JSLHR

Research Article

Classwide Extensions of Vocabulary Intervention Improve Learning of Academic Vocabulary by Preschoolers

Yagmur Seven,[a] Katharine Hull,[a] Keri Madsen,[a] John Ferron,[a] Lindsey Peters-Sanders,[a] Xigrid Soto,[a] Elizabeth S. Kelley,[b] and Howard Goldstein[a]

Purpose: Many preschoolers, especially those from low-income households, would benefit from instruction to enrich their vocabulary and language repertoires. Yet, explicit instruction of vocabulary and language skills generally occurs infrequently in early childhood education settings. This study investigated the additive effects of teacher-led, classwide review strategies to a previously studied small-group intervention on children's learning of academic vocabulary.
Method: Participants included 23 children with limited oral language skills at risk for reading difficulties enrolled in single-case experimental designs. Effects of the classroom strategies alone also were examined in 10 children with above-average language abilities from 2 classrooms.
Results: Visual analyses of the adapted alternating treatments designs showed consistent learning improvements when vocabulary instruction was extended into the classroom for 12 children, ceiling effects were evident for 3 participants regardless of condition, and inconsistent or minimal effects were demonstrated by 8 participants. Multilevel modeling used to evaluate the effects statistically revealed strong treatment effects. In addition, the 10 children with above-average language showed impressive learning of vocabulary words from books subject to teacher review strategies in comparison to words from books to which they were not exposed. Teachers varied in the extent to which they implemented review strategies in their classrooms. Nevertheless, their responses to social validity assessments were positive, supporting the feasibility of this intervention.
Conclusions: The addition of classwide review and practice opportunities is an effective means of enhancing the effects of an easy-to-implement small-group intervention that teaches challenging vocabulary words within prerecorded stories. This approach holds promise as a way to shrink the pervasive word gap that typically exists when children in high-poverty communities enter school.

Development of oral language is critical during early childhood, providing a foundation for literacy and nearly all other academic performance (Roth, Speece, & Cooper, 2002; Walker, Greenwood, Hart, & Carta, 1994). Specifically, oral language is known to be a reliable predictor of reading proficiency with a clear relation emerging between early vocabulary knowledge and later reading comprehension (Kendeou, van den Broek, White, & Lynch, 2009; Quinn, Wagner, Petscher, & Lopez, 2015; Roth et al., 2002). The consequences of poorly developed vocabulary can be devastating as children who start school with limited vocabulary are prone to developing literacy difficulties that persist throughout school (Hart & Risley, 1995; Hoff, 2013; National Research Council, 1998). Unfortunately, children exhibit wide differences in vocabulary knowledge upon school entry, placing many children at risk for academic disadvantage (National Research Council, 1998; Walker et al., 1994). Because the stakes are high for children with limited vocabulary knowledge, efforts to improve oral language and vocabulary in at-risk preschool children are paramount.

Meta-analyses have shown that vocabulary instruction for young children, often designed to be delivered within the context of storybook reading, yields mostly moderate effects (Marulis & Neuman, 2010; Mol, Bus, & de Jong, 2009; National Early Literacy Panel, 2008). Various approaches are used to promote vocabulary skills within

[a]University of South Florida, Tampa
[b]University of Missouri, Columbia
Correspondence to Howard Goldstein: hgoldstein@usf.edu

Editor-in-Chief: Sean M. Redmond
Editor: Stephen M. Camarata
Received July 5, 2019
Revision received August 13, 2019
Accepted September 9, 2019
https://doi.org/10.1044/2019_JSLHR-19-00052

Disclosure: *Howard Goldstein and Elizabeth Kelley are authors of Story Friends and have a financial interest, as they receive royalties from sales through Paul Brookes Publishing. This interest has been reviewed by their universities in accordance with their Individual Conflict of Interest policies, for the purpose of maintaining the objectivity and integrity of the research.*

the context of storybooks. For example, interactive reading and dialogic reading (Lonigan & Whitehurst, 1998; Whitehurst et al., 1988, 1994) are designed to develop oral language in young children through the use of purposeful adult–child interactions and scaffolding during storybook reading. Although these approaches to oral language development are widely studied and commonly used, the meta-analysis by Mol et al. (2009) concludes that these approaches are only moderately effective when implemented by researchers and far less effective when implemented by trained teachers. Marulis and Neuman examine a broader spectrum of approaches to vocabulary instruction in their meta-analysis of studies with preschoolers and kindergarteners. In contrast to Mol et al., these researchers specifically examined the effects of explicit instruction on vocabulary knowledge. Their findings suggest that approaches that explicitly teach words and meanings and provide multiple examples before, during, or after storybook reading are most effective at improving word learning. Multiple studies examining the use of explicit vocabulary instruction within the context of storybooks further demonstrate the power of this instruction when provided to young children across ability levels (Beck & McKeown, 2007; Coyne, McCoach, & Kapp, 2007; Goldstein et al., 2016; Justice, Meier, & Walpole, 2005; Loftus-Rattan, Mitchell, & Coyne, 2016; Pollard-Durodola et al., 2011). Even small doses of carefully planned, explicit instruction have significantly improved oral language and vocabulary outcomes for at-risk children in preschool and kindergarten (Marulis & Neuman, 2010).

Despite the evidence supporting explicit vocabulary instruction, there is growing concern that preschool children receive little or no oral language instruction during the school day (Greenwood et al., 2013; National Early Literacy Panel, 2008). Observational studies of instruction in early childhood settings reveal that many preschool teachers fail to provide high-quality oral language instruction to children in need (Dickinson, 2011; Justice, Mashburn, Hamre, & Pianta, 2008; Wright, 2012). One approach to increasing the delivery of high-quality oral language instruction in early childhood classrooms involves changing teachers' practices (Cabell, Justice, McGinty, DeCoster, & Forston, 2015; Cabell et al., 2011; Wasik, Bond, & Hindman, 2006; Wasik & Hindman, 2014). For example, Wasik and her colleagues trained preschool teachers to improve their vocabulary instruction and later observed teachers during read-alouds to code the frequency of their discussions about vocabulary. These researchers found that students of teachers who discussed words more frequently demonstrated better vocabulary outcomes. Unfortunately, there still are many preschool teachers who find it challenging to provide high-quality oral language instruction despite access to training and instructional tools, as has been observed across early childhood settings (Dickinson, 2011; Justice et al., 2008; Pence, Justice, & Wiggins, 2008). Fidelity may be low for teachers implementing language curricula in preschools (e.g., Dickinson, 2011; Pence et al., 2008). In addition, even when teachers are able to achieve fidelity after being provided with a curriculum and professional development, there is evidence that they may continue to fall short in the quality of their instruction (Justice et al., 2008). The challenges faced by preschool teachers are further complicated by a lack of early childhood curricula designed to help teachers deliver instruction that fosters vocabulary growth in children (Neuman & Dwyer, 2009). Thus, there is a need for well-designed, explicit vocabulary curricula that are highly effective yet easy for early childhood professionals to implement with fidelity in preschool settings.

Story Friends (Goldstein et al., 2016) is a supplemental curriculum for preschool children that delivers explicit vocabulary instruction through engaging, prerecorded storybooks, thereby making the curriculum inherently easy to implement with fidelity. Each audio book provides embedded instruction of four sophisticated words that is based on several key principles for robust vocabulary instruction described by Beck, McKeown, and Kucan (2002, 2008, 2013). In Story Friends, the target words are first presented within the narration of the story, and primary instruction of the target words immediately follows. The lessons provide a child-friendly definition and multiple examples using each word in a variety of contexts. Children are given multiple opportunities to practice and to actively respond during this instruction. In addition, children listen to each book three times, thereby receiving repeated exposure to each lesson.

Prior studies have shown Story Friends to be effective at increasing vocabulary knowledge in preschoolers at risk for language and literacy difficulties. On average, children in these studies demonstrate learning of 30%–50% of the instructed words (Goldstein et al., 2016; Greenwood et al., 2016; Kelley & Goldstein, 2014; Kelley, Goldstein, Spencer, & Sherman, 2015). This proportion of words learned compares favorably to other studies of explicit vocabulary intervention in which children learned a smaller percentage of words taught (e.g., Justice et al., 2005; Loftus, Coyne, McCoach, & Zipoli, 2010). Considering the relatively low dose of instruction (approximately 45 min per week) and the limited language abilities of participants, Story Friends offers an example of an effective vocabulary intervention that can be implemented in real-world classrooms settings.

