16 per book, across the nine books. The impact of the *Story Friends* treatment did seem to have a smaller impact, however, as children progressed through the treatment. Importantly, the pre-intervention treatment group scores did not differ from either the pre-intervention comparison group scores or the postintervention comparison group scores across any of the books.

Finally, in order to evaluate the size of the effect of the *Story Friends* treatment, we calculated Cohen's *d*s comparing the postintervention scores from the children in *Story Friends* treatment to the postintervention scores of children in the control group, across each book in the treatment. Cohen's *d*s ranged from 1.04 to 2.77 across the nine books, with a mean $d = 1.83$. Cohen (1988) suggested that *d*s of 0.20, 0.05, and 0.80 represent small, medium, and large effects, respectively. Consequently, the *Story Friends* treatment had a large effect on vocabulary learning across all of the books.

Moderation in the Treatment Group

Because there was clear evidence of an impact of the *Story Friends* treatment on word learning, we next explored potential moderating variables within the treatment group. Specifically, the impact of number of instructional listens during the intervention and CELF-P2 scores were evaluated as moderators of the association between book and word learning, again using an MLM approach. As reported in previous research (Goldstein et al., 2016), there was no main effect of instructional listens on word learning, $F(1, 331) = 3.58$,

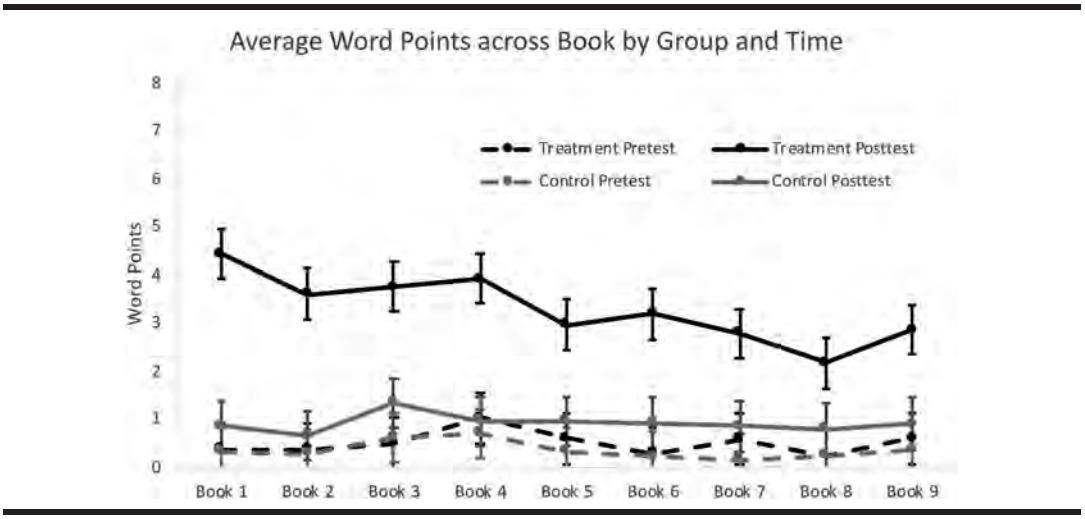
Table 5. Significance tests for fixed effects on word score.

Factor	*df*	*F*	*p*
Pre PPVT-4	1, 78	14.26	<.01
Group	1, 19	28.65	<.01
Book	8, 1282	5.45	<.01
Group × Book	8, 1282	2.52	.01
Time	1, 1293	548.26	<.01
Group × Time	1, 1293	244.63	<.01
Book × Time	8, 1279	2.46	.01
Group × Book × Time	8, 1279	2.88	<.01

Note. PPVT-4 = Peabody Picture Vocabulary Test–Fourth Edition (Dunn & Dunn, 2007).

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

Figure 3. Average word points earned by participants across books, by group at pre- and posttreatment. Error bars are 95% confidence intervals.



$p = .06$, and there was no interaction between instructional listens and book, $F(8, 303) = 1.41$, $p = .19$. For the CELF-P2, there was a significant main effect on word points, $F(1, 32) = 9.81$, $p < .01$. The unstandardized regression coefficient associated with that effect, $b = 0.10$, $SE = 0.03$, indicated that every 1-point increase in CELF-P2 scores was associated with approximately 0.10 increase in word points across books. The interaction between CELF-P2 and book was not significant, $F(8, 278) = 1.55$, $p = .14$.

Retention of Vocabulary in the Treatment Group

To evaluate the retention of vocabulary knowledge following intervention, we tested children's knowledge of six vocabulary words from Unit 1 at the end of Unit 3, approximately 2 months after words were taught. The word scores for pre-intervention, postintervention (Unit 1 posttest), and retention (Unit 3 posttest) for participants in the treatment group were submitted to a one-way within-subjects analysis of variance. The results indicated there was a significant difference between the three time points, $F(2, 114) = 37.21$, $p < .01$. A Tukey's honestly significant difference post hoc analysis indicated that pre-intervention word score ($M = 0.45$, $SD = 0.98$) was significantly lower than postintervention word score ($M = 6.56$, $SD = 3.66$) and the retention word score ($M = 5.13$, $SD = 4.16$). Importantly, there was no significant difference between the postintervention word score and the retention word score, indicating that participants generally retained the word knowledge gained during the intervention after its completion.

