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Developing Low-Income Preschoolers' Social Studies and Science Vocabulary Knowledge Through Content-Focused Shared Book Reading

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Abstract: This study evaluated the effects of integrating science and social studies vocabulary instruction into shared book reading with low-income preschool children. Twenty-one preschool teachers and 148 children from their classrooms were randomly assigned at the class level to either the Words of Oral Reading and Language Development (WORLD) intervention or a practice-as-usual condition. Children were screened and selected to approximate three vocabulary levels (15th, 30th, and 50th). WORLD teachers implemented the intervention in small groups of 5 to 6 students, 5 days per week, 20 minutes per session, for 18 weeks. Findings from multilevel models indicated statistically and practically significant effects of the WORLD intervention on standardized measures of receptive vocabulary ($\delta_T = 0.93$) and on researcher-developed measures of expressive ($\delta_T = 1.01$) and receptive vocabulary ($\delta_T = 1.41$). The WORLD intervention had an overall main effect, regardless of entry-level vocabulary, a finding that speaks to its potential applicability in preschool classrooms.

Keywords: Shared book reading, vocabulary, preschool

Preschool represents a critical window for vocabulary development that is particularly important for young children with limited experience with and exposure to rich oral language (Bowman, Donovan, & Burns, 2001). In their National Longitudinal Survey of Youth 1979 Cohort analysis of age-trajectory vocabulary growth, Farkas and Beron (2004) found that vocabulary accelerates rapidly during preschool ages of 0 to 5. However, this rate of growth is markedly unequal among preschool children, especially across ethnicities and incomes. Hart and Risley's (1995) longitudinal study documented the widely disparate vocabulary trajectories that begin early in children's lives and the negative association of vocabulary development and poverty. Specifically, in terms of words heard, by age 3 children from professional-class socioeconomic (SES) families and children from working-class SES families had accumulated experiences with vocabulary that were three (2,153 words-per-hour) and two times (1,251 words-per-hour) larger, respectively, than welfare-class SES children (616 words-per-hour).

Compared to children from higher income households, many children growing up in low-income homes experience substantially less opportunity for language development, including limited opportunity to engage in literacy activities with parents (Evans, 2004), impoverished home learning environments, infrequent access to books (Duncan &

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Brooks-Gunn, 2000), and less exposure to print media (Neuman & Roskos, 1993). This lack of opportunity and access often translates into poorly developed oral language skills, which are foundational to later literacy and academic achievement (Catts, Hogan, & Fey, 2003; Hart & Risley, 1995). The importance of Hart and Risley's (1995) findings underscores a body of research documenting that preschool oral language ability can have both direct (NICHD Early Child Care Research Network, 2000) and indirect (Storch & Whitehurst, 2002) effects on later reading ability. Storch and Whitehurst found that preschool oral language, through its effect on preschool code-related skills and kindergarten oral language ability, contributed up to 30% of variance in Grade 1 reading skills (Storch-Bracken, 2005; Storch & Whitehurst, 2002). It is important to note that the poverty/linguistic competence association in preschool foreshadows alarming reading achievement disparities in later grades (Cannon & Karoly, 2007; McLoyd & Purtell, 2008).

Accumulating evidence indicates that closing the vocabulary gap in the preschool years involves strategic and purposeful instructional and educational opportunities especially for low-income children (Frede & Barnett, 2006). Recent research reports and policies regarding the education of young children reinforce the importance of engaging children in "knowledge-building" experiences that develop vocabulary in the content areas (e.g., math, science, social studies; e.g., Cannon & Karoly, 2007; Karoly, Ghosh-Dastidar, Zellman, Perlman, & Fernyhough, 2008; Landry, 2005; National Association for the Education of Young Children [NAEYC], 2009; Rhode Island KIDS COUNT, 2005).

Preschool children's knowledge of content vocabulary is presumed to facilitate later learning and to foster future reading comprehension and more advanced science and social science learning (Hirsch, 2006). According to *Preschool Curriculum: What's in it for Children and Teachers* (Albert Shanker Institute, 2009), preschool children who have access to high-priority content instruction are well positioned for academic success in kindergarten and beyond.

WHAT CONTENT SHOULD PRESCHOOLERS KNOW?

National organization guidelines and reports as well as state standards reinforce the importance of developing young children's understanding of science and social studies.

Science

The National Research Council's (2007) report *Taking Science to School: Learning and Teaching Science in Grades K-8* indicated that young children have background knowledge of the natural world and curiosity, which can be utilized to expand their knowledge of science-related concepts. Science-related literacy instruction should develop scientific vocabulary and concepts, beginning with knowledge about the natural world, and build on children's prior experiences and background (Hirsch, 2006; Leung, 2008; National Research Council, 2005; Newcombe et al. 2009). Specifically, NAEYC's (2009) curriculum identified science as a core area and recommended that young children be provided opportunities to learn the difference between living and nonliving things, life cycles (e.g., butterflies, humans), physical changes in the earth and sky (e.g., seasons, weather), the properties of matter, and the behavior of materials (e.g., change in liquids and solids through melting). A review of state standards (e.g., Greenfield et al., 2009; National Committee on Science Education Standards and Assessment (1996); Revised Texas

Prekindergarten Guidelines, 2008) and early childhood curricula (French, 2004; Gelman & Brenneman, 2004) reinforced the importance of teaching concepts and vocabulary related to life, physical, and earth/space sciences in preschool (Core Knowledge Foundation, 2000; Greenfield et al., 2009; NAEYC, 2009; Wright & Neuman, 2009).

Social Studies

The social studies represent the study of political, economic, cultural and environmental aspects of societies past, present and future (National Council for the Social Studies [NCSS], 1988). With regard to social studies in early childhood, some content guidance is offered by the NCSS (2008). Although there is little information on particular social studies concepts that should be emphasized prior to kindergarten, NCSS does recognize that children can learn far more difficult and abstract social studies concepts much earlier than expected in traditional social studies curricula. Specifically, as young as 5 years of age, children are interested in history and geography, conceptions of work, relationships of people and their environments, explaining their immediate environment, and civic understanding (NCSS, 2008).

The need for science and social studies curricula guidelines and literacy instruction in preschool is no longer disputed. Because children entering school have substantial knowledge of the natural world, science and social studies domains provide a laboratory of common experiences for children's development of vocabulary, problem-solving language, and knowledge about the world—all fundamental to successful reading with comprehension (Hirsch, 2006; NCSS, 1988; National Research Council, 2007). Today, there is consensus that children think both concretely and abstractly and bring knowledge and experience, albeit naïve, about the natural environment that can be developed to build understandings of science and social studies concepts (National Research Council, 2007). The case for content-rich language arts and knowledge-rich science and social studies vocabulary instruction is especially salient for children from low-income households who often begin schooling with a lack of a well-developed core of general knowledge that underlies reading comprehension (Hirsch, 2006).

METHODS OF DEVELOPING CONTENT VOCABULARY

For low-income children who enter preschool with significant vocabulary delays, intervention may need to be more intensive, explicit, and systematic than typically used practices (Foorman, Breier, & Fletcher, 2003; Moats & Foorman, 2008). One recommended method of intensifying vocabulary instruction is by strategically focusing on high-priority content (Carnine, Silbert, & Kame'enui, 1997). Ideally, strategic instruction for low-income children at risk for vocabulary delay would build foundational knowledge crucial for later learning via an integrated curriculum in which young children have access to new domains of knowledge and opportunity to discuss concepts and content (Peterson & French, 2008; Wright & Neuman, 2009).

Unfortunately, findings from analyses of prekindergarten literacy curricula show that little guidance exists for teachers who are charged with the responsibility of accelerating vocabulary development for preschool children (Neuman & Dwyer, 2009). To address

the needs of low-income preschool children with limited vocabulary, we drew from two research literatures: (a) shared book reading and (b) effective vocabulary instruction.

Shared Book Reading to Develop Content-Area Vocabulary

A widely used method of promoting young children's vocabulary development involves listening to and discussing books (Ezell & Justice, 2005; Hargrave & Sénéchal, 2000; What Works Clearinghouse, 2006; Whitehurst & Lonigan, 1998). Sometimes referred to as interactive reading, shared book reading is the process of adults reading to children and interacting with books to provide an important context for developing a range of emergent language and vocabulary skills in young children (McKeown & Beck, 2006). Although this pedagogical process is commonly used to enhance preschool children's vocabulary development, few researchers have investigated its efficacy in promoting important science and social studies concepts and content-area vocabulary, especially in low-income preschoolers who may not have access to this content in their homes (Leung, 2008; Neuman, 2006).

