

Engaging, Explicit, and Elaborated

An Initial Trial of Media-Enhanced Preschool Vocabulary Instruction

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Children from backgrounds of poverty often lag behind more advantaged peers in early language skills, including breadth and depth of vocabulary knowledge. We report the results of a pilot study of an explicit and elaborated vocabulary intervention in preschool classrooms serving children from lower-income backgrounds. The intervention used multimodal instruction, including segments from public television children's programs and interactive games, to build children's knowledge of and semantic connections for 128 words across 18 weeks of daily lessons. Within 39 classrooms representing childcare, Head Start, and public prekindergarten settings, 192 preschool-age children ($M = 52.10$ months) participated in structured lessons and extension activities delivered by teachers and aides. Within-child comparisons of growth for taught target words versus matched untaught words revealed that children grew on all words but demonstrated significantly greater growth for taught words. Results support the value of elaborated and explicit vocabulary instruction and the role of visual media as contexts for preschooler's word learning.

Key words: *instruction, media, preschool, vocabulary*

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VOCABULARY is a keystone skill for the achievement of school readiness, later reading comprehension and written expression, and broader academic success. Unfortunately, many children from high-poverty backgrounds have substantial differences in their language skills relative to more affluent peers (e.g., Hoff, 2013; Noble et al., 2007). These distinctions are observable when children are toddlers, and without explicit attention tend to persist beyond school entry (e.g., Gardner-Neblett et al., 2014; Walker et al., 1994). Yet, children from high-poverty homes are often served in early childhood education (ECE) settings where they do not receive optimal language stimulation or instruction (Phillips et al., 2018; Pelatti et al., 2014), and in which educators vary extensively in experience and expertise. Here, we describe an initial evaluation of a novel supplemental program meeting the need for effective,

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yet easily implemented Tier 1 ECE language instruction.

INTENTIONAL VOCABULARY INSTRUCTION

There is evidence from experimental studies that intentional vocabulary instruction can be beneficial. The meta-analytic reviews completed by Marulis and Neuman (2010, 2013) clearly indicated that systematic instruction in vocabulary can be successful with preschool-age children. However, Marulis and Neumann (2010) noted that childcare providers—those most likely to be in Head Start and other settings serving some of the children with greatest need—obtained poorer results than did researchers and certified teachers found primarily in public prekindergartens.

Results from professional development (PD) efforts in ECE also are mixed. Whereas there are favorable results from modular techniques covered in PD offerings such as small-group dialogic reading (Lonigan et al., 2013), large-group shared reading with embedded, explicit vocabulary instruction (e.g., Gonzalez et al., 2014; Wasik & Hindman, 2020), and explicit large-group instruction with images and videos (e.g., Neuman et al., 2016), studies in which PD does not include aligned and highly structured instructional materials have demonstrated less success in impacting language skills (e.g., Cabell et al., 2011; Powell et al., 2010). Efficacy studies on comprehensive preschool curricula also yield mixed or modest results for language outcomes (e.g., Lonigan, Farver et al., 2011; Wilcox et al., 2011). Of the numerous language interventions evaluated for quality and summarized in a recent review (Herrera et al., 2021), many did not lead to significant impacts.

UNFULFILLED PROMISE OF MANY INTERVENTIONS

Given how stable the weaknesses are in many children's early language skills, it is

imperative to understand why more interventions do not have substantive impacts and to explore novel methods of generating larger effects. We executed this intervention study as a step in this direction, with two motivating arguments. One is that some disappointing prior findings are the result of a mismatch between the intensity of need demonstrated by children and the intensity of instruction provided to them. The other argument is that ECE teachers may require more written and oral instructional support for high-quality instruction than has been provided in some prior vocabulary interventions (Lee et al., 2012; Piasta et al., 2012). This argument is consistent with Dickinson's (2011) commentary, where he suggested prior interventions may not have sufficiently attended to and changed teachers' capacity to deliver high-quality language-focused instruction.