Although Story Friends has consistently resulted in robust effects on word learning in young children, it is possible that these effects have not been maximized. A growing body of research has examined the effects of extending vocabulary instruction beyond storybook reading. These extensions, which provide increased opportunities for practice throughout the day, have resulted in significantly better vocabulary learning outcomes (Beck & McKeown, 2007; Coyne et al., 2007; Coyne, McCoach, Loftus, Zipoli, & Kapp, 2009; Loftus-Rattan et al., 2016; McKeown & Beck, 2014; Wasik & Bond, 2001). In these studies, young children who received extended instruction and practice of vocabulary beyond the instruction embedded during storybook reading learned more words than children who did not. These results are not surprising as extension activities

tend to provide more exposure to words and meanings, more opportunities to practice throughout the school day, and more contexts with which children are able to connect to new words.

Across studies, extension activities have been designed to increase exposure to words and meanings by providing (a) repetition of the same instructional activities across multiple days (Beck & McKeown, 2007; McKeown & Beck, 2014); (b) follow-up and review activities that occur after book reading (e.g., Coyne et al., 2007); or (c) a variety of activities that occur before, during, and after book reading (e.g., Neuman, Newman, & Dwyer, 2011; Wasik & Bond, 2001). Most of these extensions have been designed to provide rich opportunities for children to process the meanings of new words more deeply (e.g., Coyne et al., 2007; McKeown & Beck, 2014; Neuman et al., 2011). As McKeown and Beck explain, cognitive processing that is deeper than rote memory or word associations is critical for complete and nuanced word learning. As learners repeatedly engage with and integrate words in a wide range of meaningful contexts, rich semantic networks are formed and generalization of learning is fostered.

The purpose of the current study was to evaluate Classwide Vocabulary Review Strategies (CVRS), an extension to the Story Friends curriculum. This instructional component was designed to increase vocabulary learning in preschool children receiving the Story Friends small-group explicit vocabulary instruction. Teachers were provided with prompts and materials to encourage review of and opportunities to practice vocabulary words during routine classroom activities throughout the school day. The following research questions were addressed:

1. To what extent does the addition of CVRS to the Story Friends program improve vocabulary learning compared to the Story Friends program alone for children with below-average oral language skills at risk for reading difficulties?
2. To what extent do the CVRS result in vocabulary learning among above-average children who are not exposed to the small-group vocabulary instruction?
3. To what extent do teacher social validity results and procedural fidelity measures attest to the usability and feasibility of Story Friends and CVRS program components?

Method

Participants

Four preschool teachers and 23 children were recruited from four state-subsidized, Voluntary Prekindergarten (VPK) classrooms serving children primarily from low-income households. The four female classroom teachers ranged from 31 to 50 years of age; two were multiracial, one was African American, and one was Hispanic. The teachers had 3–15 years of teaching experience; each attended some college, with one receiving her associate degree. Four teachers and 49 parents of children participating provided informed consent. One consented child left the preschool before pretesting.

Parents who agreed to allow their children to participate were asked to complete a demographic survey about their family's socioeconomic status, the home language environment, and the developmental history of their child. All children spoke English as their primary language, and four of the students spoke an additional language (Spanish, Telugu) in their homes. Twenty-two of 23 families completed the demographic survey. Characteristics of the children enrolled in the study are presented in Table 1. All parents reported holding a minimum of a high school diploma or General Educational Development, 12 parents held a bachelor's degree (seven mothers, five fathers), and eight held a graduate/professional degree (four mothers, four fathers). Household socioeconomic status (SES) levels were classified into five social strata based on Hollingshead's Four Factor Index of Social Status (Hollingshead, 1975), as indicated in Table 1. The six families with scores below 30 would be considered of low SES. Two of the 23 children had diagnosed disabilities (one with cerebral palsy, the other unreported). All participants were eligible to attend kindergarten the following year.

All children whose parents consented were screened to determine their eligibility. A total of 48 children from four classrooms were initially screened with three screening measures: (a) the Picture Naming Subtest of the Individual Growth and Development Indicators (IGDI; Wackerle-Hollman, McConnell, & Rodriguez, 2017), (b) the Peabody Picture Vocabulary Test–Fourth Edition (PPVT-IV; Dunn & Dunn, 2007), and (c) the Core Language subtests of the Clinical Evaluation of Language Fundamentals Preschool–Second Edition (CELF Preschool-2; Wiig, Secord, & Semel, 2004). These tools are individually administered, norm-referenced measures of expressive vocabulary, receptive vocabulary, and oral language skills. The IGDI Picture Naming subtest was administered to identify children with significant language delays (lacking in core vocabulary) and those who were exceeding expectations. Thus, children with Rausch-based scores between 46 and 52, indicating poor to moderate oral language skills relative to a normative sample, were identified for further language testing. Children were selected if their standard scores were at the norm to no more than 1.5 *SD*s below the mean on either the PPVT-IV or the CELF Preschool-2 to be included as primary participants. Participants demonstrated mean scores on the PPVT-IV, CELF Preschool-2, and IGDI of 93.0 (SD = 7.2), 90.7 (SD = 6.67), and 48.7 (SD = 2.23), respectively. Children's performances on these measures are provided in Table 1. Three of 26 selected children were excluded from the study due to low attendance.

Ten children with consistent attendance records from two of the larger VPK classrooms were initially screened for eligibility and excluded due to high PPVT scores (M = 110, SD = 4.7). These children did not participate in the small-group intervention but were exposed to the CVRS. By testing these children at posttest, we sought to gain

Table 1. Child and family characteristics.

Class	Child	Gender	Age	SES scores[a]	Ethnicity	PPVT	CELF	IGDI_PN
A	01[b]	F	4–8	46	Asian	101	94	52
	02	F	4–11	53	African American	96	94	47
	03	F	3–11	43.5	African American	97	90	48
	04	F	4–10	42.5	Caucasian	101	102	50
	05	M	4–3	66	Caucasian	97	79	47
	06[b]	F	4–1	66	Asian	101	100	50
B	07	M	4–0		African American	101	84	47
	08	M	4–7	33	African American	91	90	48
	09[b]	F	4–1	37	Hispanic/Latino	96	100	50
	10	F	4–6	27	African American	97	86	53
	11	M	4–7	13	African American	100	90	47
C	12	F	5–5	53	Multiracial	85	79	53
	13	F	5–5	53	Multiracial	92	94	
	14	M	4–9	53	Multiracial	88	90	48
	15	M	4–9	53	African American	84	84	47
	16	M	5–5		African American	94	100	50
	17	M	4–9	48	African American	84	86	46
D	18	M	3–10	14	African American	95	86	48
	19	M	4–5	25	African American	76	88	46
	20	F	4–4	28	African American	82	86	48
	21[b]	F	5–0	34.5	Hispanic/Latino	99	100	52
	22	F	4–9	< 8	African American	94	94	48
	23	F	4–5	32	African American	87	90	46
					M	92.96	90.70	48.68
					SD	7.12	6.67	2.23

Note. SES = socioeconomic status; PPVT-IV = Peabody Picture Vocabulary Test–Fourth Edition; CELF = Clinical Evaluation of Language Fundamentals Preschool–Second Edition, Core Language Subtest; IGDI_PN = Individual Growth and Development Indicator Picture Naming Subtest; F = female; M = male.

[a]SES scores were calculated based on Hollingshead's Four Factor Index of Social Status (Hollingshead, 1975). Scores of 55–66 are in the major business and professional strata, scores of 40–54 are in the medium business and minor professional strata, scores of 30–39 are in the skilled craftsmen and clerical strata, scores of 20–29 are in the semiskilled workers strata, and scores of 8–19 are in the unskilled workers strata. [b]Families of these children reported that children spoke two languages at home. Child 1 and Child 6 spoke Telegu and English, and Child 9 and Child 21 spoke Spanish and English at home.

preliminary information on the extent of vocabulary learning that occurred as a function of the CVRS alone (i.e., without small-group instruction).

Setting

Assessments, screening, and intervention took place at four VPK child care centers. These centers were situated in high-poverty neighborhoods. The small-group Story Friends listening center sessions took place in small quiet rooms as designated by school administrators.