Recent syntheses document moderate effects of shared book reading on oral language, specifically vocabulary, for children who participated in interactive reading practices in educational settings, $d = 0.54$ (Mol, Bus, & de Jong, 2009); home settings, $d = 0.59$ (Mol, Bus, de Jong, & Smeets, 2008); or school/home combinations, $d = 0.57$ (National Early Literacy Panel, 2008). Moreover, the effects of interactive reading may extend to other domains such as print knowledge (Mol et al., 2009). Collectively, these reviews suggest that although interactive shared book reading is a prominent practice, its efficacy may vary depending on contextual, instructional, and child characteristics (Blok, 1999; Bus, Izendoorn, & Pellegrini, 1995; Scarborough & Dobrich, 1994). Although shared book reading has been documented to produce moderate effects on vocabulary learning, disaggregated findings indicated that children with lower entry-vocabulary scores benefit less than students with higher entry-level vocabulary (Mol et al., 2009).

Two recent studies investigated the benefits of integrating science knowledge and literacy skills into shared book reading (French, 2004; Leung, 2008). French investigated the effects of teachers reading one or more books aloud to a large group of 3- and 4-year-old Head Start preschoolers using a thematically organized science module called *ScienceStart!* Books read aloud were followed by participation in science-related, small-group center activities. Both informational and narrative texts were read and connected by science themes and science activities and were extended across the preschool day. In the *ScienceStart!* curriculum lessons are organized into four integrated modules each organized into 10 to 12 lesson units that cumulatively build vocabulary, preliteracy skills, problem solving, and social interactions around science content.

On a standardized measure of receptive vocabulary, mean standard scores grew from a pretest score of 79 to a posttest score 87—a statistically significant gain between initial and final assessments for six cohorts of children ($n = 195$). More important, for two convenience cohorts of preschool children, a quasi-experimental study showed a significant difference between control and treatment groups with children in *ScienceStart!* and control classrooms averaging 109 and 100, respectively, on the Peabody Picture Vocabulary Test—III (PPVT—III; Dunn & Dunn, 1997). These findings indicated that focused and structured preschool shared reading could lead to measurable improvements in low-income children's language development. Although compelling, the study lacked true randomization as teacher assignment was not randomized by condition.

Leung (2008) explored the effects of two shared book reading conditions, (a) repeated reading and retelling of science books and (b) repeated reading only followed by hands-on science activities, on the vocabulary knowledge of 3- and 4-year-old children from varied SES backgrounds. According to the authors, repeated reading of stories provided a context for incrementally accruing more complete knowledge of new words by successively learning additional information about new words.

There were no significant differences in raw scores from pre- to posttest or condition (i.e., retell, no retell) on the standardized receptive measure, but there was a significant pretest ($M = 43.16$, $SD = 10.71$) to posttest ($M = 46.26$; $SD = 10.19$) difference for both conditions on the expressive measure ($ES = 0.30$). Post hoc analyses of researcher-developed measures of free recall of target science vocabulary showed a significant pre- to posttest difference for retell ($d = 2.90$) and no-retell ($d = 1.02$) conditions for 4-year-old children, but for the 3-year-olds only the retell condition was significant from pre- to posttest ($d = 2.41$). Children with average and high pretest knowledge of science vocabulary performed significantly better in the retelling posttest condition with effect sizes of $d = 2.41$ and $d = 2.47$, respectively, than children with low pretest vocabulary ($d = 1.10$). Finally, children who took part in one-to-one retellings were better able to explain the meaning of target science-related words from first to second and from second to third retellings.

Results indicated that repeated readings around discussions of concepts are important for developing domain-specific (i.e., science) vocabulary knowledge. Although findings supported the use of repeated readings with retelling, it is difficult to draw definitive conclusions because there was no control group that did not participate in the interactive repeated readings or retellings.

Few studies have investigated the effects of book reading interventions that integrate content-area knowledge with the goal of accelerating vocabulary development of children from low-income households. Although the majority of school-based preschool interventions were found to increase at-risk children's vocabulary knowledge, their absolute level of performance remained significantly below that of typically performing peers (i.e., an average of 16.17 standard score points below the norm on a receptive measure, the PPVT-III; Dunn & Dunn, 1997).

We propose that young children at risk of language delay may require more intensive instruction and opportunities for language interaction within shared book reading to effectively accelerate vocabulary development.

INTENSIVE INSTRUCTION OF HIGH-PRIORITY VOCABULARY

Although there are multiple ways to intensify vocabulary instruction within shared book reading, a primary strategy is purposeful selection and instruction on target vocabulary. Prior research documents that not all vocabulary words are equally important and that instructional time should be invested in words that are of high utility and not commonly understood by the majority of learners (Beck, McKeown, & Kucan, 2002; Stahl, 1991). Moreover, vocabulary words that are of critical importance benefit from intensive instruction that includes (a) providing multiple opportunities to interact with vocabulary and (b) reinforcing word learning through multiple methods that include discussing and using vocabulary in varied contexts both inside and outside of books.

In addition to selecting highly important vocabulary, children with limited knowledge of content vocabulary may benefit from intensive and intentional opportunities to integrate new information and vocabulary with existing knowledge so that new information will be

understood at a deeper level. The instructional implication is that “lesson units” can be purposefully designed around content-area themes in which children are explicitly taught relationships between new words, previously taught vocabulary, broad themes, and content-related words. Because concepts do not exist in isolation, the “knowledge hypothesis” theorizes that vocabulary knowledge accrues through understanding words via connected concepts and word relationships that are important for later comprehension (Bos & Anders, 1990; Elleman, Lindo, Morphy, & Compton, 2009; Nagy, 2005).

In an earlier pilot study, the authors extended prior research by integrating what is known about effective vocabulary instruction and learning opportunities into a content-focused shared book reading intervention and evaluated its efficacy with preschool children. The curriculum was implemented for 12 weeks and designed to integrate explicit and intensive vocabulary and concept instruction and shared book reading organized around science content.

Preschool teachers introduced and reinforced vocabulary before, during, and after book reading in lessons of approximately 20 min in length. On proximal target vocabulary measures, children in the shared book reading WORLD condition scored substantially higher on researcher-developed receptive ($\delta_T = 1.21$) and expressive ($\delta_T = 0.85$) measures than students in the comparison condition. However, findings indicated no reliable differences on standardized measures of receptive ($\delta_T = 0.09$) and expressive ($\delta_T = 0.07$) vocabulary between WORLD and the comparison condition.

Although the findings were promising, the content of the intervention was restricted to science with a limited intervention length (i.e., 12 weeks or 60 daily lessons of 20-min instruction). The short intervention period may not have been sufficient to positively impact standardized vocabulary measures. Finally, the group sizes in the pilot study were 9 to 10 children. We hypothesized that group sizes were too large for children with low vocabulary knowledge to have sufficient opportunities to engage and interact with vocabulary in an interactive reading condition.

PURPOSE OF THE PRESENT STUDY

In the present study, we conducted a randomized field trial in which preschool children, the majority of whom were at risk of reading difficulties, were stratified by class and randomly assigned to one of two conditions: WORLD experimental intervention or typical shared book reading practice. The research had four primary purposes.

First, we examined the efficacy of a shared book reading science and social studies intervention on the vocabulary development of preschool children. Although extensive prior research has been conducted on shared book reading, few studies have examined a content-focused intervention and its impact on general and content specific vocabulary development. The present study placed special emphasis on building crucial domain-specific knowledge important for developing young low-income children’s vocabulary knowledge.

Second, we explored whether findings of differential effects by learners’ entry-level vocabulary would replicate in our intervention, which was specifically designed to provide intensive intervention. In particular, the intervention was purposefully designed to provide explicit and intensive intervention, and we hypothesized that students with low entry-level skills would benefit from such an intensive design.

Third, we were interested in the situated effects of intervention when delivered by preschool personnel as opposed to research teams. A review of the shared book research documents that the majority of statistically and practically important findings from shared

book reading research are derived from researcher-delivered interventions. Thus, we sought to extend prior research by involving preschool teacher as interventionists in authentic instructional contexts.