INSTRUCTIONAL DESIGN PRINCIPLES

We developed our instructional package to be intensive and highly explicit for both teachers and children. It also was designed to be well-implemented by educators with diverse education and expertise through inclusion of four key instructional design features. First, the program included 16 weeks of daily, 30-min lessons, for a cumulative total of at least 40 hr of teacher-led instruction. We were guided by work on interventions for children's reading difficulties, often delivered within response-to-intervention models (e.g., Denton, 2012; Wanzek & Vaughn, 2007). Many Tier 3 reading interventions include over 100 instructional sessions, whereas many Tier 2 interventions include between 15 and 100 sessions (Wanzek et al., 2016). Preschool children are often aggregated in classrooms where the majority, if not all children, are deemed at-risk or already have demonstrated delays (Lonigan & Phillips, 2016; Phillips et al., 2018). Thus, we focused on providing the consistency and dose of an intensive Tier 2 program to entire classrooms of children.

Second, challenges related to delivery of high-quality and effective book reading interventions motivated our development of an alternative instructional framework. Although most vocabulary programs have relied on book reading as the core instructional mechanism, some fidelity results and investigations of teachers' extratextual comments while reading reveal that some teachers are limited in their fluent and elaborative reading (Pentimonti & Justice, 2010; Zucker et al., 2010). Whereas high-quality, interactive book reading supports vocabulary acquisition, it is important to explore complementary instructional strategies and contexts, especially those that may rely less on the expertise of the teacher. These considerations are particularly important when supporting children's learning across the spectrum of ECE contexts, including childcare settings where the minimum educational requirement for providers is a high school diploma (e.g., Florida Division of Early Learning, n.d.) and where there is less access to PD of any kind. Alternative instructional modalities also may be of utility for teacher aides, as their educational requirements often are lower than for lead teachers. These aides have untapped potential in need of supportive instructional tools (Shim et al., 2004; Sosinsky & Gilliam, 2011). Thus, our instructional design centered on scripted lesson guides and videos carefully selected from segments of the educational television shows *Sesame Street* and *Between the Lions*.

PBS educational programs seek to emphasize and mirror common features of live adult-child or child-child conversations such as the use of visual cues, joint attention, and shared present tense context (Fisch & Truglio, 2014; Prior & Bentin, 2008). This likely increases children's potential to learn vocabulary via the incidental teaching and fast-mapping mechanisms known to support language learning (Oetting et al., 1995; Rice et al., 1990). Moreover, because children benefit from peer models (e.g., Purtell et al., 2021), characters within the selected shows use linguistic content and speaking patterns

mimicking young children (Fisch & Truglio, 2014).

Several experimental studies of children's exposure to PBS educational content similar to that embedded in the present intervention study yielded significant positive effects on children's language skills (e.g., Silverman & Hines, 2009; Uchikoshi, 2005). Linebarger et al. (2009) indicated that 4- to 7-year-old children assigned to view 16 episodes of *Martha Speaks* gained more vocabulary than nonviewers. Similarly, a cluster-randomized trial with 105 preschool classrooms reported that children who watched repeated episodes of *WordWorld* gained significantly more than controls in target vocabulary and in code-related reading skills (Cohen & Hadley, 2011).

The third core design feature was our inclusion of evidence-based strategies. The scope and sequence of lessons, selection of words to teach, and very precise wording for introducing, defining, and elaborating new words for children all were informed both by the science of language development and by efficacious vocabulary interventions for older children (e.g., Beck & McKeown, 2007; Coyne et al., 2007) that emphasize the value of both explicit instruction and incidental learning, particularly when interactions are highly contextualized and require minimal inference (Camarata et al., 1994; Gray, 2005). As another evidence-based feature, lessons were embedded in week-long themes and interconnected in 4-week conceptual units. Topical instruction was intended to increase schema knowledge, accelerate acquisition of linked words (Kim et al., 2021; Neuman et al., 2011), build cohesive semantic networks (Borovsky & Elman, 2006), and support children's motivation to learn new words, which may then facilitate further vocabulary learning (Neugebauer et al., 2017; Scott & Nagy, 2004). We expected that explicit provision of child-friendly definitions and word-to-word connections would build depth of meaning, and prevent mapping to incorrect associations (Medina et al., 2011).

A fourth feature included the use of scripted lesson plans (Davis et al., 2014) to

enhance feasibility and as job-embedded PD. Specifically, because initial observations and design trials indicated that many teachers struggled to respond effectively when children provided incorrect or limited answers to questions, as noted recently by Deshmukh et al. (2021), we included exemplar feedback to children's incorrect responses in each lesson. These served as an implementation support to increase teachers' capacity to scaffold children's understanding.