Dosage and Implementation Fidelity

To describe dosage and implementation fidelity, teachers were asked to complete daily attendance and procedural checklists. However, teachers did not always complete these forms. Across books and classrooms, 8% of attendance data were missing, meaning that there was no indication whether a child had listened to that book. A similar amount of data were missing in treatment and comparison classrooms (7% and 9%, respectively), and most data were missing for review books (28% missing). Data from the procedural checklists were missing for two reasons: Either teachers did not complete the form, or teachers recorded attendance but did not complete the procedural fidelity checklists. Across books and classrooms, 18% of procedural checklists were missing, more from treatment classrooms (26% missing) than from comparison classrooms (11%).

We calculated dosage based on the available data. Because so much of the missing data were from review books, we report the means for instructional books and review books separately. Overall, dosage was high in both groups. In treatment classrooms, the average number of listens for instructional books per unit was 7.28 of a possible 9 ($SD = 1.81$, range: 2.67–9) and the average number of listens for review books was 1.86 of a possible 3 ($SD = 1.04$, range: 0–3). In comparison classrooms, the average number of listens per unit was 8.13 for instructional books ($SD = 1.00$, range: 4.67–9) and 2.67 for review books ($SD = 0.68$, range: 0–3). Across units, the number of listens for instructional books remained essentially the same for both groups and did not differ significantly. The treatment group averaged 7.20, 7.40, and 7.14 listens across the units; the comparison group averaged 7.97, 8.00, and 8.13 listens across the units.

We calculated implementation fidelity using available procedural checklists. Overall, there was a high level of adherence to the program. In treatment classrooms, average fidelity was 95% (range: 67%–100%). In comparison classrooms, average fidelity was 97% (range: 33%–100%). Implementation fidelity also was documented during observations by research staff. These observations were planned to occur 1 time per unit in each classroom, but slightly

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

fewer observations occurred (average: 2.7 for treatment classrooms, 2.3 for comparison classrooms). Implementation fidelity during observations was high; average fidelity across observations was 90% (range: 60%–100%) in comparison classrooms and 96% (range: 67%–100%) in comparison classrooms. Across all classrooms, only two of the six items on the observations checklist received scores of 80% or lower (i.e., facilitator used headphones, and environment was quiet).

During observations, research staff documented instruction provided by the teachers, use of positive feedback, and interruptions to the listening center. In comparison classrooms, teachers were never observed to provide instruction on any of the *Story Friends* vocabulary words. In treatment classrooms, teachers occasionally provided additional prompts or instruction of target words beyond what was provided in the prerecorded stories (e.g., "*You're going to be disappointed if we don't go outside. Right?*"); this was noted in about half of observations. Positive reinforcement and/or redirection of off-task student behavior was noted to occur as needed during the majority of observations. Interruptions (e.g., a child outside of the listening center interrupted teacher to ask a question) were noted in about a quarter of observations.

Some variations in the delivery of listening center were observed. In three treatment classrooms, teachers did not wear headphones consistently. On rare occasions, teachers were not able to stay in the listening center with the small group because they did not have assistance in the classroom, making it difficult to manage children in the other centers. In addition, teachers in two classrooms were observed to play the book audio using a speaker so that all children in the classroom could listen to the story together. Variations such as these were expected as teachers integrated the *Story Friends* program into typical classroom routines.

Social Validity Results

Teacher Social Validity Survey Results

At the end of the study, we collected social validity surveys from 18 of the 24 classroom teachers, 10 from treatment classrooms and eight from comparison classrooms. Teachers responded to items related to feasibility and acceptability of implementation using a 1–6 scale (1 = *strongly disagree* to 6 = *strongly agree*) and to open-ended questions. Overall, results indicated high social validity. Teachers indicated that the *Story Friends* program was easy to implement (average rating of 5.7 out of 6) and fit well within a rotation of center activities (5.3 out of 6). Teachers were highly motivated to use *Story Friends* in the future (average rating of 5.8 out of 6) and felt that the program was a good way to address language delays in young children (average rating: 5.4). Teachers in the treatment classrooms were mostly positive about classroom and home strategies as well. Teachers sometimes used the review charts when words were practiced in the classroom (3.9 out of 6) and sent word necklaces (average rating: 5.3) and stickers home weekly (average rating of 5 out of 6). Teachers in both conditions did not rate the use of Bloomz highly. Although research staff assisted in the setup of Bloomz, teachers reported that their parents rarely interacted with the application (average rating of 2.9 out of 6).

Responses to open-ended questions were generally positive. Teachers reported that their students loved the stories, but some teachers in the comparison classrooms reported that students were bored or distracted during the third listen of the book. Teachers noted several benefits of the program including learning new vocabulary words and learning concepts of print and book conventions. Children had more opportunities for conversations around new words and the storybook contexts and provided opportunities to practice answering questions about books, which helped to improve their listening and comprehension skills. Teachers liked that each book used relatable contexts for preschoolers (i.e., first day of school, going to the doctor), the format of the listening center. One teacher reported the program helped her with literacy planning for her lesson plans.