Our final purpose was more methodological in nature. Specifically, we addressed the paucity of shared reading intervention research and in particular the limited number of intervention studies that use multilevel modeling to reflect the nested nature of students within classrooms. Using multilevel modeling allows standard errors of regression coefficients to be more correctly estimated and more accurate statistical conclusions to be made. The following specific research questions were addressed:

1. What is the effect of a science- and social-studies-focused shared book reading intervention on standardized measures of receptive and expressive vocabulary?
2. What is the effect of a science- and social studies-focused shared book reading intervention on custom, researcher-developed measures of receptive and expressive vocabulary?
3. Does the impact of intervention on vocabulary development vary by children's demographic and entry-level characteristics?

METHOD

An experimental design with school-level stratified random sampling was used with teachers subsequently randomly assigned to either the intervention ($n = 13$) or practice-as-usual ($n = 8$) condition. Students were nested within teacher. Standardized and researcher-developed tests were administered before and after the intervention to measure students' receptive and expressive vocabulary development.

Participants

Schools

Participants were enrolled in classrooms in nine schools in two ethnically diverse school districts in South Central Texas. Seven classrooms were half-day programs and 14 were full-day programs. In one school district, 69% of the student body qualified for free and reduced-cost lunch, with 85% of the preschool students qualifying for free and reduced-cost lunch. In the second school district 30% of the student body qualified for free and reduced-cost lunch. In preschool, 90% qualified for free and reduced-cost lunch.

Teachers

Twenty-one prekindergarten and Head Start teachers participated in the study. Seven teachers taught both a morning and an afternoon class, yielding a total of 28 classrooms. Ten teachers were from pre-kindergarten classrooms, and 11 were from Head Start pre-K classrooms. Because some of the teachers taught multiple classes, teachers rather than classrooms were the unit of randomization. The 21 teachers were randomly assigned to participate in the intervention ($n = 13$) or comparison ($n = 8$) conditions. Of the 21 teachers, 86% held a bachelor's degree and 5% a master's degree. Further, 76% held elementary certification, 81% held early childhood certification, and 48% held English as Second Language certification. The teachers had a mean of 8.24 ($SD = 6.24$) years of teaching in

prekindergarten/Head Start. An independent samples *t*-test comparing the treatment and comparison teachers indicated no statistically significant difference between the two groups for total years, years teaching prekindergarten ($M = 12.00$, $SD = 7.56$) or years teaching prekindergarten ($M = 8.92$, $SD = 6.16$).

Students

A two-step screening process was used to identify 163 preschoolers who qualified to participate in the study. First, all students with consent were administered the PPVT-III (Dunn & Dunn, 1997). Next, from each classroom two students were selected whose scores on the PPVT-III most closely approximated the 15th, 30th, and 50th percentiles on the PPVT-III (standard scores for initial group were = 84.5, 92.13, and 100, respectively), for a goal of six students from each classroom.

The selected students formed a single shared reading group within the treatment classrooms, whereas the comparison students were grouped according to the teacher's usual practice. Actual group sizes ranged from five to seven ($Mdn = 6$) per classroom. Students' ages at pretest ranged from 4 to 5.25 years ($M = 4.56$, $SD = .30$). The 163 students participating in the study were nested under teacher treatment or comparison conditions, with 99 treatment and 64 comparison students. Of the students who completed the study ($n = 163$), the average standard score on the PPVT-III was 88.96 ($SD = 10.16$), with 19 students scoring 100 or higher. For this group of students, PPVT-III means and standard deviations for those scoring at or near the 15th, 30th, and 50th percentiles were 78.89 ($SD = 8.85$), 88.23 ($SD = 2.22$), and 95.74 ($SD = 1.91$), respectively. Students scoring above the 50th percentile had a mean PPVT-III score of 104.42 ($SD = 3.44$). Mean pretest PPVT-III standard scores did not differ between the treatment ($M = 87.98$, $SD = 11.14$) and comparison groups ($M = 89.41$, $SD = 9.24$), $F(2, 160) = 1.211$, $p = .301$.

Students were ethnically diverse: 43.6% African American, 27.6% Hispanic, 22.1% White, 4.9% Asian, and 1.8% other ethnicities. Slightly more female students (53%) participated in the intervention than male. Few students were English language learners according to teacher report (7.4%). More than 90% of the students qualified for free or reduced lunch and more than 70% had a family income of less than \$24,000. More than half of the students' parents had a high school diploma/GED (50.6% of mothers and 66.7% of fathers).

Measures and Data Collection

A battery of standardized norm-referenced and experimenter-developed measures was used to assess receptive and expressive vocabulary growth. Measures were administered individually by trained graduate and undergraduate research assistants 2 weeks prior to intervention and 2 weeks after completion of the intervention. Data collectors had to complete 2 days of training, which included practice time. Data collectors were trained, coached, and tested until they reached 100% reliability on all study measures prior to testing.

Receptive Vocabulary

The PPVT-III, Form A (Dunn & Dunn, 1997) was used to measure general receptive vocabulary. On the PPVT-III the examiner provides a verbal name or action and the child is requested to point to one of four pictures on a panel that represents that object or action.

Alpha and split-half reliability coefficients reported in the manual ranged from .86 to .98 for both forms A and B, respectively.

Receptive vocabulary was also assessed with a custom Researcher-Developed Receptive Picture Vocabulary Test (RDRPVT). Designed to measure target words taught during the WORLD intervention, the RDRPVT was created to be similar in procedure, materials, and response requirements to the PPVT–III. This meant that a target word was named by the examiner and the child was requested to point to one of four pictures on a plate that represented the target word. To construct this measure, researchers used a stratified sampling procedure selecting 18 target words used throughout the intervention. Alpha coefficients based on our sample were .66 and .77, and split-half estimates were .68 and .80 (odd–even test items compared) for pre- and posttests, respectively.

Expressive Vocabulary

The Expressive One-Word Picture Vocabulary Test (EOWPVT; Brownell, 2000) was used to assess expressive vocabulary. The EOWPVT is used to assess a child's expressive vocabulary by requesting the child to name objects, actions, and concepts pictured in illustrations. Split-half coefficients reported in the manual reflect a median of .98.

Expressive vocabulary was also assessed with a Researcher-Developed Expressive Picture Vocabulary Test (RDEPVT). Designed to measure vocabulary knowledge taught in the WORLD intervention, the RDEPVT was created to be similar in procedure, materials, format, and response requirement to the EOWPVT.

Children were requested to name the target word illustrated on the test plate presented by the examiner. Each test plate consisted of a single vocabulary word presented in the WORLD intervention. The target vocabulary words assessed were the same 18 vocabulary words as on the RDRPVT. On all administrations, the expressive test was administered prior to the receptive measure. Alpha coefficients for the test were .52 and .77, and split-half estimates were .49 and .78 (odd–even test items compared) for pre- and posttest, respectively.

Instructional Materials and Procedures

Science and Social Studies Intervention

The intervention was organized by science and social studies themes selected from our review of the Texas state preschool science guidelines (<http://www.tea.state.tx.us/curriculum/early/prekguide.html>), the Core Knowledge preschool guidelines (Core Knowledge Foundation, 2000), and standards recommendations by the NAEYC and NCSS. The intervention was also aligned with preschool teachers' instructional science and social studies priorities. Four themes served as the content foci of the 18-week intervention with daily 20-min lessons designed for each theme.

Science Themes and Books. The two science themes were *Nature* and *Living Things*. Within these themes, weekly lesson units were organized around 10 smaller science topics. For *nature*, weekly units included water, snow, storms, seasons, and light. For *living things* the weekly units included plants, trees, ocean animals, birds, and animals.

The criteria used to select the 22 science books (11 informational texts and 11 storybooks) were as follows: (a) content and language were age appropriate, (b) there was a

sufficient number of important vocabulary related to the theme and social studies and science topics, (c) target vocabulary words were depicted in book illustrations or photographs, (d) content could be read and discussed in a 20-min session, and (e) the structure allowed predicting and identifying the main idea (the “big thing that happened”).

Both storybooks and complementary informational texts were selected and paired in weekly lesson units to ensure repeated exposures to important concepts and science words. For example, in the week on plants, children listened to a book about Mr. Greg the gardener, a character in a storybook, and then learned more information about plants in the informational text, *How a Seed Grows* (Jordan, 1992).

Social Studies Themes and Books. The two social studies themes were *Places Where We Live and Go* and *Earth—Land and Water*. Within these themes, weekly lesson units were organized around six smaller topics. For *Places Where We Live and Go*, the weekly lesson units included cities, homes, school, and stores. For *Earth—Land and Water*, the weekly units included two weeks of overview on land and water and an ocean unit. The same criteria used to select the science books were used to identify the social studies texts and related vocabulary. Of the 14 social studies books selected, 7 were informational texts and 7 were storybooks.