Intervention Components and Materials

Automated Listening Centers

The Story Friends program includes automated listening centers delivered in small groups and facilitated by an adult. Children listen to prerecorded storybooks with embedded, explicit lessons to teach challenging vocabulary words. Listening center materials include Story Friends storybooks, mp3 players with accompanying audio files, an audio splitter, and headphones. The storybook set for this study included one introductory book (*Meet the Jungle Friends*) and eight instructional books from the *Jungle Friends* book series. The book titles are presented in Table 2.

The introductory book introduces *Jungle Friends* characters and the procedure of interactive book-reading sessions. Each *Jungle Friends* instructional book includes interactive embedded lessons to explicitly teach four challenging words (e.g., *enormous, soar*), which would qualify as Tier 2 vocabulary according to Beck et al. (2013). These vocabulary words were selected based on their frequency in adult language, their utility for academic language instruction, their relevance to the storyline, their applicability to a variety of contexts, and children's lack of familiarity with

Table 2. List of *Jungle Friends* books used in this study.

NJF	*New Jungle Friend*
EFD	*Ellie's First Day*
MMA	*Marquez Monkey Around*
MBD	*Marquez's Backwards Day*
EGS	*Ellie Gets Stuck*
ECF	*If Elephants Could Fly*
LBF	*Leo's Brave Face*
LLR	*Leo Loses his Roar*

Note. The order of the books was counterbalanced between classrooms.

the target words (based on prior testing with preschoolers). Each target vocabulary word is taught in two embedded lessons per book that include systematic instructional language. During each lesson, children are provided with three opportunities to say the word, two opportunities to say the definition, an example of the word in the context of the story, an example of the word in a common life experience, and an activity related to the word's meaning. The children respond to the book narrator and speak out loud while wearing headphones; the adult monitoring looks on expectantly and prompts children on occasion. Children listen to each book three times per week. Each Story Friends prerecorded audio includes four target vocabulary words that are 10–12 min in length. In total, children spent less than 40 min in small groups each week.

CVRS

The purpose of CVRS is to prompt teachers to provide opportunities to review and practice the use of target vocabulary words in contexts beyond their use in Story Friends books. The materials are designed to be easy to use, flexible, and readily incorporated into a wide range of typical classroom routines.

As part of the CVRS condition, teachers were prompted to review target words with text message reminders and in-class visual reminders and materials. Daily text message reminders modeled five sentences per week that could be used in various classroom conversations. These sentences included phrases that related to children's experiences, or that offered further explanations of words, or prompts for children to complete sentences or respond to requests or questions (e.g., "You *are birds! Lift up your wings and* ***Soar*** *to the door!*"). These text messages were sent to the teachers at their preferred time of the day. Visual reminders and materials included word cards, a weekly word chart, and a review board. The word cards were designed to remind teachers to use phrases with target vocabulary words during school time. The weekly word chart included Velcro-backed cards with the Tier 2 words and meanings to remind teachers to use the target words and help them keep track of their frequency of word use. The review board functioned as a word wall to prompt review of previously taught target vocabulary words and included small pictures from the story as well as real-life pictures (see Figure 1).

Procedure

The duration of the study from teacher training through the administration of maintenance probes was 11 weeks. Prior to implementation, classroom teachers received a brief training (~60 min) in a quiet room to discuss the program procedure and expectations. The following topics were presented at the meeting: (a) the benefits of word learning on children's academic success, (b) scheduling and situating Story Friends listening centers for three sessions each week, (c) the rationale of Story Friends CVRS and how to make use of the materials provided, and (d) the daily expectations, requirements, and roles for research staff and teachers during the study. At the end of training, research staff shared the classroom extension materials and helped teachers set them up in the classroom.

Story Friends Listening Centers

Trained research staff facilitated the Story Friends listening centers three times a week. The role of the facilitator was to ensure that each child had a headphone and a book and to encourage children to participate (e.g., responding to the narrator's instructions) and to stay on task (e.g., turning the pages). The facilitator provided praise for on-task behavior and redirected children when necessary but did not provide any additional instruction or explicit approval of the children's responses. Implementation of listening centers by research staff ensured that the teachers were blind to words introduced in the books in the Story Friends–only control condition.

Children participated in the listening centers in groups of three or four with the facilitator. Prior to listening to any of the instructional books, participants listened to the Story Friends introductory book (*Meet the Jungle Friends*) one time. The introductory session enabled them to practice listening center expectations and procedures, such as responding to the interactive lessons and turning pages when directed.

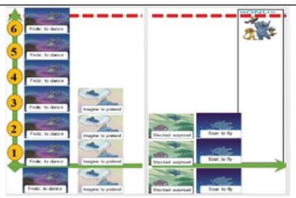
In both conditions, children participated in small-group centers three times per week. Prompts and materials used in the CVRS condition were introduced every other week. During the CVRS condition, teachers practiced target vocabulary words from a given book during the week the book was introduced, and they continued to practice the same vocabulary words for a second week as children listened to a new book in the listening center–only condition.

Dependent Variables

Children's knowledge of targeted vocabulary words was assessed using a mastery monitoring probe. Mastery monitoring vocabulary probes intermixed testing of words to be taught with words that were previously taught. Words were each assessed at four time points: pretest (before listening to storybooks), posttest (after completing three listening centers), Maintenance 1 (1 week after posttest), and Maintenance 2 (2 weeks after posttest). Thus, testing occurred on four successive weeks for each book. During the mastery monitor probes, children were asked to provide definitions for targeted vocabulary words (e.g., *What does soar mean?*). The child responses were scored as reflecting complete knowledge (2 points), partial knowledge (1 point), and no knowledge (0 points), with a maximum score of 8 for four target vocabulary words per book.

Social validity assessments were conducted to evaluate self-reported teacher perceptions regarding their impressions and satisfaction with the program and its feasibility. The two assessments included a structured interview with seven open-ended questions and a survey with nine Likert-scale

Figure 1. Components of Classwide Vocabulary Review Strategies.

Instructional component	Delivery method	Example
Word Cards	Teachers received the review cards weekly. These cards provided target vocabulary words, their meanings, and example phrases.	
Weekly Word Chart	Teachers provided opportunities and review vocabulary words throughout the school day and placed cards when used.	
Story Friends Review Board	Teacher placed cards in board at the beginning of week that followed the treatment book.	

questions that evaluated teachers' attitudes and ideas regarding the Story Friends curriculum.

Research staff who facilitated the listening centers collected field notes during school visits that overlapped with classrooms' circle and center times. These field notes were not collected systematically, but we took advantage of eight 20-min opportunities to gather examples of how teachers were addressing target words in the classroom. The observers transcribed these teacher–child conversations verbatim.

Fidelity of Assessment Administration and Scoring Reliability

The research staff received training on all measures. This training covered administration of the CELF Preschool-2, PPVT-IV, and IGDI Picture Naming standardized assessment tools, as well as the researcher-developed mastery monitor vocabulary probes. Mastery monitor vocabulary assessment sessions were recorded to examine the fidelity of test administration. A second research staff member listened to 20% of all testing sessions and judged whether items were read correctly, responses were recorded accurately, and the standard prompting protocol was followed. Fidelity of assessment administration averaged 89% (range: 71%–98%).

After a primary trained researcher scored all measures, a second trained staff member rescored 20% of the mastery monitor vocabulary assessments to assess reliability. Item-by-item response agreement was calculated by dividing the agreements by the total number of agreement and disagreements. Interrater agreement percentages were high, averaging 96.9% (range: 93.75%–100): 100% at pretest, 100% at posttest, 93.75% at Maintenance 1, and 96.87% at Maintenance 2 probes.

Experimental Design and Analysis

As in prior evaluations of Story Friends intervention, a repeated acquisition design was used to determine the extent to which vocabulary learning effects were replicated within and across participants for each book. The criterion for demonstrating experimental effects required a gain from before intervention to after intervention of at least 2 word points (e.g., the equivalent of learning one word or demonstrating partial knowledge of two words) for each book. Thus, we calculated the percentage of books for which learning effects were replicated.