In the current study, we present results from a within-subjects experimental test of the intervention in diverse classrooms serving preschool children. As an initial trial, our goal was to evaluate children's acquisition of taught words, in comparison to similar but untaught words. Given the relatively intensive instruction and careful design, we expected children to learn taught words at a significantly greater rate than they learned untaught words. However, as children also may learn words through incidental exposure and they were likely to hear some of the untaught words, we expected to see growth in these words, too. Because words were randomly assigned to the assessment forms, and then children assigned randomly to forms, we did not expect a significant effect of form, but we tested this in our models.

METHOD

Site selection

During the summer preceding the implementation school year, preschool classrooms were recruited for participation in the field trial of the Building Language Opportunities and Outcomes through Media intervention. Eligibility criteria required 50% of enrolled children to be from low-income backgrounds. Initially, we selected 42 preschool classrooms serving 3-to 5-year old children that represented private childcare centers (31; 73.8%), Head Start (6; 14.2%), and public schools (9; 21.4%); these numbers exceed 42 because four classrooms were Head Start located within public schools. Participating

classrooms were in two midsize metropolitan areas in the southeast United States, with slightly more classrooms in one city (i.e., 20 vs. 22 in the original sample). Of the original 42 classrooms, three withdrew due to administrative issues prior to intervention commencing. One teacher left mid-year, but her replacement teacher received training to continue implementation; therefore, the final sample included 40 lead teachers. Initially, the 39 classrooms included 8–20 children ($M = 13.28$; $SD = 4.00$) although size varied as children withdrew and enrolled across the year. Unless they were particularly small, classrooms had a lead teacher and one to two aides.

Teacher participants

Lead teachers, including one male, ranged in age from 20 to 60 years ($M = 41.86$; $SD = 11.02$) and included 42.1% White, 55.5% African American, and 2.6% Asian participants. Education level among lead teachers included 52.6% who held a high school diploma or some college, 26.3% who held an AA, 18.4% who held a BA, and 2.6% (1) who held a degree higher than a BA. Teaching experience ranged from 1 to 35 years ($M = 9.49$, $SD = 8.46$), with 35.3% of teachers having taught 3 years or less, 29.2% having taught 4–9 years, and 35.0% having taught for 10 years or more. In 26 of the 39 classrooms, teacher aides (all female) were active implementers. Among the 20 aides for whom these data were available, 95% held at most a high school diploma and 5% (1) held a bachelor's degree.

Child participants

Through multiple rounds of solicitation, we obtained consent for 515 children in the original 42 classrooms. Within each classroom, four children were randomly selected from among those with consent and randomly assigned to complete one of two assessment forms, as described later. Throughout the year, some children withdrew or were repeatedly absent. Whenever possible, children from the originally consented pool,

or occasionally children who enrolled and consented partway through the year, were randomly selected as replacement participants to maintain an assessed sample of four children per classroom. Therefore, rather than including only originally selected children (i.e., $39 \times 4 = 156$), the current sample includes data from 192 children who participated in one to five waves of data collection. On average (range = 4–8), five children participated per classroom. Children included approximately 51% boys and ranged in age from 33 to 68 months ($M = 52.10$; $SD = 6.08$). Most participants were 4 (85%) or 3 years old (12%). Among the children, 95 were assigned to Form A assessment materials and 97 to Form B; 144 (75%) had data from at least three of five waves of data collection.

Intervention development and design

Core design features

We aimed to capitalize on benefits from viewing high-quality videos while supporting teachers in how to complement the videos with explicit, systematic, and interactive instruction in ways that might generalize to linguistic support beyond the lessons. Whereas ideal implementation would likely be in small groups, we were motivated by considerations for feasibility and sustainability. Therefore, the intervention followed a “hybrid” group-size framework such that the daily 30-min lessons were conducted as a 15-min whole-group segment followed by 15-min of activities delivered simultaneously to two smaller groups with approximately the same number of children in each group. On Fridays, teachers were encouraged to complete the post-video cumulative review activities in smaller groups. These instructional formats required teaching aides to lead the daily activities delivered in smaller groups, a practice consistent with some evidence-based curricula (e.g., Lonigan, Farver et al., 2011) and with goals of professionalizing the teaching aides’ activity (Sosinsky & Gilliam, 2011). Teachers completed the 30 min all at once or in two 15-min segments during the day.