Vocabulary Words and Instruction. Fifty-nine science and 35 social studies vocabulary words were selected from the books to develop lexical sets (e.g., water, liquid, frozen) to assist students in acquiring associative knowledge. Our word selection process was guided by the knowledge hypothesis (Bos & Anders, 1990) in that words were selected that would assist children with limited content knowledge to understand connected concepts and word relationships that are important for later comprehension. In preparation for this study, we examined a range of word lists and curriculum materials to guide our selection process. Finding no definitive list, we used the following criteria for word selection: (a) relevance to science and social studies concepts, (b) not likely to be known by preschool students or learned through everyday conversation, and (c) importance for later learning and understanding of word relationships. In addition, preschool teachers reviewed vocabulary lists for their importance and appropriateness. Our selection criteria included words had to be visually represented in the book, thematically related, and applied to higher cognitive concepts. These words were often identical to science and social studies vocabulary lists developed by state and local school districts for kindergarten teachers. Three words were selected from each text for a total of six words taught per week. However, to scaffold difficulty, early lessons introduced only two vocabulary words per book.

Target words were explicitly taught and integrated throughout science and social studies themes and topics and across informational and storybooks to facilitate frequent encounters (e.g., cumulative reviews, repeated readings, challenge questions) and deep processing of vocabulary knowledge and new concepts. There was an established routine for introducing and reviewing vocabulary to ensure that discussion of words was distributed before, during, and after reading the book and that an explicit definition and opportunities for children to repeat the words and word meanings was provided in a consistent manner. For example, the method for introducing a new word on the first day of reading a book included the following process: (a) Before Reading, Explicit Definition/Life Experiences (*Look at this picture. This is the Earth. The Earth is a place where we live that is made of land and water. What is this, everyone? What things do you already know about the Earth?*), (b) Before Reading Book Preview/Predictions (*On this page you will learn about the word Earth.*

Tell your neighbor what you will learn about Earth on this page.); (c) While Reading Brief In-Context Word Meanings/Concepts (Look at this page. This is Earth. The Earth is a place where we live and is made of land and water. What is this everyone? Here we see a big circle made of land and water. Who do you think lives on this land and in the water?); and (d) After Reading Review with picture cards (This is Earth. What is this everyone? Remember, the Earth is a place where we live that is made of land and water. What is the earth made of? What things can live on the Earth?). The after reading review also included a guided discussion with two book related questions for each vocabulary word (What is a place where we live and is made of land and water? Tell me about things you have seen on the earth.). A similar distributed instructional sequence was implemented on the second reading of the book.

Five-Day Lesson Cycle. Daily lessons were developed around the themes, books, and vocabulary using a 5-day instructional cycle in which specific days were used to (a) introduce new words and concepts (Days 1 and 3), (b) review previously taught knowledge and reread the book (Days 2 and 4), and (c) integrate new words and science and social studies concepts across twin texts in a cumulative review (Day 5). Days 1 and 2 were used to introduce and review a storybook and teach target vocabulary, whereas Days 3 and 4 introduced and reviewed an informational text and introduced new vocabulary. Day 5 activities were designed to review and integrate science and social studies content and vocabulary across both books. See Appendix A for an example of how this 5-day instructional cycle was used to design instruction in a social studies theme.

Training and Implementation

One week prior to implementation, the 13 intervention teachers participated in a half-day professional development session led by project researchers. In this session, researchers introduced the rationale, materials, and procedures of the intervention. Teachers were also instructed to practice lesson components with each other. They were introduced to the instructional materials and received manuals that included thematic overviews and detailed lesson plans for shared book readings and vocabulary instruction. All books for the 18 weeks were provided with a picture card for each theme and two 8 × 10 in. picture cards for each target vocabulary word depicting additional photos of the vocabulary word. In addition to the professional development session, teachers met with the lead researchers two to three times during implementation to review progress and identify and resolve implementation obstacles.

The intervention began in October and lasted for 18 weeks. The teacher-led sessions lasted 20 min each, 5 days a week. Typically, teachers replaced their normally scheduled small-group reading session with the intervention for the five to seven participating students in their classroom. The remaining classroom students did not participate in the shared book reading, intervention but engaged in other center-based activities facilitated by a teacher's aide. Average intervention book reading sessions lasted 17.2 min ($SD = 2.77$) with the time fairly divided between before, during and after reading sessions.

Fidelity

To measure treatment fidelity, project personnel developed a measure of critical intervention components for each of the 5 days of the weekly intervention (see Appendix B for sample

form). Teacher fidelity was rated on specific activities before, during, and after reading components of the intervention with Likert-type anchors ranging from a score of 3 (*very high* implementation) to 0 (*low*). Teachers were also rated using the same Likert-type format on general aspects of their intervention performance such as “Students are highly engaged in the lesson” and “Instructor maintains appropriate pacing.”

Using specific guidelines, the trained observers assigned numerical ratings to each fidelity item. Observers also wrote field notes to provide additional detail on instructional behaviors as they occurred. Interobserver agreement was calculated for 20% of the fidelity ratings to ensure teachers were being rated accurately and similarly across observers. Mean percent agreement ($A/[A+D]$) for the interobserver agreement was .89 ($SD = .13$). Percentage perfect fidelity scores from 60.34% to 98.71% with a mean fidelity score of 85% ($SD = 12\%$). Small-group feedback sessions were scheduled after each observation to discuss intervention fidelity.

Business-as-Usual (Comparison) Condition

Comparison teachers engaged in “business-as-usual” shared book reading activities by selecting their own books and reading strategies. Some teachers used texts and materials that were determined by the district’s curriculum. Other teachers had more flexibility in selecting books and their book reading strategies. Classroom sessions were videotaped to document the length of book reading sessions, materials, grouping, and general procedures of the typical book reading practices. On average, book reading sessions lasted 10.54 min ($SD = 6.14$), with most instructional time spent reading the book and limited time allocated for teaching vocabulary or on before or after reading activities ($M = 2.13$ min, $SD = 3.53$). In all observations, comparison teachers used storybooks as their sole source of materials within the shared-reading times.

RESULTS

Analytic Strategy

Because of the use of nonindependent observations due to the nesting structure in our data (i.e., 148 students nested within 28 classrooms taught by 21 teachers), we chose multilevel modeling (Hox, 2002) to analyze the data, as it takes nonindependency into account. Multilevel modeling is preferred over traditional fixed-effects models for nested data, in which individuals within a group are not independent. Using multilevel modeling allows standard errors of regression coefficients to be more correctly estimated and more accurate statistical conclusions to be made. Because nonindependence of students within classrooms was likely to be a result of sharing the same teacher, in all multilevel models, the teacher (rather than the classroom) was used to define clusters of students.

All multilevel models were estimated using SPSS mixed (V15.0). Restricted maximum likelihood was used for estimating all the models. Restricted maximum likelihood is the default estimation method used in many multilevel programs when analyzing multilevel data with a continuous outcome/dependent variable (e.g., HLM, SPSS mixed, and SAS proc mixed). Effect sizes were calculated for effects of the intervention using Hedges’s (2007) δ_T , which is a Cohen’s d -like metric for multilevel models.

Analysis of Pretreatment Assessments

Initially, there were 163 participants. Fifteen children dropped out of the study for various reasons (e.g., moved). The analyses for the PPVT–III, RDRPVT, and RDEPVT are based on 148 students, excluding these 15. There was no evidence of differential attrition between intervention and comparison conditions, $\chi^2(1) = 1.37, p = .242$. Due to their absence at pretest, six children were not administered the EOWPVT. Therefore, 142 children were included for the analyses of this variable.

Potential differences between completers (i.e., 148 children for the PPVT–III, RDRPVT, and RDEPVT; 142 children for the EOWPVT) and noncompleters (i.e., 15 children for the PPVT–III, RDRPVT, and RDEPVT; 21 children for the EOWPVT) on the demographic variables (i.e., age, attendance, gender, ethnicity, English learner status, school district, program format, and intervention group assignment) were examined. Results for *t* tests and chi-square tests showed that there were no statistically significant differences between the two groups on any of these demographic variables or any of the four vocabulary measures at pretest.

Within the completers, we further examined differences between the children in the intervention group (*n* = 96) and the comparison group (*n* = 52) on the demographic variables and the pretest measures. No statistically significant differences were found between the two groups on any demographic variables or pretest measures. Descriptive statistics for the intervention and comparison groups are presented in Table 1; pretest and posttest measures are listed in Table 2.