To answer our primary research question for this study, an adapted alternating treatments design (AATD) was used to compare the effects of Story Friends listening center instruction alone (SF) versus Story Friends listening center instruction with CVRS. The AATD was selected because of its applicability to comparing the effects of instructional practices with nonreversible behaviors (Gast & Ledford, 2014). The order of the two conditions was counterbalanced across classrooms to control for possible differences in word difficulty among books. The SF condition included three listening center sessions and lasted 1 week for each book. The CVRS condition also included listening centers lasting 1 week and added teacher-implemented classroom vocabulary review strategies that occurred for 2 weeks. These two conditions were initiated in an alternating fashion with each new book, and book assignment was counterbalanced among classrooms. Thus, four books were

assigned to the SF condition, and four books were assigned to the CVRS condition, except for Class B, which withdrew from the study after six books because the classroom teacher transferred to another preschool.

Visual analyses, descriptive statistics, multilevel modeling procedures, and summaries of social validity and procedural fidelity measures were used to evaluate treatment effects. First, visual analysis allowed researchers to determine whether functional relations between treatments and vocabulary learning were demonstrated, whether learning was enhanced by CVRS, and the extent to which results were replicated within and across participants (Gast & Ledford, 2014).

Second, vocabulary gains were computed for each student for each of the eight books by subtracting pretest scores from the average of vocabulary scores for the posttest, Maintenance 1, and Maintenance 2. These gain scores were initially analyzed descriptively by computing least square estimates, that is, mean gain across books for each experimental condition (SF and CVRS) for each participant.

Third, a two-level, linear, cross-classified, random effects modeling procedure was used to further characterize variations in children's vocabulary gains. Although the automated nature of SF listening centers results in high treatment fidelity, teachers are more likely to vary in the extent to which they implement CVRS. Because children are nested in classrooms, multilevel modeling was applied. More specifically, fixed effects in the model allowed us to estimate and test the average difference in gains between the two treatment conditions (CVRS and SF), as well as to estimate differences in gains between the classrooms, which we treated as fixed effects because there were less than five classrooms, and to test the classroom by treatment effects. The random effects in the model allowed us to examine the variation in the gains across books and children. The cross-classified random effects modeling analyses were conducted using SPSS mixed models with restricted maximum likelihood estimation. Satterthwaite estimated degrees of freedom were applied to obtain fixed-effect inferences that have been shown to be accurate with single-case data (Ferron, Bell, Hess, Rendina-Gobioff, & Hibbard, 2009; Ferron, Farmer, & Owens, 2010).

Finally, social validity, procedural fidelity, field notes, and teacher-reported implementation data provided rich data sources to evaluate the teacher perceptions and to gather examples of teacher-improvised implementation. After compiling and organizing the qualitative data from various resources, the common themes were identified through open coding and code condensation (Creswell & Poth, 2017).

Results

Comparing Vocabulary Gains Across Conditions

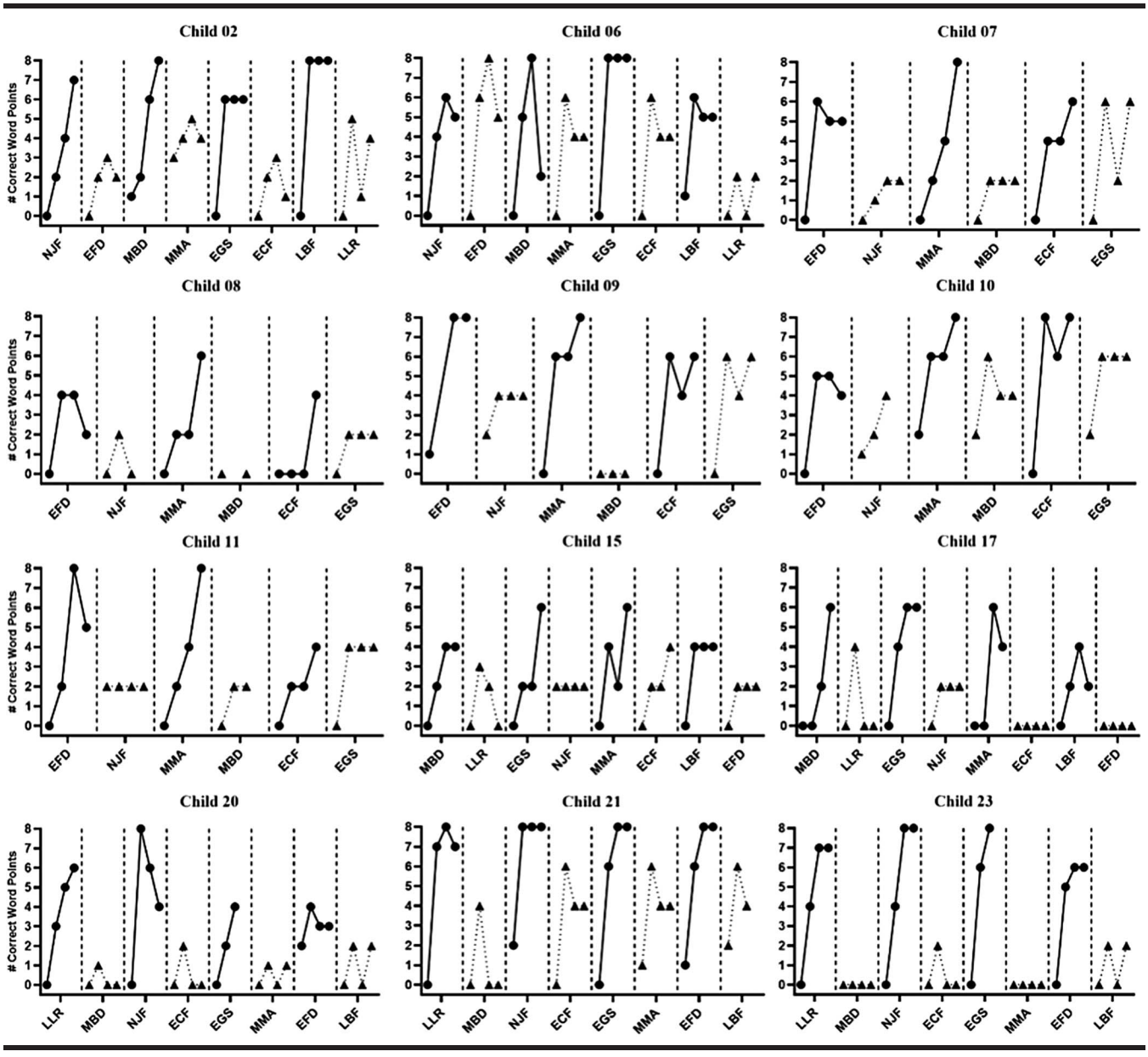
Visual analysis of the immediacy, level, variability, and maintenance of effects was conducted for 23 graphs presented in Figures 2–4. Data points reflect correct responses for four target vocabulary words per book before intervention (pretest), after intervention (posttest), and after the second and third weeks (Maintenance 1 and 2). Thus, vocabulary learning scores were plotted at four time points for each book, with closed triangles denoting the Story Friends–only (SF) condition and closed circles denoting the Story Friends + CVRS condition. The expected learning trend was an abrupt change in level after introducing the SF intervention. However, higher levels and greater stability were expected for the SF + CVRS condition.

First, using the repeated acquisition design, we evaluated whether there were repeated improvements from pretest to posttests/maintenance tests as books were introduced each week. The 23 children were exposed to as many as eight books each, resulting in a total of 174 possible replications. Learning effects of an increase of at least 2 word points was demonstrated for 89% of the 174 possible replications. Because there were 3 weeks of posttesting and maintenance testing for each book, variability in performance can be seen (see Figures 2–4). Most often, the performance stayed relatively consistent with the posttest. You will see examples of drop-offs, stability, and increases in learning gains in both the SF and CVRS conditions, with more examples of continued growth in the CVRS condition. Interestingly, a lack of learning effects was demonstrated 17 times for books during the SF condition and only three times during the CVRS condition.

Second, the first and last authors independently judged whether the AATD revealed differential experimental effects for each participant when comparing the SF and CVRS conditions. They were in agreement for 91% of the participants. Figures 2–4 are organized according to the agreed-upon results of this visual analysis. Figure 2 presents 12 children who demonstrated overall higher performance in the CVRS condition than in the SF condition; Figure 3 presents three children who did not show differential effects because of ceiling effects (i.e., very high vocabulary learning in both conditions); and Figure 4 presents eight children, six of whom showed inconsistent differential effects between conditions and two children (P18 and P19) who showed weak learning effects in general.