We augmented the modeling (including character’s peer-modeling) in videos with explicit lessons that included teacher role-play of a peer model with the use of *Sesame Street* character puppets. That is, the “novice learner” puppet asked for assistance and clarifications regularly when learning new words alongside the children. Furthermore, videos and written puppet dialogues served as a scaffold for the adult educators with which to enhance their skill at presenting and extending vocabulary in a child-friendly and engaging manner. To ensure ample exposures across contexts, which may be especially relevant for children with small semantic networks (Gray, 2003; Storkel et al., 2017), videos and lessons included high-density exposure (i.e., 12–20 planned exposures) to words across contexts, augmented by teachers’ and peers’ informal uses. Consistent with our goal of providing educative materials and of encouraging teachers to extend the themes and use of new vocabulary across the day, we included guidance regarding language support techniques to embed in conversations (e.g., recasts, expansions; Cabell et al., 2011) and extension activities like transition and supplemental activity ideas.

Word selection and explicit instruction

Prior to the implementation described here, the intervention was iteratively developed in 20 comparable classrooms through component and multiunit design trials incorporating extensive teacher feedback and observational data to guide revisions. We first evaluated the feasibility and age-appropriateness of theme-embedded target words. Using a set of 713 words aligned to 26 themes, we assessed knowledge among approximately 450 preschool children. We excluded words known by 65% or more and those known by fewer than 20% of participants as too easy or too advanced, respectively. After selecting 16 themes, some remaining words from excluded themes became “untaught” words on the proximal measure described later.

Teachers explicitly taught eight words a week, with four words introduced Monday to Tuesday and four introduced Wednesday to Thursday. Thus, across 16 themes there were 128 target words varying by proportions of nouns, verbs, adjectives, and adverbs as appropriate for each theme and video selections. In total, we taught 45 concrete nouns (e.g., instrument and planet), 15 abstract nouns (e.g., suggestion and energy), 39 more and less imageable verbs (e.g., gather and cooperate), and 29 adjectives and adverbs (e.g., adventurous and edible). We embedded extra help for verb acquisition, which can be more challenging (McDonough et al., 2011), including multimodal supports (pictorial, gestural, and video) and clear verbal descriptions (e.g., Brandone et al., 2007; Maguire et al., 2008).

Weekly and daily intervention structure

The full intervention comprised 16-week-long units, plus initial preview and final review weeks. Daily 30-min lessons began in whole-group settings with explicit but highly engaging (i.e., including puppets, images, and songs) preteaching or review of that day's four words and their child-friendly definitions. Next, also in the whole group, children viewed 8- to 10-min edited video montages from PBS Educational Television shows *Sesame Street* and *Between the Lions* as authentic contexts where target words were presented. Each week children viewed two videos multiple times while responding to questions and gesturing when seeing or hearing target words.

After coviewing the videos, children divided into the smaller groups simultaneously led by the lead and aide teachers (unless the class was small and there was no aide) and played two interactive games in the remaining 15 min. These games supported acquisition of target vocabulary along with broader language skills of listening comprehension, elaborated expressive language, and conversational skills. Each week, children played five of 11 games that frequently recurred to facilitate ease of implementation. These 11 games were selected from a larger

initial set after each was tried out with multiple themes and words in multiple classrooms not included in this full trial during two prior school years. The pre-video whole-group introduction (Mondays and Wednesdays) and review (Tuesdays and Thursdays) lessons also were tested and refined in these earlier stages involving iterative design, implementation, and feedback cycles.

We selected the four primary games for each week to best match the words being taught (e.g., some games fit adjectives better and others were well-suited for verbs). Throughout the week, each child played each game twice; on Fridays, children played two cumulative review activities. In one game played in seven of the week-long units, children explored relations among three target words, generated new words that fit the semantic network, and discussed why they belonged. In the Key Words game played both as an initial and Friday review game, children selected the correct vocabulary "key" to open a door when prompted with the aligned definition. In another activity, children described theme-linked pictures to practice using target vocabulary in authentic conversations. Most games included both newly and previously taught words to reinforce retention and semantic connections. See Supplemental Digital Material Tables S1 and S2 (available at: <http://links.lww.com/TLD/A95> and <http://links.lww.com/TLD/A96>) for additional information on each game and for the distribution of games.