Table 1. Descriptive statistics for comparison and intervention groups

Demographics	Intervention ^a	Comparison ^b
Gender		
Female	51	29
Male	41	27
Ethnicity		
African American	42	23
Hispanic/Latino	22	20
Caucasian	21	11
Other	7	2
School district		
A	6	7
B	44	34
C	42	15
English Learner status	8.7%	3.6%
Age in months (at pretest)		
<i>M</i> (<i>SD</i>)	54.71 (3.64)	54.41 (3.54)
Attendance		
<i>M</i> (<i>SD</i>)	166.15 (10.24)	165.25 (10.81)
Program		
Full day	48	27
Half day	44	29

Note. *N* = 148.
^a*N* = 92. ^b*N* = 56.

Table 2. Pretest and posttest measures for intervention and comparison groups

Measure	Pretest			Posttest		
	Intervention ^a	Comparison ^b	<i>t</i> (146) ^c	Intervention ^a	Comparison ^b	<i>t</i> (146)
PPVT-III						
<i>M</i>	88.70	89.86	0.66, <i>p</i> = .510	95.04	92.29	1.67, <i>p</i> = .097
<i>SD</i>	10.90	9.45		8.75	11.16	
EOWPVT						
<i>M</i>	85.60	84.71	0.50, <i>p</i> = .616	91.91	91.52	0.22, <i>p</i> = .829
<i>SD</i>	9.83	10.71		9.47	12.60	
RDRPVT						
<i>M</i>	12.36	11.55	1.60, <i>p</i> = .113	16.83	14.09	7.91, <i>p</i> < .001
<i>SD</i>	3.02	2.90		1.58	2.63	
% of max	68.67	64.17		93.50	78.28	
RDEPVT						
<i>M</i>	20.82	20.52	0.46, <i>p</i> = .646	29.18	23.93	7.04, <i>p</i> < .001
<i>SD</i>	3.96	3.56		4.79	3.68	
% of max	57.83	57.00		81.06	66.47	

Note. PPVT–III = Peabody Picture Vocabulary Test–Third Edition; EOWPVT = Expressive One-Word Picture Vocabulary Test; RDRPVT = Researcher-Developed Receptive Vocabulary Test; RDEPVT = Researcher-Developed Expressive Picture Vocabulary Test.

^a*n* = 92 (90 for EOWPVT pretest). ^b*n* = 56 (52 for EOWPVT pretest). ^c*df* = 140 for EOWPVT pretest.

Analysis of Treatment Effects

The following equations describe the models.

Level 1 (Student-Level) Model

$$\begin{aligned} \text{Posttest}_{ij} = & \beta_{0j} + \beta_{1j} \text{Pretest}_{ij} + \beta_{2j} \text{Gender}_{ij} + \beta_{3j} \text{Age}_{ij} \\ & + \beta_{4j} \text{English Learner Status}_{ij} + \beta_{5j} \text{African American}_{ij} \\ & + \beta_{6j} \text{Hispanic}_{ij} + \beta_{7j} \text{Other Ethnicity}_{ij} \\ & + \beta_{8j} \text{Attendance (School Year)}_{ij} \\ & + \beta_{9j} \text{Attendance (Intervention)}_{ij} + e_{ij} \end{aligned}$$

In this model, $i = 1 \dots 148$ th student and $j = 1 \dots 21$ th group. The model was estimated separately for each of the four posttest measures (i.e., PPVT–III, EOWPVT, RDRPVT, and RDEPVT) as the outcome variable. For each model, the pretest measure of the same variable was entered as a covariate. As shown in the previous equation, other covariates included in the models were gender, age, English learner status, ethnicity (represented by three dummy variables with Caucasian children as the reference group), number of days attended in the school year, and number of days attended in the intervention. Attendance in the intervention was coded as zero for control group children.

Level-2 (Group-Level) Model

$$\begin{aligned} \beta_{0j} = & \gamma_{00} + \gamma_{01} \text{Intervention}_j + \gamma_{02} \text{School District A}_j + \gamma_{03} \text{School District B}_j \\ & + \gamma_{04} \text{YearsExperience}_j + \gamma_{05} \text{School day length}_j + U_{0j} \\ \beta_{1j} = & \gamma_{10} \text{ (the fixed effect of the corresponding pretest measure on the posttest)} \\ \beta_{2j} = & \gamma_{20} \text{ (the fixed effect of gender on the posttest measure)} \\ \beta_{3j} = & \gamma_{30} \text{ (the fixed effect of age on the posttest measure)} \\ \beta_{4j} = & \gamma_{40} \text{ (the fixed effect of English learner status on the posttest measure)} \\ \beta_{5j} = & \gamma_{50} \text{ (the fixed effect of the African American dummy variable on the} \\ & \text{posttest measure)} \\ \beta_{6j} = & \gamma_{60} \text{ (the fixed effect of the Asian dummy variable on the posttest measure)} \\ \beta_{7j} = & \gamma_{70} \text{ (the fixed effect of the Hispanic dummy variable on the posttest} \\ & \text{measure)} \\ \beta_{8j} = & \gamma_{80} \text{ (the fixed effect of attendance in the school year on the posttest} \\ & \text{measure)} \\ \beta_{9j} = & \gamma_{90} \text{ (the fixed effect of attendance in the intervention on the posttest} \\ & \text{measure)} \end{aligned}$$

In the Level-2 model, we included the intervention effect (i.e., Intervention) and controlled for potential differences between school districts by creating two dummy variables (i.e., School District A_j and School District B_j) to represent the three school districts (District C in Table 1 served as the reference district). Teachers' years of experience and school day length (full day vs. half day) were also included in the model. The target effect, γ_{01} ,

captured the difference between the control group and the intervention group on the posttest measures after controlling for all other variables in both student- and group-level models.

The first research question examined the effects of the shared book reading intervention on the PPVT–III and EOWPVT, standardized measures of general receptive and expressive vocabulary, respectively. As illustrated in Table 3, on the receptive vocabulary measure, children in the treatment group scored higher at posttest than did children in the comparison group, PPVT–III ($\gamma_{01} = 7.57$, $p = .029$, $\delta_T = 0.93$) after controlling for covariates. The effects of the student variables indicated that higher pretest scores were associated with higher posttest scores ($\gamma_{10} = .52$, $p < .001$). The effect of age was also significant ($\gamma_{30} = -.50$, $p = .009$), indicating that younger students scored higher at posttest relative to their pretest scores than older students.

The intervention did not have a statistically significant effect on the expressive vocabulary measure, EOWPVT ($\gamma_{01} = -2.20$, $p = .63$, $\delta_T = -0.21$), after controlling for covariates. Among student variables, age was a significant predictor ($\gamma_{30} = -.57$, $p = .024$), indicating that younger students scored higher at posttest relative to their pretest scores than older students. Also, one of the ethnicity effects was significant ($\gamma_{60} = -5.55$, $p = .041$), indicating Hispanic children scored lower than Caucasian children regardless of intervention.

In addition, as shown in Table 2, both intervention and comparison students improved from pre- to posttest on standardized measures of receptive and expressive vocabulary. For the intervention group, mean scores on the PPVT–III increased from the 23rd to the 37th percentile, whereas mean scores for the comparison group increased from the 25th to the 30th percentile. Overall, mean scores on the EOWPVT increased for the intervention group from the 17th to the 29th percentile and from the 15th to 29th percentile for the comparison group.

With regard to the effect of the shared book reading intervention on researcher-developed measures of science and social studies receptive vocabulary, findings indicated statistically significant differences for the WORLD intervention (i.e., RDRPVT; $\gamma_{01} = 2.75$, $p = .001$, $\delta_T = 1.41$) after controlling for all the covariates. As shown in Table 2, children's mean scores on the RDRPVT (which tested a subset of words taught) at pretest were 69% in the intervention group and 64% in the control group. At posttest, children in the intervention group had improved to 94%, more than one and a half times the improvement of those in the control group, who had improved to 78%. Among the student variables, higher pretest scores were associated with higher posttest scores ($\gamma_{10} = .14$, $p = .024$), the effect of attendance in school was significant ($\gamma_{80} = .04$, $p = .018$), indicating that children who attended more total school days scored higher than children with lower attendance. One of the dummy variables entered to control for differences between school districts was also significant ($\gamma_{02} = 1.70$, $p = .030$), indicating a difference across school districts in posttest scores. Children in School District A were 1.70 points higher than children in the reference district.