We averaged the gains for each of the books assigned to each condition to obtain the mean gain for each child (see Table 3). Average child vocabulary gains in the CVRS condition were 4.7 word points (SD = 1.37) versus a mean of 2.8 word points (SD = 1.16) in the SF condition, a difference of 1.9 word points. Average child vocabulary gains also varied among classrooms. As can be seen in Table 3, Classrooms A, B, C, and D showed differences in mean gain scores between the CVRS and SF conditions of 0.6, 2.5, 1.7, and 3.0 word points, respectively. Based on visual inspection of the AATD, we identified 12 children who demonstrated higher performance in the CVRS condition; their average gain over the SF condition was 2.86 word points. Interclass correlation coefficient variance proportions were calculated for the unconditional model. The interclass correlation coefficients in this analysis were .31 for children and .049 for books. Hence, a two-level, linear, cross-classified,

Figure 2. Results of repeated acquisition and adapted alternating treatments designs showing superior word learning for the Classwide Vocabulary Review Strategies condition (solid circles) versus the Story Friends–only condition (solid triangles). The *x*-axis represents the order of abbreviated book names in Table 2. For each book, four data points are shown for pretest, postintervention, Maintenance Week 1, and Maintenance Week 2. NJF = New Jungle Friend; EFD = Ellie's First Day; MBD = Marquez's Backwards Day; MMA = Marquez Monkey Around; EGS = Ellie Gets Stuck; ECF = If Elephants Could Fly; LBF = Leo's Brave Face; LLR = Leo Loses his Roar.



random effects model was used to disentangle how the vocabulary gains, which were cross-classified by 23 children and eight books, varied as a function of experimental condition (CVRS or SF) and classroom. More specifically,

$$WORDKNOW_{ijk} = \beta_{0jk} + \beta_{1jk} Treatment + r_{ijk} \quad (Level\ 1), \quad (1)$$

$$\beta_{0jk} = \gamma_{00} + \gamma_{01} * (ClassA) + \gamma_{02} * (ClassB) + \gamma_{03} * (ClassC) + v_{0k} + u_{0j} \quad (Level\ 2), \quad (2)$$

$$\beta_{1jk} = \gamma_{10} + \gamma_{11} * (ClassA) + \gamma_{12} * (ClassB) + \gamma_{13} * (ClassC) + v_{1k} + u_{1j} \quad (Level\ 2), \quad (3)$$

where $WORDKNOW_{ijk}$ represents *i*th vocabulary gain for the *j*th child and the *k*th book, treatment is coded 1 for CVRS and 0 for SF, and the Class variables are coded 1 for the class indicated and 0 for all other classes. Thus, γ_{00} is the average gain in Class D for the SF condition, and

Figure 3. Results of repeated acquisition and adapted alternating treatments designs showing ceiling effects for the Classwide Vocabulary Review Strategies condition (solid circles) and the Story Friends–only condition (solid triangles). The *x*-axis represents the order of abbreviated book names. For each book, four data points are shown for pretest, postintervention, Maintenance Week 1, and Maintenance Week 2. NJF = New Jungle Friend; EFD = Ellie's First Day; MBD = Marquez's Backwards Day; MMA = Marquez Monkey Around; EGS = Ellie Gets Stuck; ECF = If Elephants Could Fly; LBF = Leo's Brave Face; LLR = Leo Loses his Roar.

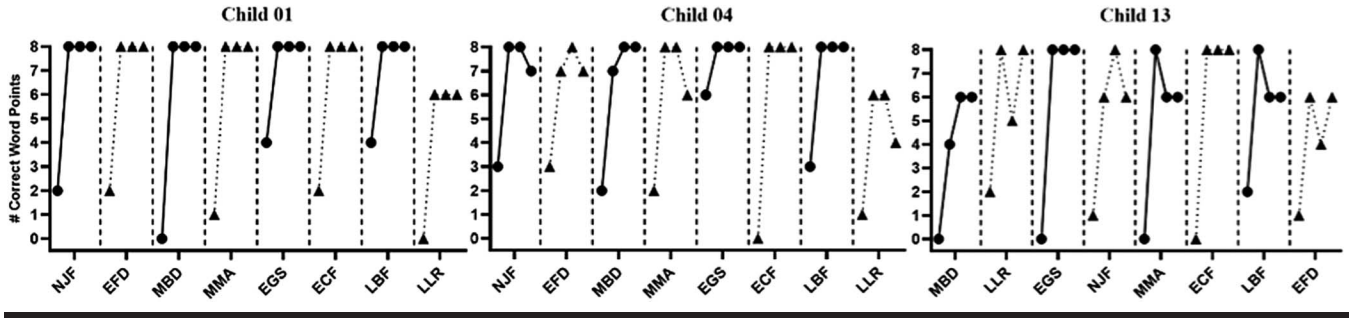


Figure 4. Results of repeated acquisition and adapted alternating treatments designs showing no differential or minimal word learning for the Classwide Vocabulary Review Strategies condition (solid circles) and the Story Friends–only condition (solid triangles). The *x*-axis represents the order of abbreviated book names. For each book, four data points are shown for pretest, postintervention, Maintenance Week 1, and Maintenance Week 2. NJF = New Jungle Friend; EFD = Ellie's First Day; MBD = Marquez's Backwards Day; MMA = Marquez Monkey Around; EGS = Ellie Gets Stuck; ECF = If Elephants Could Fly; LBF = Leo's Brave Face; LLR = Leo Loses his Roar.