Teachers in the treatment condition extended vocabulary instruction to other parts of the school day and encouraged their students to use the words as well. For example, several teachers tried to incorporate the words in whole group settings, while children were at learning centers, during lunch, and playground time (i.e., *It's time to clean up, this area is filthy*; *You're preparing lunch for us like in the book, you're getting it ready*). Interestingly, several teachers indicated they did not use or would forget to use the vocabulary review chart even though practice and review occurred throughout the day. They also commented on the use of the home extension materials, indicating that children were excited to wear the necklaces and stickers home and that parents liked them as well. Three teachers noted that parents did not use the home materials or, at least to their knowledge, were unaware of their parents' response to the home extension program. Comparison teachers noted students loved the storybook characters and would talk about the characters and the stories outside of the listening center. For example, one teacher had students who would "play" Bobby Bear on the playground.

Overall, teachers were happy with the program and only recommended minor changes such as using a device other than the mp3 player because it was difficult to navigate, implementing the small-group listening center with all of the children in their class so all could benefit from the program. Teachers noted that parents' use of Bloomz was very limited. Although they thought it was a useful tool, most were unable to get any parent to participate in the application. One teacher would have liked to have the program in both English and Spanish so all her students could participate.

Parent Social Validity Survey Results

We received 11 social validity surveys back from parents (out of a possible 84), five from five different treatment classrooms and six from four different comparison classrooms. Although the return rate was low (13%), those who returned the surveys provided valuable feedback. Parents

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

were motivated to use the home extension materials with their children (4.8 out of 6) and felt that the program was a good way to address children's language needs (average rating of 4.5). They were able to implement the program at home in a variety of family activities (average rating of 4.7), and the time required to do so was adequate (average rating of 4.6). Parents with children in treatment classrooms reported that their children sometimes came home with vocabulary necklaces or wearing stickers (average rating of 2.4 out of 3). Despite the low rating, parents commented that they felt the necklaces were effective and used them to practice the words each week. Parents reported that they rarely use Bloomz (rating of 1.4 out of 3) nor did they access the short practice videos (average rating of 1.4 out of 3). Furthermore, five parents reported that they did not have access or did not know about Bloomz and the parent videos. Overall, parents were pleased with the program but recommended small changes to include a bilingual component or small storybooks to accompany the vocabulary necklaces so parents could practice reading the books with their children.

Discussion

The purpose of the current study was to examine the effects of the revised *Story Friends* program on the vocabulary knowledge of preschool children. The program was implemented by educational staff in preschool classrooms that served families with low-income, and participants were children with limited oral language skills. There were strong treatment effects on the measure of vocabulary knowledge. Prior to intervention, children rarely knew any of the target vocabulary words (pretest average of less than 4% of words). At posttest, children in the treatment classrooms demonstrated substantial gains, with average posttest scores of 30.25 of a possible 72 word points across the 13 weeks of the program, representing knowledge of 42% of taught words or approximately 15 of 36 words. Findings from the retention test indicate that children generally maintained their knowledge of taught vocabulary words approximately 2 months after instruction. In contrast, very little learning was observed in comparison classrooms with average posttest scores of just 7.82 word points (11% of taught words).

Findings indicate that the revisions to *Story Friends* were successful in increasing the effects on children's vocabulary knowledge. Although we did not conduct a direct comparison of the revised program and the original program, we can compare the findings of this study to our examination of the previous version of *Story Friends* (Goldstein et al., 2016). In that study, children in the treatment classrooms had posttest averages representing 28.3% of taught words or approximately five of 18 words per series. In the current study, children learned a higher percentage of taught words (42%), and we taught twice the number of words. Thus, children learned almost 3 times as many words (15 of a possible 36) in the current study. Postintervention vocabulary knowledge was higher than similar studies by other research groups (27% in Penno et al., 2002). In Storkel et al. (2017), kindergarteners with developmental language disorders who received 36 exposures learned five of 30 taught words (17%). The higher percentage of words learned in the current study might be explained by increased treatment intensity; children who received the intended dosage of the small-group listening centers (three listens to each instructional book and three listens to the review book) would have received at least 48 exposures to each target vocabulary word in embedded lessons, with potential additional exposures in the classroom and at home. As hypothesized, by teaching more words and by creating additional opportunities for review and practice in the classroom and at home, children in the treatment classrooms made substantial gains in vocabulary knowledge.

Children learned the most words in Unit 1 ($M = 11.73$ of a possible 24 word points, $SD = 6.96$); posttest scores were lower in Unit 2 ($M = 10.75$, $SD = 7.33$) and Unit 3 ($M = 7.77$, $SD = 6.29$). We anticipated that dosage (i.e., number of listens) might contribute to the decline in learning, but this was not the case. It may be that motivation and engagement of teachers and children decreased across the study. Near the end of the school year, the demands on teachers' time may increase and changes to daily schedules are more frequent. We observed that children were less compliant during testing as the study continued; the novelty of a visit from a new adult seemed to wear off. Another possibility is that there were differences in word difficulty across the *Forest Friends* series. We used consistent criteria to select vocabulary words, but it may be that words presented later in the series were harder to learn. In future studies, it will be important to carefully monitor variables that relate to engagement and implementation.