The shared book reading intervention also had a significant effect on the researcher-developed measure of expressive vocabulary (RDEPVT; $\gamma_{01} = 4.01$, $p = .023$, $\delta_T = 1.01$) after controlling all the covariates. As shown in Table 2, children in both groups scored about 57% on average at pretest. At posttest, children in the intervention group had improved to 81%, whereas those in the control group had improved to 66%, meaning that intervention children's improvement was over twice that of control children's. The effect of pretest score on the RDEPVT was statistically significant ($\gamma_{10} = .49$, $p < .001$), but no other student or teacher variables were significant. In summary, findings indicated moderate and positive effects of the WORLD 18-week book reading intervention on proximal

Table 3. Parameter estimates for multilevel models

Parameter Estimates for Multilevel Models	Dependent Variable			
	Standardized Measures		Researcher-Developed Measures	
	PPVT-III	EOWPVT	RDRPVT	RDEPVT
Fixed effects				
Intercept	98.07**	120.82**	6.28	8.95
(SE)	(17.38)	(22.61)	(3.82)	(7.55)
Level-1 Pretest (γ_{10})	0.52**	0.05	0.14*	0.49**
(SE)	(0.07)	(0.09)	(0.06)	(0.10)
Level-1 Gender (γ_{20})	1.87	2.10	−0.15	−0.04
(SE)	(1.35)	(1.75)	(0.33)	(0.63)
Level-1 Age (γ_{30})	−0.50**	−0.57*	−0.01	0.01
(SE)	(0.19)	(0.25)	(0.05)	(0.09)
Level-1 ELL status (γ_{40})	3.59	−4.86	−0.97	1.12
(SE)	(3.55)	(4.51)	(0.85)	(1.65)
Level-1 African American (γ_{50})	2.99	−3.93	−0.58	−0.21
(S.E.)	(1.93)	(2.35)	(0.45)	(0.90)
Level-1 Hispanic (γ_{60})	−1.90	−5.55*	−0.10	−0.50
(SE)	(2.10)	(2.68)	(0.51)	(1.03)
Level-1 Other_ethnicity (γ_{70})	−4.45	−0.72	1.37	1.71
(SE)	(4.01)	(5.24)	(0.97)	(1.96)
Level-1 Attendance in school (γ_{80})	−0.16	0.04	0.04*	0.03
(SE)	(0.07)	(0.09)	(0.02)	(0.03)
Level-1 Attendance in intervention (γ_{90})	−0.06	0.05	0.00	0.01
(SE)	(0.04)	(0.06)	(0.01)	(0.02)
Level-2 Intervention (γ_{01})	7.57*	−2.20	2.75**	4.01*
(SE)	(3.42)	(4.56)	(0.81)	(1.72)
Level-2 School District A (γ_{02})	0.09	1.22	1.70*	2.41
(SE)	(3.18)	(4.69)	(0.73)	(1.78)
Level-2 School District B (γ_{03})	0.70	−3.36	0.27	−0.50
(SE)	(2.63)	(3.81)	(0.62)	(1.44)
Level-2 Years of experience (γ_{04})	0.05	−0.12	0.04	0.09
(SE)	(0.11)	(0.17)	(0.03)	(0.06)
Level-2 Full day (γ_{05})	−0.51	−6.98	−0.58	−1.00
(SE)	(2.49)	(3.74)	(0.58)	(1.42)
Random effects				
Level-1 Residual variance (σ^2)	61.54**	98.20**	3.65**	13.32**
(SE)	(7.94)	(13.33)	(0.47)	(1.74)
Level-2 Residual variance (τ_{00})	4.32	15.13	0.16	2.49
(SE)	(5.01)	(13.48)	(0.26)	(1.85)

Note. PPVT-III = Peabody Picture Vocabulary Test-Third Edition; EOWPVT = Expressive One-Word Picture Vocabulary Test; RDRPVT = Researcher-Developed Receptive Vocabulary Test; RDEPVT = Researcher-Developed Expressive Picture Vocabulary Test.

*Regression coefficient is significant at the .05 level, two-tailed. **Regression coefficient is significant at the .01 level, two-tailed.

researcher-developed measures of science and social studies receptive and expressive vocabulary. In addition, there was a consistent predictive effect of pretest score—children who scored higher at pretest scored higher at posttest—and for both measures of expressive vocabulary younger students outperformed older students.

Analysis of Differential Treatment Effects

The third research question asked whether the WORLD intervention had differential impacts on outcomes depending on student background characteristics (pretest scores, age, ethnicity, English learner status, and attendance variables). This question was addressed by reestimating the four multilevel models just described but with additional predictors to test for differential impact of the intervention. The additional predictors were interaction terms between the intervention and student variables. In the prior Level-2 equations, this means that the intervention variable was entered as a predictor for each of the Level-1 coefficients ($\beta_{1j}-\beta_{9j}$) corresponding to student variables. When the Level-2 models are substituted into the Level-1 model, this created the interaction terms. A separate model was estimated for each of the four outcome measures (the PPVT-III, EOWPVT, RDRPVT, and RDEPVT). The models were estimated using the full sample (including WORLD and comparison groups) because properly estimating the interaction of the intervention with student variables requires estimating the main effect of intervention as well, requiring both WORLD and comparison groups be included in the data.

In these four models, only two significant interactions emerged (complete results are not tabled because there were so few significant interaction effects). First, in the model of EOWPVT, the interaction of intervention and intervention attendance was significant ($\gamma_{91} = .25, p = .047$), indicating that, although as in the main effects model the intervention did not have an overall significant effect on EOWPVT scores, the intervention was differentially effective depending on attendance. Specifically, it was more effective for children who attended more sessions of the intervention. The second significant effect was in the model of RDRPVT, where the interaction of English Learner status and intervention was significant ($\gamma_{41} = 7.27, p < .001$). The main effect of English Learner status was similar in magnitude but had an opposite sign ($\gamma_{40} = -6.44, p < .001$). Because the intervention was dummy coded in this model, this main effect was actually the simple effect of English Learner status for the comparison group. Taken together, the simple effect and the interaction effect indicated that English Learners scored more poorly than native English speakers in the comparison group, but not in the intervention group.

Analysis of Fidelity Effects

Fidelity of treatment was used to analyze whether intervention fidelity predicted student performance. To answer this question, the multilevel models described previously were reestimated using fidelity as a predictor. Fidelity was measured only for the intervention, so this analysis included only children participating in the intervention. The teachers' percentage perfect fidelity scores (percentage of points earned out of total possible points) were entered in the models in place of the intervention variable, at Level-2. As before, a separate model was estimated for each of the four measures. The fidelity effect was not significant in any of the four models, although it did approach significance in predicting the RDEPVT ($\gamma_{01} = 0.22, p = .109$). Values of the fidelity variable were very restricted in range—the mean percentage perfect score was 85%—so its failure to predict scores on any of the four dependent variables may simply be a result of its not having enough variance to covary reliably with other variables.

DISCUSSION

In this randomized field trial, preschool children who were largely from low-income households who received 20-min daily sessions of content-focused shared book reading and vocabulary instruction over 18 weeks outperformed their peers who received business as usual shared book reading on three of four vocabulary outcome measures. Significant effects were found on the standardized measure of receptive vocabulary and both researcher-developed measures of receptive and expressive social and science vocabulary. Effects exceeded the magnitude of findings from a previous preschool study of the pilot 12-week WORLD curriculum (authors) with effects of this study ranging from $\delta_T = 0.93$ for general receptive vocabulary to $\delta_T = 1.41$ intervention specific receptive vocabulary. Our findings compared favorably with recent meta-analyses. Regarding the value added of school-based dialogic shared book reading Mol et al. (2009) found effect sizes of $d = 0.62$ and $d = 0.40$ for expressive and receptive vocabulary. The authors did not differentiate between researcher-developed and general measures of vocabulary. Also, the National Early Literacy Panel (2008) found an effect size ($d = 0.60$) for school/home shared-book reading effects on general standardized measures of vocabulary.