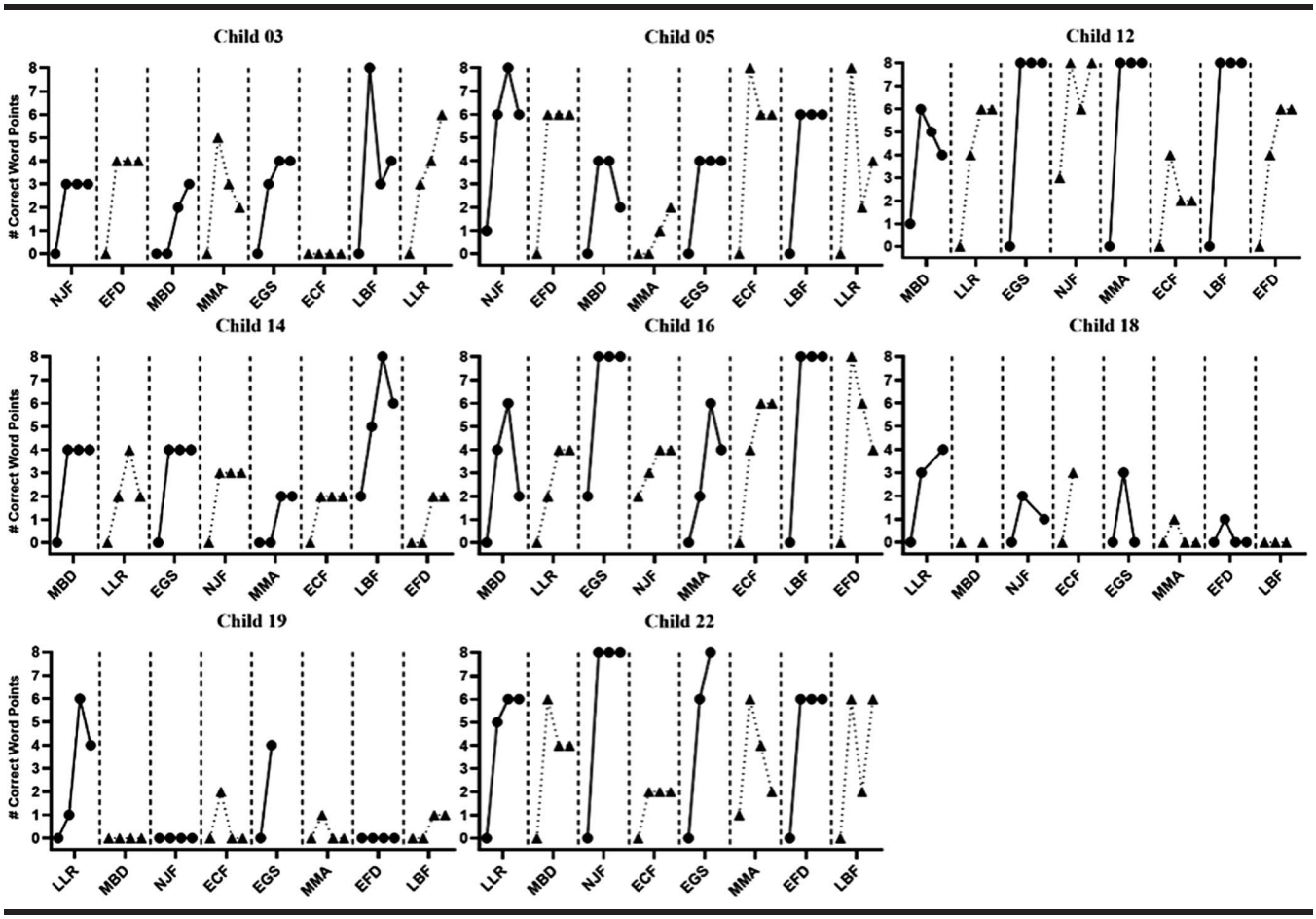


Table 3. Means and standard deviations of child vocabulary gains by experimental condition.

Child ID	Story Friends plus Classwide Vocabulary Review Strategies		Story Friends only		Mean difference between conditions
	M	*SD*	*M*	*SD*	
01[a]	5.50	1.66	6.25	0.43	–0.75
02[b]	5.67	1.51	2.25	0.72	3.42
03[c]	3.33	1.20	2.92	1.72	0.41
04[a]	4.33	1.39	5.50	1.50	–1.17
05[c]	4.75	1.11	4.58	2.19	0.17
06[b]	5.58	1.42	4.25	1.82	1.33
Classroom A	*4.86*	*1.38*	*4.29*	*1.40*	*0.57*
07[b]	4.89	0.31	2.78	1.34	2.11
08[b]	2.67	1.41	1.00	0.82	1.67
09[b]	6.33	2.81	2.44	2.20	3.89
10[b]	5.56	2.64	2.89	0.83	2.67
11[b]	4.11	1.99	2.00	1.63	2.11
Classroom B	*4.71*	*1.83*	*2.22*	*1.36*	*2.49*
12[c]	7.00	1.73	4.42	1.09	2.58
13[a]	6.17	1.28	5.75	1.38	0.42
14[c]	3.42	1.21	2.25	0.64	1.17
15[b]	3.67	0.33	1.58	0.98	2.09
16[c]	5.50	1.66	4.08	1.71	1.42
17[b]	3.50	1.09	0.83	0.87	2.67
Classroom C	*4.88*	*1.22*	*3.15*	*1.11*	*1.73*
18[c]	1.71	1.14	0.83	1.26	0.88
19[c]	1.92	1.92	0.42	0.28	1.50
20[b]	3.75	1.75	0.75	0.36	3.00
21[b]	6.75	0.60	3.17	1.21	3.58
22[c]	6.67	0.91	3.58	1.14	3.09
23[b]	6.33	0.53	0.50	0.55	5.83
Classroom D	*4.52*	*1.14*	*1.54*	*0.80*	*2.98*
Grand mean	4.74	1.37	2.83	1.16	1.92

Note. Italicized values indicate summary parameters for each classroom.

[a]Children who demonstrated high vocabulary knowledge in both conditions. The range of mean difference scores of conditions are –1.17 to 0.42, averaging –0.50. [b]Children who demonstrated overall higher vocabulary knowledge in the Classwide Vocabulary Review Strategies condition than the Story Friends–only condition. The range of mean difference scores of conditions are 1.33–5.83, averaging 2.86. [c]Children who demonstrated inconsistent performance between conditions. The range of mean difference scores of conditions are 0.17–3.08, averaging 1.40.

the differences in this gain for Classes A, B, and C are γ_{01}, γ_{02}, and γ_{03}, respectively. The difference in average gain between the CVRS and SF conditions for Class D is γ_{10}, whereas Classes A, B, and C differ from Class D in the effect of CVRS relative to SF by $\gamma_{11,}$ γ_{12}, and γ_{13}, respectively. The error terms (i.e., r_{ijk}, v_{0k}, u_{0j}, v_{1k}, and u_{1j}) are assumed to be normally distributed.

The proposed model statistically fits better than an unconditional model, $\chi^2 = (11, N = 174) = 161.8$, $p < .01$. In addition, the model assumptions were evaluated by examining each of the residuals in the model using a box plot for outliers, a scatter plot for homoscedasticity, and a QQ-plot for normality. Results indicated a homoscedastic residual distribution with multivariate normality and independence across levels and that observations were independent conditional on the variance components.

As shown in Table 4, the estimated parameter representing child vocabulary gains for the SF condition averaged 1.50 word points for the reference classroom (i.e., Classroom D). For Classrooms A, B, and C, the average gains were estimated to be 2.60, 0.81, and 1.49 word points higher, respectively. Thus, the average gains for the four classrooms for the SF condition were 4.10, 2.31, 2.99, and 1.50 word points. The classroom extension condition expanded child vocabulary gains by an estimated 2.80 word points for Classroom D, which was a statistically significant difference, $t(24) = 4.75$, $p < .001$. When factoring in the Class × Treatment interactions, the average gains for the CVRS condition were 4.80, 4.80, 4.96, and 4.30 for Classrooms A, B, C, and D, respectively.

As seen in Table 4, the model also revealed several statistically significant variance components. Namely, the

Table 4. Output of full-model mixed effects for estimating child vocabulary gains.

Parameter	Parameter estimate	*SE*	95% CI	Significance
Fixed effects				
Intercept	1.502	0.649	[0.16, 2.85]	.030
Class A	2.596	0.880	[0.76, 4.43]	.008
Class B	0.805	0.932	[–1.32, 2.74]	.397
Class C	1.486	0.887	[–0.36, 3.33]	.109
Class D	—	—	—	—
Treatment	2.802	0.590	[1.58, 4.02]	.000
Class A × Treatment	–2.102	–0.792	[–3.74, –0.45]	.014
Class B × Treatment	–0.310	0.845	[–2.54, 1.43]	.717
Class C × Treatment	–0.834	0.810	[–2.51, 0.83]	.313
Class D × Treatment	—	—	—	—
Variance estimates				
Within child	2.828	0.189	[2.48, 3.22]	.000
Between child				
Intercept	1.997	0.728	[0.97, 4.08]	.006
Treatment effect	1.213	0.562	[0.49, 3.01]	.031
Covariance	–0.316	0.466	[–1.23, 0.60]	.498
Between books				
Intercept	0.247	0.195	[0.53, 1.16]	.206
Treatment effect	0.237	0.265	[0.27, 2.11]	.370
Covariance	–1.672	0.197	[–0.55, 0.22]	.396

Note. CI = confidence interval. Dashes represent the "reference group" in the analyses.

residual variance within children ($\sigma^2 = 2.83$), the variance between children for the SF condition ($\tau_{u0} = 2.00$), and the variance between children for the treatment effect ($\tau_{u1} = 1.21$), that is, the difference between the gains in the CVRS and SF conditions, were significant. The random variance associated with the books was not statistically significant.

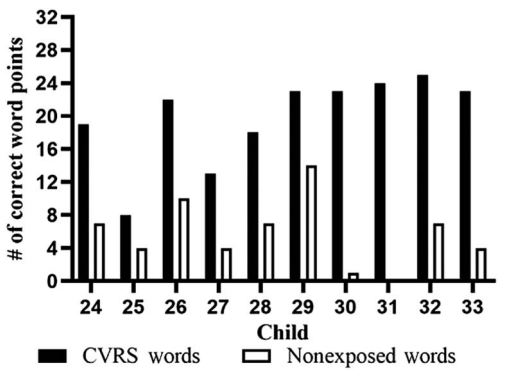
Learning of Children Exposed to Words Through Classwide Vocabulary Review Activities

CVRS occurred in a classroom context, which allowed all children to hear targeted words, definitions, and teaching examples. Although the listening centers were run by the research assistants, classroom teachers were responsible for reviewing the words in the CVRS condition. Thus, learning opportunities varied as a function of the extent to which teachers implemented practice activities with children in their classrooms. Upon completion of the study, we analyzed the vocabulary learning of 10 children who did not receive listening centers from Classrooms C and D by asking them to define vocabulary words (mastery monitor probes) from both conditions. The maximum vocabulary score was 32 word points per condition (4 books × 4 target words × 2 points per word). Results are shown in Figure 5. The means of children's vocabulary scores for the SF condition words versus for the CVRS condition words were 5.8 ($SD = 3.9$) and 19.8 ($SD = 5.2$), representing 18.1% and 61.9% correct, respectively. A paired-samples t test indicated significantly better vocabulary knowledge for the CVRS condition, $t(9) = 6.89$, $p < .001$, $d = 2.18$.