Beyond core lessons, suggested extension activities, including transition activities, supported word retention and thematic concepts during daily routines. For example, as a transition activity during the Farm theme, children were prompted to plant imaginary seeds on their way to the playground. Weekly posters reminding teachers of these ideas also included incidental scaffolding strategies to be embedded in conversations (e.g., expanding child language) throughout the day. Suggested extension activities included reading theme-related storybooks, engaging in art activities, viewing additional accessible videos, and singing songs.

Professional development

Teaching teams received workshop PD and regular in-class coaching sessions by project personnel with early childhood mentoring experience. Teachers received a full day of initial training that included information on children's language development, how to support language during preschool activities, and practice using the lesson plans, accompanying videos, and other materials provided. Two additional half-day workshops within the first 3 weeks of implementation addressed scheduling and logistical management of daily lesson formats and extension activities; they also focused on classroom management techniques to support child engagement and on differentiated instruction. We also designed the weekly written intervention guides to facilitate feasibility and increasingly autonomous implementation. Lesson plans detailed goals, materials, ordered lesson steps, and recommended but not required wording that specifically included written models of suggested scaffolding techniques (see Supplemental Digital Content Table S3, available at: <http://links.lww.com/TLD/A97>).

Each teaching team received between 12 and 16 (depending on scheduling logistics) in-class coaching sessions that included modeling, feedback, and logistical troubleshooting. The coaches initially focused on assisting teachers with executing the lesson plans and on empowering aides to implement activities. When daily implementation became routine, coaches guided teachers to maximize children's engagement, use teachable reinforcement and review moments during informal conversations, and to scaffold for children with varying skill levels.

Measures

Curriculum-based assessment

To create the assessment, we randomly selected 10 words from each of the four conceptual units and paired them with untaught words matched on lexical class (i.e., adjectives, adverbs, verbs, and nouns) and likelihood of being known based on pilot data.

We then created two parallel forms (Forms A and B) of the curriculum-based vocabulary measure by randomly assigning taught-untaught pairs to each form. Thus, on each form, items comprised 40 words including 20 taught and 20 untaught words. Within classrooms, we randomly assigned two children to each form; children received the same form (with identical words) at all waves including a baseline before instruction began, week 6, week 12, immediately after week 16, and then at about a 4-week delay. Items on each form were presented in a unique random order at each wave to minimize any likelihood of repeated testing effects. This procedure also had the advantage of mixing between expressive and two-part receptive/expressive items and varying across word classes. Trained research assistants, who were whenever possible blind to the instructional condition of tested words, gave assessments in sessions no longer than 25 min.

All item stimuli included realistic color photographs, curated from stock photo databases, representing the object, action, or descriptive concept. Given the young age (i.e., older 3-year-olds and younger 4-year-olds) of many participants, especially at the beginning of the year baseline wave, we elected not to design the assessment to include asking children to provide a definition of the word. For most items, children were shown a single image and asked direct labeling queries (e.g., "what is this?"; "what is she doing?"), or cloze queries.

Other items, following a format developed for a state prekindergarten assessment project (Lonigan, Phillips et al., 2011), included four image choices and an initial, partial-credit (i.e., 1/2 point) request to point to an image; this prompt did not include the target word (e.g., for *absorb* the request was, "Point to the thing that can soak up water."). The remaining 1/2 point on these items was earned by responding to a follow-up prompt for the specific expressive label (e.g., for *construct* the prompt was, "What is the word that means building a house?"). The rationale for the two-part design of these

items was to ensure that all items required some expressive component and to partially account for the aspect of chance embedded in multiple-choice items (i.e., that may render them easier). Across waves, the average internal consistencies for Forms A and B were 0.81 and 0.83, respectively.

Fidelity measures

Self-report and observational measures of teachers’ fidelity of implementation are briefly described here; elaborated descriptions are provided in Phillips et al. (2017). Teachers completed weekly log sheets documenting their completion of the specific daily activities unique to each week’s content. Additionally, using the teacher logs and their own field notes from coaching visits, coaches completed midpoint and end-of-year global ratings of implementation consistency on a 5-point scale such that 1 represented a teacher missing entire weeks of lessons and 5 represented a teacher who completed all or virtually all activities. Separately, coaches completed observational fidelity measures of quality and child engagement not reported here.