On standardized measures of general vocabulary, the effect of the WORLD intervention differed by type of measure. In general, standardized measures provide a more rigorous evaluation of the generalizability of the effects of an intervention than researcher-developed measures that are closely aligned to books used during intervention (Arnold, Lonigan, Whitehurst, & Epstein, 1994). With respect to standardized receptive vocabulary, the WORLD intervention effected improvement over typical practice. Findings from prior research using standardized measures of general receptive vocabulary report mixed results; however, our findings are corroborated from prior studies that have found that more intensive shared book reading interventions can positively impact children's receptive language (Wasik & Bond, 2001; Wasik, Bond, & Hindman, 2006). Moreover, this effect was larger than our previous 12-week intervention effects for standardized receptive ($\delta_T = 0.09$) and expressive ($\delta_T = 0.07$) measures. From this finding, we conclude that students with low entry-level vocabulary scores may benefit from more intensive interventions (18 weeks compared to 12). Although not investigated experimentally in our study, other dimensions of intensity that warrant future research are intervention duration (number of weeks) and dosage (number of sessions and length of sessions).

With regard to expressive vocabulary, we found no statistically significant effects on the standardized expressive vocabulary measure. These findings were unexpected. Despite evidence for the efficacy of shared-reading on expressive vocabulary (see series of studies conducted by Whitehurst and colleagues, Mol and colleagues), the present study did not replicate this finding. Studies have generally found moderate effects of interactive reading for children's acquisition of expressive (see Mol et al., 2009, and Mol, Bus, de Jong, & Smeets, 2008, meta-analyses) but less so for receptive vocabulary. According to previous research, one possible explanation is that interactive reading benefits children's expressive vocabulary through the active verbal involvement of the child because it increases attention to words and provides production practice via child responses. Although the WORLD intervention is designed to promote significant interaction about words, it is possible that this interaction was not sufficient to impact children's ability to express knowledge on a more comprehensive vocabulary set. It will be important to evaluate whether the absence of effects is a task requirement versus content (vocabulary) matter (Wagner, Muse, & Tannenbaum, 2007). Finally, as pointed out by the National Reading Panel (National

Institute of Child Health and Human Development, 2000); Coyne, Simmons, Kame'enui, and Stoolmiller (2004); Hargrave and Sénéchal (2006); and others, it is altogether possible that standardized measures of expressive vocabulary were not sensitive enough to capture the nuanced complexities involved in vocabulary acquisition

With respect to children's growth on science and social studies vocabulary, preschool-age children in the WORLD shared-book reading intervention scored substantially higher on both custom measures of receptive ($\delta_T = 1.41$) and expressive vocabulary ($\delta_T = 1.01$) than their peers in the control condition. These outcomes extend previous findings (e.g., Hargrave & Sénéchal, 2000; Sénéchal, 1997) showing that custom measures of vocabulary are more sensitive to growth for taught words than global, norm-referenced standardized measures. Because the WORLD intervention integrated vocabulary within semantically rich interactive read-alouds using science and social studies content and pedagogical dimensions, it is difficult to discern the particular components (e.g., shared-reading in the context of broad themes to maximize exposure to new ideas and words) or techniques that accounted for the effects. What we can conclude is that an intensive focus on vocabulary before, during, and after book reading had a robust impact on taught vocabulary. We intensified vocabulary instruction throughout the intervention, by embedding questions before, during and after book reading, fostering vocabulary development through a variety of response types including explaining (e.g., A gymnasium is a big room where people play games or sports), summarizing (e.g., If it is hot outside we would not see a snowflake because it has to be cold for a snowflake to fall from the sky), comparing and contrasting (e.g., What is the difference between a custodian and a principal?), anticipating (e.g., Do you think the whale will find Little Otter's mother?), predicting (What do you think we'll learn about rain in this book?), and application (e.g., "Go home and talk about liquids."). By participating in before, during and after book reading question type children were able to display what they knew or "verbal display of knowledge" and were challenged to think and build their background knowledge (van Kleeck, 2008, p. 634).

Finally, we were interested in whether there was a differential impact of intervention by children's entry level vocabulary scores and characteristics. We were particularly interested in determining whether students with lower entry-level vocabulary would benefit more than students with higher vocabulary at pretest. We intentionally integrated evidence-based vocabulary practices with shared book reading to strengthen the impact of book reading practices in children with significant vocabulary delay who typically benefit less from instruction than children with higher vocabulary levels. Overall findings indicate a significant effect of the WORLD intervention for the full range of students who participated in the study but no differential effect. Two implications stem from this finding. First, the WORLD intervention had an overall main effect, irrespective of entry-level vocabulary, a finding that speaks to its potential applicability in preschool classrooms. Second, the finding that pretest scores predicted posttest scores, suggests that students with lower entry skills may need more intensive vocabulary instruction that cuts across multiple activities and periods throughout the day and extends beyond book-based small group sessions (e.g., Penno, Wilkinson, & Moore, 2002; Robbins & Ehri, 1994). It is quite possible that small-group, book-based vocabulary instruction is not sufficient to overcome significant vocabulary disparities. As Penno et al. (2002) noted, compensatory strategies such as direct instruction in vocabulary may be more beneficial than participating in small group interactive storytelling for children with vocabulary delays. It is quite conceivable that it may require multiple forms of intervention to address the vocabulary differences that children bring to the preschool door. Clearly, this area of vocabulary research warrants further investigation

In addition to entry-level vocabulary, the effect of age was also significant with younger low income children performing better at posttest. This finding was consistent with a recent meta-analysis by Mol and colleagues (Mol et al., 2008) that younger children profit more from shared book reading than older children. The presumption being that as children get older, the effects of shared-reading weaken and may be insufficient.

Limitations

As with most studies, there are some limitations to the present study. To begin, the sample was not very large. Because randomization was performed at the classroom level, the sample size could be considered as just the 19 classrooms, although of course measuring performance of the individual students provided more powerful tests of the hypotheses than a sample of 19 would suggest. The sample was drawn from a fairly small geographic area—only two school districts. Generalizing the study to broader populations of preschoolers may therefore be difficult. Students in the study were measured only twice, before the beginning of the study and after it had concluded. An obvious concern is whether the differences found in the present study at posttest will persist as students continue in school. The present study does not offer any basis for answering this question. Another possible limitation arises from our use of researcher-developed measures to assess vocabulary taught only to the experimental group. As Slavin (2008) pointed out, this has the potential to bias outcomes in favor of the experimental group. We acknowledge this as a potential source of bias but also recognize that standardized measures may not be sufficiently sensitive to vocabulary changes to use as sole dependent measures when assessing vocabulary growth. Clearly, there is a need for development of standardized measures that are more sensitive to complexities involved in vocabulary acquisition (National Institute of Child Health and Human Development, 2000). Moreover, although some of the vocabulary were condition specific (e.g., *coral*, *sprout*, *cone*), many of the target vocabulary (e.g., *season*, *shadow*, *liquid*, *solid*, *root*) were terms identified in curriculum guides as relevant and important for preschool. To address the issue that children learned what was taught, future studies will need to compare vocabulary learning under conditions where teachers in both conditions have common vocabulary lists or book sets.

Finally, there is the potential that intervention effects were moderated by group size and time favoring the experimental group. Teachers in the comparison condition were allowed to structure groups, allocate time, and conduct shared book reading sessions according to their typical practices. Although the majority of teachers in the comparison practice-as-usual condition reported shared reading group sizes of 10 or fewer students, this factor was not controlled for in the comparison condition. Therefore, future research should attempt to standardize delivery conditions to more accurately account for intervention effects.

Implications and Conclusion

Shared book interventions hold particular promise as one method of developing vocabulary among young children whose households and prior experiences have not afforded sufficient opportunities. However, prior research has yielded mixed effects regarding its efficacy with children who enter with the greatest vocabulary needs. This study confirms and extends the literature showing that children primarily from low-income homes can learn vocabulary when shared book reading focuses on high-priority words, provides multiple opportunities

to interact with vocabulary in small groups, relates vocabulary to prior knowledge and world concepts, and extends over an 18-week period. Our methods of intensifying shared book reading focused on vocabulary instruction and interactive dialogue that not only accompanied book reading but purposefully integrated teaching and learning opportunities before, during, and after book reading. Our curriculum was designed to teach not only individual word meanings but how they related to larger science and social studies concepts. Vocabulary were consistently linked to one another (*sprout, root, bulb, plant*) and to relevant science (living things: plants) or social studies (earth: land) concepts. Toward that end, we sought to teach vocabulary not merely to enhance vocabulary but to also enhance understanding and better prepare children for future comprehension (Anderson & Freebody, 1981; Nagy, 2005).