Teacher Implementation and Social Validity

The four teachers who participated in the study showed various frequencies and forms of targeted vocabulary use during daily classroom instruction. For lack of direct observational data, we used three sources of information to characterize the extent to which teachers taught targeted vocabulary words during classroom activities: word cards placed on Story Friends Weekly Word Charts and Review Boards, field notes collected during school visits, and social validity surveys and interviews conducted with the teachers at the end of the study. For example, field notes included the examples of teacher–child dialogues with target

Figure 5. Ten typical children's correct definitions of classroom exposure words versus nonexposure words at posttest (without the Story Friends listening center intervention). CVRS = Classwide Vocabulary Review Strategies.



vocabulary words. An example of such an exchange follows:

> *Child: I was sick.*
> *Teacher: You were '**ill**'. What did your mom do to make you feel better?*
> *Child: Medicine.*
> *Teacher: Did she '**comfort**' you?*
> *Child: yes.*

After each vocabulary use, teachers were asked to add a word card to the word chart. We did not observe teachers doing so with great regularity. Teacher-reported frequency averaged 5.8 word cards per week (SD = 2.05). The teacher-reported frequencies of vocabulary exposure averaged 5.5 word cards per week (SD = 0.89) for Classroom A, 8.5 (SD = 2.2) for Classroom B, 5.9 (SD = 0.44) for Classroom C, and 3.5 (SD = 1.2) for Classroom D. Although this underestimates actual extension activities, it seemed to reflect relative frequency of engagement in such practices among classrooms.

Analysis of the social validity survey (nine Likert-scale questions with a range of 1–4) indicated that teachers were motivated to implement the program to support vocabulary learning in their classrooms (M = 3.75). Teachers strongly agreed that they received explicit program implementation instruction (M = 4.0) and understood how to use the program (M = 4.0). They expressed that the amount of time required to implement this program was reasonable (M = 3.75) and the program implementation required support from coworkers (M = 3.25). Teachers also reported that they would be excited to use this program (M = 3.75) and the program can be implemented as frequently as desired (M = 3.5). They all reported that their frequency of self-reported vocabulary use was an underestimation of their actual frequency of vocabulary use. Teachers mentioned the challenges of adding cards to the classroom chart after each vocabulary use, such as during outside time. Thus, the implementation frequency reported should be evaluated cautiously.

Five topics emerged based on the results of teacher social validity interviews, which will be discussed below.

Overall Vocabulary Use in the Classroom

Teachers reported three strategies for embedding targeted vocabulary into daily conversations: (a) Teachers taught words to the whole group during circle time, (b) teachers noticed when children used the words and followed up with prompts for other children, and (c) teachers targeted words that fit easily into suitable contexts (e.g., "when *the kids ride their bicycle, I say ok, hold on, you can **collide** with your friends. The other is **destroy**, when you build the blocks, your friends may **destroy** it.*").

Observed Child Reactions Toward the Program and Target Vocabulary Word

Teachers expressed that the children were curious and excited about the program and target words. Children used them in the conversations with their classmates, asked the meanings when they could not recall, and pointed out their meanings without the teacher asking (e.g., "*They kind of go with it and if I say '**leap**', somebody will yell 'to jump' instead of me asking for the meaning.*").

Evaluation of Classroom Chart and Review Board

Teachers noted that the Story Friends classroom visuals were constant reminders of words to use repeatedly during a day. One teacher stated that the visuals helped her to keep track of the less frequently used words so that she could use these words more frequently.

Recommended Example Sentences and Daily Text Messages

Overall, teachers said that they utilized the example sentences and their own sentences. One teacher expressed her appreciation for receiving various sentence structures recommended by the research team (i.e., "*I liked how you guys taught me how to use them with the kids.*").

Overall Teacher Reaction to the Program

Teachers evaluated what they liked about CVRS of the Story Friends program: "The program gave different vocabulary words that I usually didn't use in the classroom." "I like it a lot. Children were excited about the books, new words, and headphones." "I like the words and how they were presented." and "The program was well put together and very organized, materials that were provided, text messages, books, word wall, listening center, and small group time."

Discussion

Results indicated that the Story Friends program with classroom extensions produced child vocabulary gains approximately twice as much as Story Friends alone. This improvement in learning was functionally related to the CVRS condition in a predictable way. First, 23 preschool children from four classrooms increased vocabulary learning by at least 2 word points during the CVRS condition for 84 books of the 87 possible replications (97%) in comparison to 70 books of 87 possible replications (80%) during the SF condition. Second, the Story Friends program with CVRS significantly enhanced child vocabulary knowledge compared to the SF condition. Based on posttest scores, children's demonstrated vocabulary knowledge averaged 41.9% of words in the SF condition. The same children demonstrated better learning, averaging 62.3% of vocabulary words taught during the CVRS condition. The percentage of the vocabulary learning in the SF condition was in line with previous Story Friends findings (Goldstein et al., 2016; Greenwood et al., 2016; Kelley et al., 2015; Spencer, Goldstein, Sherman, et al., 2012).

Adding CVRS to the Story Friends program substantially improved child vocabulary learning compared to previous studies (Goldstein et al., 2016; Kelley & Goldstein, 2014; Kelley et al., 2015). The 20.4% increase shown in this study reflects a marked improvement. This result extends

the literature demonstrating positive effects of increased opportunities to practice vocabulary words throughout the school day beyond the instruction in storybook contexts (Coyne et al., 2007, 2009; Loftus-Rattan et al., 2016; McKeown & Beck, 2014; Wasik & Bond, 2001). Comparing studies is complicated by the differences in the number and difficulty of words taught and differences in the measures of word learning. Investigators have suggested that adults can support child vocabulary learning by initiating multiple conversations with explicit instruction using target vocabulary words (Loftus-Rattan et al., 2016; Silverman & Crandell, 2010). The CVRS condition exemplifies a viable means of prompting and promoting explicit vocabulary instruction through such adult–child conversations. Indeed, teachers reported that they benefited from text messages and visual materials that reminded them to embed target words into daily classroom interactions.

One conceivable explanation of increased child vocabulary knowledge could be multiple explicit vocabulary instructional episodes in meaningful contexts to which children could relate (Beck et al., 2002; Marulis & Neuman, 2010; Spencer, Goldstein, & Kaminski, 2012). Children were provided ample opportunities to respond, which is a robust predictor of learning (Greenwood, Delquadri, & Hall, 1984; Greenwood, Horton, & Utley, 2002; Sutherland & Wehby, 2001). Researchers have posited that child vocabulary learning progresses in stages, for example, from recognizing words, to comprehending words, to expressing words, to defining words (Beck et al., 2013; Christ, 2011; Goldstein et al., 2017; McKeown & Beck, 2003). Our study exemplifies review strategies that are feasible for implementation in various contexts during classroom routines to provide multiple opportunities to learn and practice novel vocabulary words.

The combination of repeated acquisition design and AATD presented unique opportunities to apply multiple data analytic techniques. The repeated acquisition design essentially replicated effects consistent with previous evaluations of the SF intervention mainly with preschoolers from low-income communities. AATDs are among the few options for comparing two (or more) treatment conditions using single-case experimental designs. However, they are risky designs because they are not very sensitive to detect small differences. Moreover, this potential problem tends to be exacerbated when including a treatment repeatedly shown to result in substantial learning. Indeed, ceiling effects masked potential treatment differences for at least three participants, which was consistent with high achievers in past studies of Story Friends.