Teacher feedback survey

At the end of the year, teachers completed a 9-item survey indicating their disagreement or agreement on a 5-point scale with items related to how well supported they felt by the provided materials (e.g., pictures, lesson plans, and child-friendly definitions of taught words) and by the multiple aspects of PD (i.e., workshops and coaching). Teachers also were asked open-ended questions about the instructional components (e.g., about favorite themes, elements they perceived to be most effective) to which they provided written responses.

RESULTS

Fidelity of implementation and teacher feedback

On average, teachers implemented approximately 14 of the 16 weeks of lessons ($M =$

14.28; $SD = 3.49$). More than 80% completed at least 13 weeks of implementation. As these numbers were derived from teacher and coach logs of teacher’s completed lessons, this likely underestimates the number of weeks teachers completed because, on occasion, a coach visit was not completed due to unavoidable scheduling conflicts. Coach ratings of the consistency of implementation averaged across midpoint and end-of-year ratings yielded a mean of 4.09 ($SD = 0.92$) on the five-point scale, indicated high overall consistency across the 39 classrooms. Additional findings related to fidelity are presented in Phillips et al. (2017). In keeping with the high fidelity, teachers’ end-of-year feedback was highly favorable, and the average agreement rating out of 5 for the nine items was 4.41. Teacher’s written comments, represented by some quotations in Supplemental Digital Content Table S4 (available at: <http://links.lww.com/TLD/A98>), were consistently positive and reflected support for the videos as assisting children with word learning and as engaging their attention.

Children’s vocabulary growth

Table 1 displays the means at each of the five waves, separated by assessment form, in

Table 1. Descriptive statistics by form, condition, and wave

	Taught Words		Untaught Words	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Form A				
Wave 1	3.24	1.90	3.82	2.17
Wave 2	5.70	2.62	4.26	2.21
Wave 3	7.04	3.09	4.93	2.14
Wave 4	8.96	3.55	5.60	2.26
Wave 5	9.10	3.23	6.38	2.62
Form B				
Wave 1	4.66	2.14	3.22	1.96
Wave 2	6.35	2.58	4.09	2.15
Wave 3	8.23	2.79	5.19	2.56
Wave 4	9.82	3.56	6.01	2.86
Wave 5	9.86	3.26	6.24	3.07

Note. Maximum possible per subset = 20.

the upper and lower panels, respectively. Separate means are reported for words taught and untaught within explicit lessons. Children knew few of the words on either form at the baseline assessment and grew on both over time. To characterize results more, we calculated the proportions of children who knew five or fewer taught and untaught words on their assigned assessments. On Form A at wave 1, 69% and 60% met this criterion for taught and untaught words, respectively. By wave 5, the proportion who knew five or fewer words was just 5% for taught words but still 22% for untaught words. On Form B, the proportion of children who knew five or fewer words at wave 1 was 32% and 78% for taught and untaught words, respectively. Again, by wave 5, just 2% of the children met this criterion for taught words but 37% of the children still knew this few untaught words.

We conducted analyses of children's baseline knowledge and acquisition of taught words from different lexical classes. Results, reported in percentages because exact numbers varied by class and form, revealed no clear pattern favoring or disadvantaging a particular lexical class. On Forms A and B, respectively, children initially (wave 1) earned 12% and 33% of possible points on to-be-taught nouns but earned 50% and 65% of possible points by wave 5. For targeted verbs, the proportions at wave 1 were 21% and 24%, respectively, but 40% and 49% by wave 5. Similarly, children earned 16% and 13%,

respectively, of possible points on targeted adjectives and adverbs at wave 1 but earned 48% and 35% at wave 5. All further analyses combined across lexical classes.

The primary research question was whether the increase in performance on assessments of taught words was greater than the increase in performance for untaught words. To explore this question, we constructed growth models across the five waves of data collection. SPSS MIXED models nested children within their classrooms, with the intercept set at the baseline wave and both time, in weeks, and classroom included as random effects. As children within each classroom were randomly assigned to Form A or Form B, and as each form included both taught and untaught words, the model included fixed effects for form and taught status.