As in previous studies of *Story Friends*, there was considerable variability in learning among participants; 25% of the variance in word points was explained by the child. At each unit, some children in treatment classrooms learned no new words, whereas others learned nearly every word taught. The moderation analysis indicated that children with higher pre-intervention language scores learned more words in *Story Friends* than children with lower scores. However, even children with low pre-intervention language skills made substantial gains: The 13 participants in the treatment group with PPVT-4 standard scores below 85 gained an average of 15 word points, representing approximately one new word per book. Thus, pre-intervention language ability did not fully predict response to intervention. However, the wide variability in children's learning highlights the importance of quickly and efficiently identifying those children who are not learning. In our previous RCT, learning during the first few weeks of intervention was a sensitive benchmark to identify poor responders (Kelley et al., 2018). To effectively implement *Story Friends* as part of a multitiered system of support, it will be important to efficiently identify children who need additional support. Children who do not respond to the small-group listening center might benefit from increased intensity. Next steps in this line of research would include testing the effects of an individualized variation of *Story Friends* for struggling learners.

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

In comparison classrooms, children were exposed to the target vocabulary words in the context of the prerecorded storybooks but learned few vocabulary words. This finding is consistent with our previous studies and with a larger body of evidence on vocabulary learning; simply exposing children to challenging vocabulary words is not sufficient to produce meaningful change in vocabulary knowledge (Beck & McKeown, 2007; Goldstein et al., 2016).

Implications for Vocabulary Instruction in Preschool Classrooms

Results of the current study provide guidance on the appropriate number of academic vocabulary words that can be targeted in explicit instruction during shared storybook reading and reinforced by teachers and families. The revised *Story Friends* program taught a total of 36 challenging vocabulary words, four words per book and twice as many words as in previous versions. We determined that four words could be successfully included in automated listening centers in a series of single-case experimental design studies (Peters-Sanders et al., 2020); findings of the current study reinforce the decision to include the additional vocabulary targets. Many of the teachers we worked with had the habit of choosing a single challenging vocabulary word per book; we suggest that vocabulary learning in preschool classrooms can be maximized by teaching at least four academic vocabulary words per week.

We hypothesize that the additional practice opportunities provided by teachers and families contributed to increased learning in the revised *Story Friends* program. In a previous study (Seven et al., 2020), children demonstrated substantial learning of vocabulary words when the only instruction came from classroom strategies (among typically developing children who did not participate in listening centers). Among the children receiving small group instruction, half the words were subject to classroom practice strategies, which clearly boosted learning in the majority of participants. Similar to the Seven et al. study, informal communication with teachers and observations of our research staff in the current study indicated that, when teachers frequently used classroom strategies, all children in those classrooms benefited from the practice strategies and learned many of the targeted vocabulary words. Classroom strategies were designed to promote review of previously taught words and may have contributed to the maintenance of vocabulary knowledge on the retention test. We suggest that children's learning of academic vocabulary can be increased by the use of feasible strategies for practice and review across the school day and at home.

Limitations and Future Directions

As with any study conducted in classroom settings, there was some variability in the ways in which the program was implemented. Our criteria for fidelity of implementation focused on the delivery of the automated listening center. We planned for and expected variation in the use of classroom and home strategies. We encouraged teachers to use classroom strategies and materials to embed practice opportunities in a variety of settings across the school day, which made precise measures of implementation difficult. Instead, we relied on observations and social validity surveys to answer our research question about feasibility. In some classrooms, teachers made use of the materials and strategies as intended by practicing target vocabulary words in meaningful classroom contexts, using posters and cards as prompts and review opportunities. Some teachers used target vocabulary words in creative ways, for example, as journal prompts. In other classrooms, little use of classroom strategies was observed: Posters and related materials were not readily visible in the classroom, and teachers rarely reported using the target vocabulary words. Although we anticipate that these differences in implementation would relate to differences in learning, we saw very few differences in learning across classrooms. The classroom ICC was low (6.3%), suggesting that differences in implementation of the classroom strategies did not have a large impact on learning. In future studies, we can add detail to our understanding of classroom implementation by increasing the frequency or duration of observations and by adding feasible self-reporting strategies.

We did not anticipate such little interest in Bloomz. In our previous development studies, parental use of messaging applications was higher, even when teachers were responsible for coordinating the communications (Soto et al., 2020). When Bloomz was unsuccessful, we adapted our approach by sharing the training videos on iPads and at parent conferences and by sending e-mail messages. However, we were unable to track the extent to which teachers sent e-mail messages or the use of home strategies with individual families, and the return rate of the family social validity survey was low. The challenge of effective family engagement is not unique to our project; other studies have reported similarly low rates (Sheridan et al., 2011). Continued, innovative effort in this area is necessary to produce interventions that are acceptable and feasible for use with at-risk families.