Although it is unusual to include 23 participants in single-case design experiments, it allows one to examine individual differences in learning not captured in group design experiments. A novel and notable aspect of this study was the use of multilevel modeling analysis. One advantage was the use of multilevel modeling to characterize the individual differences among classrooms, largely attributable to differences in teacher implementation, as well as other potential sources of variability, for example, books. This analysis also has the advantage of providing an overall estimate of the magnitude of our treatment effect, expressed in word point gains. Although these effects and the differences between classrooms were explored descriptively in Table 3, the use of the model provided a formal mechanism to estimate the effects, express uncertainty in the effect estimates, and examine moderators. That is, the point estimates from the model summarized and mirrored the descriptive mean differences provided in Table 3, but by using the model, we obtained standard errors that accounted for the complex cross-classified structure of the data. These standard errors facilitated the creation of confidence intervals and hypothesis tests for the effects, as well as tests for the differences in effect between classrooms.

Despite the large effects revealed through statistical analyses, significant variation in vocabulary learning was evident among children. Our visual analyses revealed different learning patterns that influenced our comparison of the CVRS and SF conditions: (a) Three children demonstrated near-maximal learning in both conditions, (b) 12 children demonstrated consistently better learning outcomes during the CVRS condition, (c) six children demonstrated inconsistent differences in vocabulary learning across conditions, and (d) two children showed minimal learning in both conditions. Visual inspection may result in rather conservative judgments of experimental effects. For example, Child 12 had the highest overall gains associated with the CVRS condition, but SF gains were almost as high for two of four books, which resulted in our judgment of inconsistent effects. As can be seen in Figure 4, even among the 26% of children who did not show a consistent advantage of the CVRS over the SF condition, an impressive amount of word learning was demonstrated.

These results shed light on how preschool children respond differently to vocabulary intervention programs and may inform strategies for moving children among tiers of instruction to maximize learning. Certainly, we would consider the two children who demonstrated minimal learning in both conditions to be candidates for a higher tier of instruction. We realize that children with limited language skills may be at a disadvantage in learning challenging vocabulary words if they have trouble understanding the definitions or contexts used to illustrate the use of these novel words. Some children could learn and retain new words and their meanings more rapidly than other children. Others may have memory, attention, or behavior problems that interfere with learning. Consequently, we explored whether results were predicted by PPVT and CELF scores. The only significant correlation was between PPVT and the SF condition ($r = .52$, $p < .05$). Child 19, with the lowest PPVT score (76), was one of the two children demonstrating minimal learning, albeit slightly better than Child 18 who had a PPVT score of 95. Notably, these two children were among the six children from the low social strata. However, most of the children from low-income homes demonstrated good word learning, especially in the CVRS condition. We found no readily apparent

pattern based on standardized pretest scores. In general, children with lower vocabulary and language test scores seemed to benefit quite a bit from the CVRS condition. Future research is needed to better understand the sources of variation in vocabulary learning among young children with various background knowledge and learning trajectories and how to overcome poor learning outcomes. Nevertheless, results of this intervention show promise for narrowing the alarming word gap often found among children living in impoverished homes and communities.

The classroom extension activities also presented an opportunity to observe vocabulary learning among children who were excluded from small-group sessions due to their higher PPVT scores. These children were exposed to vocabulary words and definitions only in the CVRS condition during classroom routines. Upon the completion of the program, these children learned a mean of 61.9% of CVRS condition vocabulary words compared to a mean of 18.1% words to which they were not exposed. The base rate of 18.1% is slightly lower than the pretest mean (21.9%) for the three participants who showed ceiling effects. The latter participants showed even more improvement averaging 90.8% of words known at posttest across the two conditions. Nevertheless, the average vocabulary knowledge of these children as a function of CVRS alone was as much as the average vocabulary knowledge (62.3%) of children with limited language skills who participated in SF listening centers + CVRS condition. Hence, teacher implementation of CVRS could help elevate the vocabulary knowledge of children with typical and limited language skills. The typical children are able to increase their vocabulary knowledge by listening and observing teachers' language use during large group instruction (Marulis & Neuman, 2010). Thus, teachers may efficiently provide instruction at the general classroom and small group levels.

We also sought to judge the acceptability and feasibility of asking teachers to extend review and practice into their classrooms. Because teachers implemented CVRS at various times across the school day, and capturing accurate data on implementation rates was not possible, we relied on multiple, subjective sources of information from teachers and research staff. Social validity measures indicated that teachers were able to implement classroom extensions of the Story Friends curriculum, and they perceived the strategies to be engaging and beneficial to young children. Despite the current literature pointing to the need to provide more teacher training and coaching for better child vocabulary learning (Hindman & Wasik, 2012; Neuman & Wright, 2010), the present intervention only required a 1-hr teacher training to introduce the program. Thereafter, daily text messages and classroom visual materials were provided to remind teachers to use the target vocabulary words.

Field notes from research staff indicated that teachers incorporated provided materials in a number of ways. They implemented large group instruction during circle time, used target words instead of common words during daily classroom instruction, and capitalized on teaching opportunities when children used the words. In contrast to prior research, this study demonstrated that teachers can reinforce the learning in structured vocabulary interventions with minimal training (Dickinson, 2011; Justice et al., 2008). Some of these studies describe the low likelihood of finding robust vocabulary instruction in low-SES classrooms with diminished classroom and teacher resources (Dickinson, 2011; Wright, 2012). Perhaps, the focus on relatively few targeted words made this a more achievable goal for teachers. Although we do not know how many review opportunities were provided, results revealed benefits to vocabulary learning for a majority of the children in classrooms.

Observations of research staff indicated that teachers varied in the extent to which teachers extended vocabulary instruction into daily classroom routines. Staff members noted that the teachers were not very good at documenting review opportunities on the chart that was provided for that purpose. Nevertheless, they agreed that the relative ranking of teacher implementation was consistent with the number of words added to word wall charts. Future research needs to capture perceptions of implementation more systematically to relate class differences to differences in vocabulary learning.

How to best monitor teacher implementation of classroom practice activities needs to be determined. This is key to developing an understanding of how to prompt and reinforce classwide vocabulary practice needed to optimize results. This information would provide a better understanding of how the current intervention program should be implemented in preschool settings by classroom teachers and instructional aides. Our results on teacher usage of target words underestimated implementation. Other self-monitoring strategies might be more successful (Kalis, Vannest, & Parker, 2007; Oliver, Wehby, & Nelson, 2015). Future work must devise alternatives to expensive, time-consuming observations across the day to assess the frequency of teacher instruction targeting vocabulary during classroom routines. It may be beneficial to incorporate a recording system that captures teacher utterances, such as LENA Pro. We also need to figure out how to best incorporate practice at home to optimize the effects of vocabulary instruction.

Another limitation of this study is that the Story Friends small-group sessions were implemented by the researchers and not educational staff. This likely helped us maintain experimental control as teachers likely were unaware of words on alternate weeks and thus less likely to implement CVRS in the SF condition. Nevertheless, the Story Friends program was designed to provide an automated curriculum delivered to small groups of children by any educational staff (e.g., instructional aides). Previous studies demonstrated high fidelity of the classroom implementation of small-group sessions, as a prerecorded curriculum with well-constructed explicit instruction does not require intensive training (Goldstein et al., 2016; Greenwood et al., 2016; Kelley & Goldstein, 2014; Kelley et al., 2015). Teaching staff merely need to provide minimal monitoring

and input, such as helping children to turn pages and encouraging children to stay on task. Moreover, teachers may benefit from knowing contexts used when vocabulary words are introduced and how they are taught. Thus, we believe that asking teaching staff to implement daily listening centers and classwide review activities is likely to prove viable.

In conclusion, the purpose of this study was to examine the effects of adding classroom review and practice to the Story Friends program on the learning of challenging vocabulary among preschoolers with limited oral language skills. Findings indicated significant improvements in children's learning of targeted vocabulary. Additionally, we provided preliminary evidence of how children with above-average language scores can advance their target vocabulary knowledge merely as a result of the classroom review activities. Classroom extensions of the Story Friends program appear to be feasible to implement in preschool education settings and a promising approach to improving children's target vocabulary knowledge.

Acknowledgments

This research was supported by Grant R324A150132 from the Institute of Education Sciences awarded to the University of South Florida. We would like to thank the teachers and students who participated in the study.

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