Table 2 displays results for the final model. Taught status and, unexpectedly, form contributed to significant effects. Specifically, the significant interaction of form with condition indicates that the intercept (i.e., baseline score) for Form A was significantly lower than that for Form B, but only for taught words. As expected, there was a significant interaction between taught status and wave, indicating that children grew faster on taught than untaught words. The significant three-way interaction of taught by wave by form indicated that the difference in growth between taught and untaught words over time was slightly different between the two forms. Figure 1 shows

Table 2. Fixed effect results of multilevel growth models with prediction from form and taught status

	Coefficient	SE	<i>t</i> Value	<i>p</i>
Intercept	6.26	0.23	26.98	<.001
Condition (taught/untaught)	3.78	0.18	20.99	<.001
Form	−0.34	0.28	−1.23	.22
Wave	0.11	0.18	0.62	.55
Form × condition	−0.56	0.26	−2.16	.03
Form × wave	−0.04	0.18	−0.21	.83
Condition × wave	0.07	0.01	7.21	<.001
Form × condition × wave	0.03	0.01	2.43	.02

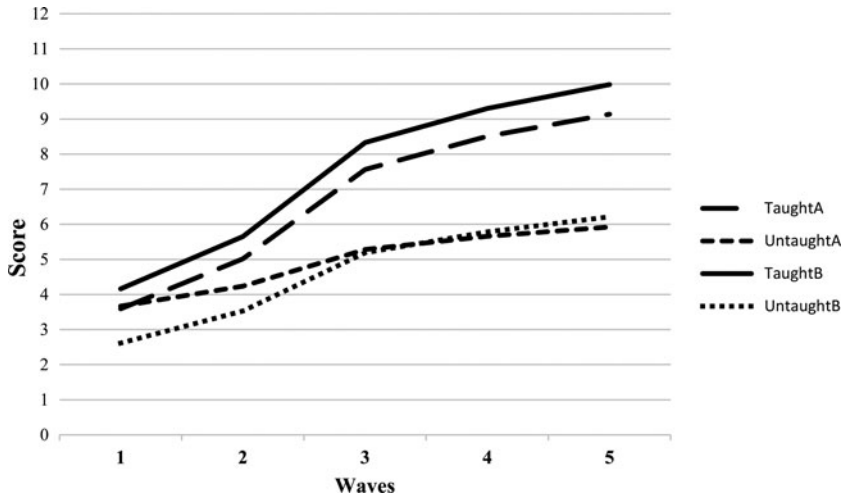


Figure 1. Estimated predicted means by form, taught status, and wave.

the pattern of growth across five waves using modeled values for each form.

DISCUSSION

The primary purpose of this study was to evaluate the efficacy of a novel, whole-class, teacher-led instructional program for supporting vocabulary learning in preschool children from disadvantaged backgrounds. To this end, the evidence indicates that we were successful in teaching children the target words. Children grew substantially in their knowledge of these words and, most importantly, grew significantly more in their knowledge of the taught words than of those that were not explicitly taught. When average gains for taught words that were directly assessed are generalized to the full set of taught words, we estimate children learned an average of more than 30 new words, and in some cases many more than that, from the intervention.

Our related purpose was to demonstrate a proof of concept for the idea that carefully selected media segments could serve as the central attentional and organizing focus for vocabulary instruction, much the way books typically do. Assessment outcomes, fidelity, and child engagement data (Phillips et al., 2017) all indicate that these PBS media provided a feasible learning context. We

emphasize that the instructional design did not uniquely rely on the videos to support children's word acquisition but rather embedded them within explicit and elaborated teacher-provided lessons. As a result, we cannot ascribe effectiveness uniquely to this aspect of the multicomponent intervention. Yet, teacher feedback and, informally, coach reports suggest that the videos may have provided a model for teachers of how to talk about words using child-friendly language, that videos likely facilitated child engagement, and that they supported children's comprehension of novel concepts. Whereas some video segments used in this project were provided by PBS production teams, there are extensive *Sesame Street* segments available online, including some we included, that could be used as part of similar lessons.

One key design aspect of vocabulary instruction relates to word selection; most discussions of this issue focus on the presumed difficulty of words (e.g., Beck et al., 2002). We considered difficulty, as empirically operationalized through direct assessment of a larger set of words inclusive of our selections with a comparable group of children. Rather than exclusively focusing on Tier 2 or difficult words, we also included more basic but thematically relevant words.

Given that most children began knowing few assessed words, the focus on words with a range of difficulty appears to have been warranted. Moreover, a grounding in basic words also likely helps children grow the related semantic networks (Borovsky et al., 2016).