The current study provides an example of a hybrid study (Curran et al., 2012) in which we examined both treatment efficacy and implementation of the *Story Friends* intervention package. Findings provide strong evidence of treatment efficacy. Although observations and social validity data were a rich source of information on the implementation of the small-group listening centers, the information on implementation on classroom and home practice components is far less complete. We planned for ways to gather information about teachers' and families' use of materials (e.g., pictures of *Story Friends* chart, communication via Bloomz). Although we would have gathered more information from teachers and parents, this does not mean that their implementation was poor. Indeed, it varied from poor to excellent. In future studies, we will examine feasible, efficient ways for teachers and families to report use of strategies. Nevertheless, these findings contribute to our understanding of the characteristics of interventions that

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

are feasible for implementation in authentic education settings. These hybrid designs can help to accelerate the application of research findings into practical settings (Schliep et al., 2017).

Conclusions

Findings indicate that a carefully designed intervention can produce robust vocabulary learning by high-risk children. Children in the *Story Friends* treatment classrooms were able to define an average of 42% of taught words, all selected to be challenging and academically relevant, after participating in 13 weeks of a low-dose intervention. The program was implemented in early childhood classrooms by educational staff who received minimal training (1 hr), indicating that the program is feasible for implementation in authentic educational settings. Although large treatment effects were observed, averaging $d = 1.83$, the iterative development process should continue to refine classroom and home strategies that can increase opportunities for review and practice.

Author Contributions

Elizabeth Spencer Kelley: Conceptualization (Equal), Data curation (Supporting), Funding acquisition (Equal), Investigation (Equal), Methodology (Equal), Project administration (Supporting), Writing – original draft (Lead), Writing – review & editing (Lead). **R. Michael Barker:** Data curation (Equal), Formal analysis (Lead), Writing – original draft (Supporting), Writing – review & editing (Supporting). **Lindsey Peters-Sanders:** Data curation (Equal), Project administration (Supporting), Writing – original draft (Supporting), Writing – review & editing (Supporting). **Keri Madsen:** Data curation (Supporting), Methodology (Supporting), Project administration (Lead), Writing – original draft (Supporting), Writing – review & editing (Supporting). **Yagmur Seven:** Conceptualization (Supporting), Investigation (Supporting), Writing – original draft (Supporting), Writing – review & editing (Supporting). **Xigrid Soto:** Conceptualization (Supporting), Investigation (Supporting), Writing – original draft (Supporting), Writing – review & editing (Supporting). **Wendy Olsen:** Investigation (Supporting), Writing – original draft (Supporting), Writing – review & editing (Supporting). **Katharine Hull:** Investigation (Supporting), Writing – review & editing (Supporting). **Howard Goldstein:** Conceptualization (Equal), Funding acquisition (Equal), Investigation (Equal), Methodology (Equal), Project administration (Supporting), Resources (Lead), Writing – original draft (Supporting), Writing – review & editing (Supporting).

Acknowledgments

This research was supported by funding from the U.S. Department of Education, Institute of Education Sciences, R432A150132, awarded to the University of South Florida, Howard Goldstein and Elizabeth Kelley, principal investigators.

References

Beck, I., & McKeown, M. (2007). Increasing young low-income children's oral vocabulary repertoires through rich and focused instruction. *The Elementary School Journal, 107*(3), 251–272. https://doi.org/10.1086/511706

Beck, I., McKeown, M., & Kucan, L. (2013). *Bringing words to life: Robust vocabulary instruction*. Guilford Press.

Bradfield, T. A., Besner, A. C., Wackerle-Hollman, A. K., Albano, A. D., Rodriguez, M. C., & McConnell, S. R. (2014). Redefining individual growth and development indicators: Oral language. *Assessment for Effective Intervention, 39*(4), 233–244. https://doi.org/10.1177/1534508413496837

Carta, J. J., Greenwood, C. R., Atwater, J., McConnell, S. R., Goldstein, H., & Kaminski, R. A. (2014). Identifying preschool children for higher tiers of language and early literacy instruction within a response to intervention framework. *Journal of Early Intervention, 36*(4), 281–291. https://doi.org/10.1177/1053815115579937

Catts, H., Fey, M., Tomblin, J. B., & Zhang, X. (2002). A longitudinal investigation of reading outcomes in children with language impairments. *Journal of Speech, Language, and Hearing Research, 45*(6), 1142–1157. https://doi.org/10.1044/1092-4388(2002/093)

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.