Despite promising findings, the intervention did not sufficiently accelerate students' vocabulary levels to norms for their ages. Students in the intervention group grew on average approximately 12 months in regard to expressive vocabulary in the course of 6 months between pre- and posttest. Although children started the intervention, on average, approximately 11.6 months behind where they should be for their age, they finished the intervention at, on average, approximately only 7.6 months behind where they should be for their age. This estimates that children grew approximately 6 months extra growth beyond matriculation to catch up 4 months on their peers. Students in the intervention group grew on average approximately 10 months in regard to receptive vocabulary in the course of 6 months between pre- and posttest. Although children started the intervention, on average, at approximately 9.1 months behind where they should be for their age, they finished the intervention at, on average, approximately 7.1 months behind where they should be for their age. This estimates that children grew approximately 4 months of extra growth beyond matriculation to catch up 2 months on their peers. Although the effects of the WORLD intervention were effective on targeted vocabulary, children were still behind their chronological age for standardized measures of receptive and expressive vocabulary.

Even before formal schooling begins, many children develop rather extensive knowledge networks of vocabulary and associated concepts that serve as building blocks for later learning (Neuman & Dwyer, 2009; Stanovich, Cunningham, & West, 1998). As preschools increasingly emphasize science and social studies in their curricula, it is important to understand the vocabulary variability that exists among preschoolers and to address disparities as early as possible. We know that "the gap attributed to cultural and economic differences has not closed appreciably in the past 12 or 13 years" (Taylor & Pearson, as cited in van Kleeck, 2008, p. 628) and is unlikely to close without intentional intensive intervention (van Kleeck, 2008). Science and social studies can play an integral role at the center of a coherent, integrated early childhood program to build vocabulary and knowledge structures necessary for reading comprehension. Unfortunately, reviews of well-known preschool curricula reveal that limited guidance exists to help teachers select and provide effective vocabulary instruction for young children (Neuman & Dwyer, 2009).

Shared-book reading provides an instructional context for fostering and accelerating vocabulary development. There is great potential for specific strategies and techniques used in shared-reading to advance vocabulary for low-income children who enter preschool with limited knowledge of words. The WORLD shared-reading intervention sought to use a recognized set of instructional design principles and integrate them to validated practices for shared-book reading to optimize science and social studies word-learning opportunities for children with word-learning difficulties. More research is needed investigating how to bolster effects for children with the most limited vocabulary. Although it is well

understood that building comprehension depends mainly on knowledge and knowledge-related vocabulary (Hirsch, 2006), what is less clear is how to identify a corpus of preschool high-priority vocabulary useful for later comprehension, especially in science and social studies. More research is needed on ways of identifying high-utility science and social study words. Moreover, further studies must compare the efficacy of shared book reading to other viable interventions that are implemented for comparable amounts of time.

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APPENDIX A

Example of the 5-Day Instructional Cycle in a Social Studies Lesson

In *Places Where We Live and Go*, Day 1 included (a) introducing theme-building background knowledge on cities; (b) previewing the new vocabulary using researcher-developed picture cards (e.g., *city*, *building*); and (c) predicting what would happen in the storybook, *The Adventures of Taxi Dog* (Barracca & Barracca, 1990). Example activities involved talking about the theme by showing the picture/concept card for *Places Where We Live and Go* and saying, “This week we are going to read books and learn about places where we live and go. Today we will learn about cities. Cities are places where we live and go.” Teachers then read the book and stopped at a designated intermittent point to discuss the target vocabulary on the page on which it occurred (*Introduce Magic Words within the Book*). For example, when the words cities and building occurred in *The Adventures of Taxi Dog* (Barracca & Barracca, 1990), the teacher briefly paused, pointed to the illustration of each word, and asked children to identify the picture using their new vocabulary. After reading instruction included (a) reviewing target vocabulary with researcher-developed picture cards (Magic Word Review) and (b) responding to six challenge questions in which new words were used to discuss social studies concepts (e.g., *What are the tall things on both sides of this street* [buildings]). This sequence of instruction was the same for Day 3, when introducing the theme-related informational text, *Taking a Walk* (Emberley, 1990).

On Days 2 and 4, the storybook or informational text was read again, with additional after-reading activities designed to review and provide multiple exposures to concepts and target vocabulary. For example, after reading *The Adventures of Taxi Dog* (Barracca & Barracca, 1990), teachers looked into a mirror and described essential clues for target words (e.g., I see a place that has lots of people and a lot of buildings). In response to word clues, a child would identify the appropriate target word (e.g., *cities*) and then describe and pretend to view the target word in the “magic mirror.”

On the last day of the instructional cycle, children reviewed social studies concepts and words from both the storybook and informational text that was read during the week and participated in deep processing activities (e.g., talk about similarities across texts) while using selected pictures.

APPENDIX B

Days 1 and 3 Fidelity Form

FIDELITY MEASURE FOR TEACHERS: Day 1 or 3

WORLD SHARED BOOK READING

Teacher: _____

Observer: _____

School: _____

Start Time
(when lesson began): _____

Length of Lesson: _____

Day: _____

Date: _____

Book: _____

Stop Time: _____

Lesson #: _____

Number of Students in Group: _____

Type of Observation: _____English

_____Spanish

_____Inter-rater Agreement

Use the following anchors to complete the Fidelity of Implementation Form:

Very High: Instructional component implemented with high fidelity and minimal changes and improvements are indicated.


Mid High: Most Instructional components implemented with high fidelity; some changes/ improvements indicated.

Mid Low: Several Instructional components are inconsistent with lesson and should be target of improvement.

Low: Most instructional components were either not implemented or instructional method was highly inconsistent with lesson. These areas should be high priority targets of improvement

FIDELITY BY ACTIVITY

SCALE: 3 = VERY HIGH 2 = MID HIGH 1 = MID LOW 0 = LOW

Activity	Before (5 min)			During (5 min)		After (5 min)		Overall
	1: Talk about Theme (Day 1 Only Narrative)	2: Magic Word Preview	4: Text Structure and Prediction	1&2: Summarize Listening Goals & Introduce Magic Words within the Book	1: Magic Word Review	2 & 3: Book Questions with Magic Words & Wrap-Up		
 Start Time:								n/a
Fidelity								
Follows procedures for activity.								
Follows wording in lesson.								
Provides opportunities for students to ask questions/respond.								
Provides feedback/confirms student responses.								
Completes all components of activity.								

Field Notes:

Overall Observations for Fidelity

Teacher: _____ Observer: _____
Date: _____ Day: _____

Use the following anchors to complete the Overall Observations of Fidelity Form:

Excellent: Instructional component implemented with high fidelity and no changes or improvements are indicated.

Good: Most instructional components implemented with high fidelity; minor changes/ improvements indicated.

Partially effective: Several instructional components are inconsistent with lesson and should be target of improvement.

Minimally effective: Most instructional components were either not implemented or instructional method was highly inconsistent with lesson. These areas should be high priority targets of improvement.

OVERALL OBSERVATIONS

Skills Specific to Fidelity	Quality of Instruction			
	Excellent	Good	Partially Effective	Minimally Effective
Materials are ready for each activity.	3	2	1	0
Instructor is organized and familiar with the lesson.	3	2	1	0
Instructor models skills/strategies appropriately and with ease.	3	2	1	0
Instructor completes all parts of the lesson.	3	2	1	0

General Skills	Quality of Instruction			
	Excellent	Good	Partially Effective	Minimally Effective
Students are highly engaged in the lesson.	3	2	1	0
Instructor provides opportunities for students to participate actively and successfully.	3	2	1	0
Instructor evaluates and provides appropriate feedback on student progress during intervention.	3	2	1	0
Instructor maintains appropriate pacing.	3	2	1	0
Instructor maximizes amount of time available for instruction.	3	2	1	0
Instructor manages student behavior.	3	2	1	0
Instructor uses effective communication skills.	3	2	1	0

GLOBAL OBSERVATIONS

Overall, the teacher implemented the instructional practices	Above Expectations	Adequately	Less than Adequately	Not at all
	3	2	1	0

Overall, dialogue with children was	Above Expectations	Adequately	Less than Adequately	Not at all
	3	2	1	0

Overall, instructional time was	Mostly Instructional	Some Interruptions	Frequent Interruptions	Mostly Management
	3	2	1	0

Overall, I would consider the teacher's instruction to be	Mostly Effective	Somewhat Effective	Somewhat Ineffective	Mostly Ineffective
	3	2	1	0

Overall, student success was	High	Somewhat High	Somewhat Low	Low
	3	2	1	0