We mandated that all instructional themes include target words representing multiple parts of speech (i.e., nouns, adjectives, verbs, and adverbs) including, where appropriate, abstract nouns. This decision was based on our logic model indicating children's vocabulary would largely comprise nouns, with concrete nouns particularly likely to be learned incidentally (McDonough et al., 2011); therefore, it was especially important to explicitly teach other lexical classes. Whereas the limited sample of assessed words precludes specific analyses comparing across themes or lexical classes, descriptive findings indicated no patterns suggestive of particular difficulty for children in learning specific parts of speech, given intensive exposure and active engagement. Inclusion of varied word classes and both concrete and abstract terms produced a measurement challenge in that not all words were assessed identically. We suspect this led to findings of an interaction of time and taught status with form; despite random assignment of words to forms, Form A included slightly more exclusively expressive, and thus often more difficult, items than did Form B. Future research controlling for assessment features is required to fully distinguish genuine versus artifactual results for different words.

A secondary study purpose was to demonstrate that preschool teachers and aides with varied educational levels could implement with both consistency and high fidelity to lesson plans. Despite primarily including lead teachers with less than a college degree, most teachers implemented most lessons and did so with good fidelity (also see Phillips et al., 2017). Whereas current results indicate that teacher aides also can implement these lessons well, future research should explore fidelity and implementation quality distinctly for lead teachers and teacher aides.

These results suggest a lack of formal higher education is not necessarily a barrier to evidence-based instruction when teachers are provided with sufficient training and job-embedded PD (also see Mowrey & Farran, 2021). The consistent organization, provision of all necessary materials, and scripting of lessons may have bolstered ECE teachers' confidence in correctly executing lessons, while also decreasing their planning responsibilities. Moreover, the clearly specified instructional goal statements, explicit models for scaffolding to address children's learning challenges and misunderstandings, and suggestions for extending the focus on these vocabulary into other aspects of their instructional day likely served an educational role for teachers who did not, in general, have experience implementing intentional and explicit vocabulary instruction.

The concept of educative materials originated among instructional designers for elementary and secondary science education (e.g., Davis et al., 2014) but has been applied more recently in early childhood contexts (e.g., Neuman et al., 2016). In contrast to the negative light in which written curricular materials are sometimes cast in ECE (e.g., Parks & Bridges-Rhoads, 2012), these results, bolstered by high fidelity and very positive teacher feedback, indicate written lesson guides can be well received and support improved instruction and children's learning. Future studies should explore whether these materials also support teachers' capacity to more autonomously develop new lesson plans modeled after those provided.

Although quite promising, this study has some limitations. Sample size and funding limitations did not allow for a between-subjects design in which entire classrooms were assigned to a business-as-usual control condition. Rather, in the context of a trial primarily focused on implementation, we utilized a within-subjects design, similar to that employed by Beck and McKeown (2007). Of course, given the complex instruction design, words were not randomly assigned to taught and untaught conditions. However, both

children and words were randomly assigned to lists, and taught–untaught word pairings utilized careful matching on part of speech and concreteness and previously collected empirical data on the likelihood that children would already know the words. Future research with these materials should include a larger sample and a between-groups design to complement and replicate the current results in designs with stronger internal validity.

Another limitation, shared by many studies of vocabulary interventions (e.g., Bass & Barron, 2014; Dennis et al., 2016), is that we only assessed children on researcher-developed assessments rather than also administering a standardized, distal measure that also could have helped characterize children’s baseline language skills. Our main goal in this initial pilot study was to demonstrate the potential of our package of instructional strategies and PD supports. Future research is required to explore how well this package may support learning of other word sets and improve performance on standardized language measures, possibly through overall increases in the volume, and repetitions, of

words to which children are exposed during the school year and perhaps through children’s heightened attention to new words.

Overall, we see great promise in this novel combination of explicit lessons, videos, and extended games in building the critical vocabulary knowledge young children of all backgrounds need to achieve academic goals. For both children and teachers, we view these results as indicative of the power of supportive scaffolding. When provided with elaborated and engaging lessons, children demonstrated substantial uptake of taught words, including abstract and challenging words representing multiple lexical classes. Similarly, when provided with comprehensive written and in-person supports, teachers, and perhaps even more critically, teacher aides, successfully implemented daily systematic instruction at a level of intensity likely necessary to truly advance children’s language skills. Given the urgency of supporting children’s language development, all creative efforts to assist teachers in these efforts seem warranted.

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