Coyne, M., McCoach, D., & Kapp, S. (2007). Vocabulary intervention for kindergarten students: Comparing extended instruction to embedded instruction and incidental exposure. *Learning Disability Quarterly, 30*(2), 74–88. https://doi.org/10.2307/30035543

Coyne, M., McCoach, D., Loftus, S., Zipoli, R., Jr., & Kapp, S. (2009). Direct vocabulary instruction in kindergarten: Teaching for breadth versus depth. *The Elementary School Journal, 110*(1), 1–18. https://doi.org/10.1086/598840

Coyne, M., McCoach, D. B., Loftus, S., Zipoli, R., Jr., Ruby, M., Crevecoeur, Y. C., & Kapp, S. (2010). Direct and extended vocabulary instruction in kindergarten: Investigating transfer effects. *Journal of Research on Educational Effectiveness, 3*(2), 93–120. https://doi.org/10.1080/19345741003592410

Curran, G., Bauer, M., Mittman, B., Pyne, J. M., & Stetler, C. (2012). Effectiveness-implementation hybrid designs: Combining elements of clinical effectiveness and implementation research to enhance public health impact. *Medical Care, 50*(3), 217–226. https://doi.org/10.1097/MLR.0b013e3182408812

Dickinson, D. (2011). Teachers' language practices and academic outcomes of preschool children. *Science, 333*(6045), 964–967. https://doi.org/10.1126/science.1204526

Dickinson, D., Nesbitt, K. T., Collins, M. F., Hadley, E. B., Newman, K., Rivera, B. L., Ilgez, H., Nicolopoulou, A., Golinkoff, R. M., & Hirsh-Pasek, K. (2019). Teaching for breadth and depth of vocabulary knowledge: Learning from explicit and implicit instruction and the storybook texts. *Early Childhood Research Quarterly, 47,* 341–356. https://doi.org/10.1016/j.ecresq.2018.07.012

Dickinson, D., & Smith, M. (1994). Long-term effects of preschool teachers' book readings on low-income children's vocabulary and story comprehension. *Reading Research Quarterly, 29*(2), 104–122. https://doi.org/10.2307/747807

Dickinson, D., & Tabors, P. (1991). Early literacy: Linkages between home, school and literacy achievement at age five. *Journal of Research in Childhood Education, 6*(1), 30–46. https://doi.org/10.1080/02568549109594820

Dunn, L. M., & Dunn, D. M. (2007). *Peabody Picture Vocabulary Test–Fourth Edition*. NCS Pearson Assessments. https://doi.org/10.1037/t15144-000

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

Dwyer, J., & Harbaugh, A. (2018). Where and when is support for vocabulary development occurring in preschool classrooms? *Journal of Early Childhood Literacy, 20*(2), 252–295. https://doi.org/10.1177/1468798418763990

Elwér, Å., Keenan, J. M., Olson, R. K., Byrne, B., & Samuelsson, S. (2013). Longitudinal stability and predictors of poor oral comprehenders and poor decoders. *Journal of Experimental Child Psychology, 115*(3), 497–516. https://doi.org/10.1016/j.jecp.2012.12.001

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

Foorman, B. R., & Moats, L. C. (2004). Conditions for sustaining research-based practices in early reading instruction. *Remedial and Special Education, 25*(1), 51–60. https://doi.org/10.1177/07419325040250010601

George, D., & Mallery, P. (2016). *IBM SPSS statistics 23 step by step: A simple guide and reference* (13th ed.). Routledge. https://doi.org/10.4324/9781315545899

Goldstein, H., Kelley, E., Greenwood, C., McCune, L., Carta, J., Atwater, J., Guerrero, G., McCarthy, T., Schneider, N., & Spencer, T. (2016). Embedded instruction improves vocabulary learning during automated storybook reading among high-risk preschoolers. *Journal of Speech, Language, and Hearing Research, 59*(3), 484–500. https://doi.org/10.1044/2015_JSLHR-L-15-0227

Greenwood, C. R., Carta, J. J., Atwater, J., Goldstein, H., Kaminski, R., & McConnell, S. (2013). Is a response to intervention (RTI) approach to preschool language and early literacy instruction needed? *Topics in Early Childhood Special Education, 33*(1), 48–64. https://doi.org/10.1177/0271121412455438

Greenwood, C. R., Carta, J. J., Guerrero, G., Atwater, J., Kelley, E. S., Kong, N. Y., & Goldstein, H. (2016). Systematic replication of the effects of a supplementary, technology-assisted, storybook intervention for preschool children with weak vocabulary and comprehension skills. *The Elementary School Journal, 116*(4), 574–599. https://doi.org/10.1086/686223

Hadley, E. B., Dickinson, D. K., Hirsh-Pasek, K., & Golinkoff, R. M. (2019). Building semantic networks: The impact of a vocabulary intervention on preschoolers' depth of word knowledge. *Reading Research Quarterly, 54*(1), 41–61. https://doi.org/10.1002/rrq.225

Hulleman, C. S., & Cordray, D. S. (2009). Moving from the lab to the field: The role of fidelity and achieved relative intervention strength. *Journal of Research on Educational Effectiveness, 2*(1), 88–110. https://doi.org/10.1080/19345740802539325

Justice, L., Mashburn, A., Pence, K. L., & Wiggins, A. (2008). Experimental evaluation of a preschool language curriculum: Influence on children's expressive language skills. *Journal of Speech, Language, and Hearing Research, 51*(4), 983–1001. https://doi.org/10.1044/1092-4388(2008/072)

Justice, L., Meier, J., & Walpole, S. (2005). Learning new words from storybooks: An efficacy study with at-risk kindergartners. *Language, Speech, and Hearing Services in Schools, 36*(1), 17–32. https://doi.org/10.1044/0161-1461(2005/003)

Kaderavek, J. N., & Justice, L. (2010). Fidelity: An essential component of evidence-based practice in speech-language pathology. *American Journal of Speech-Language Pathology, 19*(4), 369–379. https://doi.org/10.1044/1058-0360(2010/09-0097)

Kelley, E. S., & Goldstein, H. (2015). Building a Tier 2 intervention: A glimpse behind the data. *Journal of Early Intervention, 36*(4), 292–312. https://doi.org/10.1177/1053815115581657

Kelley, E. S., Goldstein, H., Spencer, T. D., & Sherman, A. (2015). Effects of an automated Tier 2 storybook intervention on vocabulary and comprehension learning in preschool children with limited oral language skills. *Early Childhood Research Quarterly, 31,* 47–61. https://doi.org/10.1016/j.ecresq.2014.12.004

Kelley, E. S., Leary, E., & Goldstein, H. (2018). Predicting response to treatment in a Tier 2 supplemental vocabulary intervention. *Journal of Speech, Language, and Hearing Research, 61*(1), 94–103. https://doi.org/10.1044/2017_JSLHR-L-16-0399

Language and Reading Research Consortium., & Logan, J. (2017). Pressure points in reading comprehension: A quantile multiple regression analysis. *Journal of Educational Psychology, 109*(4), 451–464. https://doi.org/10.1037/edu0000150

Loftus, S., Coyne, M., McCoach, D. B., Zipoli, R., & Pullen, P. C. (2010). Effects of a supplemental vocabulary intervention on the word knowledge of kindergarten students at risk for language and literacy difficulties. *Learning Disabilities Research & Practice, 25*(3), 124–136. https://doi.org/10.1111/j.1540-5826.2010.00310.x

Marulis, L. M., & Neuman, S. B. (2010). The effects of vocabulary intervention on young children's word learning: A meta-analysis. *Review of Educational Research, 80*(3), 300–335. https://doi.org/10.3102/0034654310377087

Nation, K., Cocksey, J., Taylor, J. S., & Bishop, D. (2010). A longitudinal investigation of early reading and language skills in children with poor reading comprehension. *The Journal of Child Psychology and Psychiatry, 51*(9), 1031–1039. https://doi.org/10.1111/j.1469-7610.2010.02254.x

National Early Literacy Panel. (2008). *Developing early literacy: Report of the National Early Literacy Panel.*

National Institute of Child Health and Human Development. (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction (NIH Publication No. 00-4769)*. Government Printing Office.

Neuman, S. B., Newman, E. H., & Dwyer, J. (2011). Educational effects of a vocabulary intervention on preschoolers' word knowledge and conceptual development: A cluster-randomized trial. *Reading Research Quarterly, 46*(3), 249–272. https://doi.org/10.1177/1086296X11403089

O'Donnell, C. L. (2008). Defining, conceptualizing, and measuring fidelity of implementation and its relationship to outcomes in K–12 curriculum intervention research. *Review of Educational Research, 78*(1), 33–84. https://doi.org/10.3102/0034654307313793

O'Fallon, M., Von Holzen, K., & Newman, R. S. (2020). Preschoolers' word-learning during storybook reading interactions: Comparing repeated and elaborated Input. *Journal of Speech, Language, and Hearing Research, 63*(3), 814–826. https://doi.org/10.1044/2019_JSLHR-19-00189

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

Peters-Sanders, L., Kelley, E., Haring Biel, C., Madsen, K., Soto, X., Seven, Y., Hull, K., & Goldstein, H. (2020). Moving forward four words at a time: Effects of a supplemental preschool vocabulary intervention. *Language, Speech, and Hearing Services in Schools, 51*(1), 165–175. https://doi.org/10.1044/2019_LSHSS-19-00029

Quinn, J. M., Wagner, R. K., Petscher, Y., & Lopez, D. (2015). Developmental relations between vocabulary knowledge and reading comprehension: A latent change score modeling study. *Child Development, 86*(1), 159–175. https://doi.org/10.1111/cdev.12292

Scarborough, H. (1998). Early identification of children at risk for reading disabilities: Phonological awareness and some other

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions

promising predictors. In B. Shapiro, P. Accerdo, & A. Capute (Eds.), *Specific reading disability: A view of the specturm* (pp. 75–119). York Press.

Schliep, M. E., Alonzo, C. N., & Morris, M. A. (2017). Beyond RCTs: Innovations in research design and methods to advance implementation science. *Evidence-Based Communication Assessment and Intervention, 11*(3–4), 82–98. https://doi.org/10.1080/17489539.2017.1394807

Sénéchal, M. (1997). The differential effect of storybook reading on preschoolers' acquisition of expressive and receptive vocabulary. *Journal of Child Language, 24*(1), 123–138. https://doi.org/10.1017/S0305000996003005

Sénéchal, M., Oullette, G., & Rodney, D. (2006). The misunderstood giant: On the predictive role of early vocabulary to future reading. In D. K. Dickinson & S. Neuman (Eds.), *Handbook of early literacy research* (Vol. 2, pp. 173–182). Guilford.

Seven, Y., Hull, K., Madsen, K., Ferron, J., Peters-Sanders, L., Soto, X., Kelley, E. S., & Goldstein, H. (2020). Classwide extensions of vocabulary intervention improve learning of academic vocabulary by preschoolers. *Journal of Speech, Language, and Hearing Research, 63*(1), 173–189. https://doi.org/10.1044/2019_JSLHR-19-00052

Sheridan, S. M., Knoche, L. L., Kupzyk, K. A., Edwards, C. P., & Marvin, C. A. (2011). A randomized trial examining the effects of parent engagement on early language and literacy: The Getting Ready intervention. *Journal of School Psychology, 49*(3), 361–383. https://doi.org/10.1016/j.jsp.2011.03.001

Smith, K. E., Landry, S. H., & Swank, P. R. (2005). The influence of decreased parental resources on the efficacy of a responsive parenting intervention. *Journal of Consulting and Clinical Psychology, 73*(4), 711–720. https://doi.org/10.1037/0022-006X.73.4.711

Soto, X., Seven, Y., McKenna, M., Madsen, K., Peters-Sanders, L., Kelley, E., & Goldstein, H. (2020). Iterative development of a home review program to promote preschoolers' vocabulary skills: Social validity and learning outcomes. *Language, Speech, and Hearing Services in Schools, 51*(2), 371–389. https://doi.org/10.1044/2019_LSHSS-19-00011

Spencer, E., Goldstein, H., Sherman, A., Noe, S., Tabbah, R., Ziolkowski, R., & Schneider, N. (2012). Effects of an automated vocabulary and comprehension intervention: An early efficacy study. *Journal of Early Intervention, 34*(4), 195–221. https://doi.org/10.1177/1053815112471990

Stahl, S. A., & Fairbanks, M. M. (1986). The effects of vocabulary instruction: A model-based meta-analysis. *Review of Educational Research, 56*(1), 72–110. https://doi.org/10.3102/00346543056001072

Storkel, H. L., Komesidou, R., Pezold, M. J., Pitt, A. R., Fleming, K. K., & Romine, R. S. (2019). The impact of dose and dose frequency on word learning by kindergarten children with developmental language disorder during interactive book reading. *Language, Speech, and Hearing Services in Schools, 50*(4), 518–539. https://doi.org/10.1044/2019_LSHSS-VOIA-18-0131

Storkel, H. L., Voelmle, K., Fierro, V., Flake, K., Fleming, K. K., & Romine, R. S. (2017). Interactive book reading to accelerate word learning by kindergarten children with specific language impairment: Identifying an adequate intensity and variation in treatment response. *Language, Speech, and Hearing Services in Schools, 48*(1), 16–30. https://doi.org/10.1044/2016_LSHSS-16-0014

Whitehurst, G., Falco, F., Lonigan, C. J., Fischel, J., DeBaryshe, B., Valdez-Menchaca, M., & Caulfield, M. (1988). Accelerating language development through picture book reading. *Developmental Psychology, 24*(4), 552–559. https://doi.org/10.1037/0012-1649.24.4.552

Wiig, E. H., Secord, W. A., & Semel, E. (2004). *Clinical Evaluation of Language Fundamentals Preschool–Second Edition*. Harcourt Assessment.

Wright, T. S. (2012). What classroom observations reveal about oral vocabulary instruction in kindergarten. *Reading Research Quarterly, 47*(4), 353–355.

Zevenbergen, A. A., & Whitehurst, G. J. (2003). Dialogic reading: A shared picture book reading intervention for preschoolers. In A. Van Kleeck, S. A. Stahl, & E. Bauer (Eds.), *On reading books to children* (pp. 177–200). Routledge.

Appendix

Group comparisons for children with complete data and children with missing data

	Complete data		Missing data				
Variable	***M***	***SD***	***M***	***SD***	***t***	***p***	***d***
IGDI PN	47.4	2.09	47.14	2.14	−0.33	.74	0.07
CELF-P2	80.71	9.03	74.36	9.25	−2.16	<.05	0.69
Pre PPVT-4	88.4	7.96	90.43	7.39	−1.10	.27	0.24
Pre word score	0.40	0.42	0.31	0.38	−1.02	.31	0.23
Post word score	2.08	1.99	2.06	1.71	−0.05	.96	0.01
Post PPVT-4	92.71	9.41	94.25	11.84	−0.03	.75	0.16

Note. IGDI PN = Individual Growth & Development Indicators Picture Naming (Bradfield et al., 2014); CELF-P2 = Clinical Evaluation of Language Fundamentals Preschool—Second Edition (Wiig et al., 2004); PPVT-4 = Peabody Picture Vocabulary Test–Fourth Edition (Dunn & Dunn, 2007); Pre word score = pretest score per book out of 8 possible points; Post word score = posttest score per book out of 8 possible points.

Downloaded from: https://pubs.asha.org ERIC on 01/06/2021, Terms of Use: https://pubs.asha.org/pubs/rights_and_permissions