# Proximal Effects of Robust Vocabulary Instruction in Primary and Intermediate Grades

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**Background / Context:** Student vocabulary growth needs to be a priority of instruction if schools are to meet the goal of helping every student become college and career ready. With more challenging expectations for academic achievement, the importance of vocabulary to reading cannot be ignored. Vocabulary is a significant correlate of concurrent and future reading achievement (Cunningham & Stanovich, 1997; Storch & Whitehurst, 2002). Yet, young children who struggle with reading do not develop adequate vocabularies, and therefore do not read well; because they are not reading well, they are not learning vocabulary (Aarnoutse & van Leeuwe, 1998; Chall, Jacobs, & Baldwin, 1990; Cunningham & Stanovich, 1997; Dickinson & Tabors, 2001; Juel, 1988; Moats, 2001; White, Graves & Slater, 1990). During third grade, for example, above average readers make 31 percent gains in vocabulary; below average readers make gains of only 12 percent (Chall, Jacobs, & Baldwin, 1990).

Educational practices are needed to promote strong vocabulary growth so that vocabulary can be both the cause and result of successful reading. Vocabulary interventions need to begin early and continue for a sustained period of time (Beck & McKeown, 2007a; Biemiller, 2003; Foorman, Seals, Anthony & Pollard-Durodola, 2003). According to theoretical and empirical research, there are three components of vocabulary instruction that are needed to boost vocabulary growth and improve reading. A number of literature reviews have concluded that successful vocabulary instruction includes: (1) both definitional and contextual information, (2) more than one or two exposures to each word, and (3) engagement of students in deep processing about word meaning and use (Baumann, Kameenui, & Ash, 2003; Beck, McKeown & Kucan, 2002; Blachowicz & Fisher, 2000; Mezynski, 1983; Nagy & Scott, 2000; Rupley & Nichols, 2005; Stahl & Fairbanks, 1986).

*Elements of Reading®: Vocabulary (EOR-V)* (Beck & McKeown, 2004) is an instructional intervention that was designed to incorporate these three components and be used daily by classroom teachers to supplement core reading instruction. As *EOR-V* was developed in parallel fashion for use in consecutive grades (K-5), it provides an opportunity to examine the effects of early and sustained vocabulary instruction on children's vocabulary and reading comprehension. Prior research supports the promise of *EOR-V* for positively impacting vocabulary and reading comprehension (Apthorp, 2006; Beck & McKeown, 2007b; Beck et al., 1982; McKeown, Beck, Omanson, & Perfetti, 1983; McKeown, Beck, Omanson, & Pople, 1985), but a randomized control trial of the intervention with appropriate treatment of clustering effects has not yet been conducted.

**Purpose / Objective / Research Question / Focus of Study:** The purpose of this study was to provide unbiased estimates of the effects of robust vocabulary instruction as instantiated in *EOR-V* in schools serving children from low-income households. Vocabulary researchers recognize that word learning does not occur easily or quickly (McKeown, Beck, Omanson & Pople, 1985; White, Graves & Slater, 1990). Children need early, more and continuous robust vocabulary instruction to develop a vocabulary of sophisticated words (Beck & McKeown, 2007a). The research to be presented addressed this need by testing the effects of a full, one- and two-year implementation of *EOR-V* on both vocabulary and reading comprehension. The specific purpose of the proposed presentation is to report estimates of the proximal effects of *EOR-V* on vocabulary and listening or reading comprehension as evaluated at the end of the first year of the two-year intervention.

**Setting:** Forty-six elementary schools located in four districts/areas in the South-eastern United States agreed to participate in this study. Two schools dropped from the study after random assignment leaving 44 schools, all but one of which met Title 1 eligibility requirements. The

average percent of students receiving free/reduced lunch across the schools was 72% ranging from 43 to 96%. Approximately 41% of participant schools were in suburban locations, with 31% from rural locales and towns, and 27% within small to large cities.

**Population / Participants / Subjects:** Study participants included all general education classroom teachers and their students in kindergarten and grades one, three and four in Year 1 (2008-2009) and all classroom teachers and their students in grades one, four and five in Year 2 (2009-2010). Participants include 753 teachers and 9,313 students (kindergarten, 1st, 3rd and 4th grades) in Year 1 of the study.

**Intervention / Program / Practice:** The *EOR-V* program supplements any core kindergarten through fifth grade reading program using 15- to 20-minute daily lessons that progress in a five-day sequence from read-alouds to viewing photo cards to increasingly challenging discussion and activity prompts to a weekly quiz. The activities are designed to (1) provide children both definitional and contextual information about each vocabulary word, (2) provide more than one or two exposures to each word, and (3) engage students in deep processing about word meaning and use. Lessons focus on rather sophisticated, unfamiliar words that have application across multiple domains – labeled Tier 2 words. Tier 2 words provide more refined labels for familiar concepts. For example, "benevolent" can replace a common word such as "kind" (Beck, McKeown & Kucan, 2002). A new set of seven Tier 2 words are taught in each of the 24 *EOR-V* weekly lessons. Teachers implement the program using the five-day, weekly lesson plans and materials provided in the *EOR-V* teacher's guide and classroom kit.

Reading coaches from each school were trained in the use of *EOR-V* and subsequently trained and supported treatment teachers in the use of *EOR-V.* Training occurred in October and November 2008. *EOR-V* materials arrived in two districts/areas for 12 schools in October and November 2008 and in January 2009 in the other two districts/areas for 32 schools. Thus, there was a late start to implementation of *EOR-V* in the majority of schools.

**Research Design:** The study used a cluster randomized trial design in which schools were the unit of assignment. Schools were blocked by district/area and randomly assigned to either Primary or Intermediate Intervention. In the Primary Intervention schools, the primary grades were the treatment group and the intermediate grades were the control group. In the Intermediate Intervention schools, the reverse was the case with the primary grades as the control group and the intermediate grades as the treatment group. As shown in Table 1 (Research Design), orthogonal to group assignment, are two studies: Study 1 (Primary Grades) and Study 2 (Intermediate Grades). Kindergartners and 1st graders in Primary Intervention schools and 3rd and 4th graders in Intermediate Intervention schools received *EOR-V* for two consecutive years. In the control classrooms for two consecutive years, vocabulary was taught business as usual.

**Data Collection and Analysis:** To collect data on *EOR-V* implementation fidelity and programmatic differentiation between treatment and control conditions, teacher surveys, site visits, and audio-recording of lessons were used. To measure vocabulary and comprehension, pre-tests and Year 1 posttests were administered to students.

To control for prior academic performance, students were administered the SAT-10 as a pre-test prior to the start of the intervention. Students completed selected SAT-10 subtests, *Listening* or *Reading*, that reflect achievement of the key outcomes in the study. The reliability estimates for the subtests are high enough to distinguish groups of students (frequently in the 0.80s, but ranging from 0.53 to 0.93; Carney, 2005; Morse, 2005).

To measure proximal effects, students were administered researcher-developed *Tests of Instructed Word Knowledge* in vocabulary and comprehension (TOIW-V and TOIW-C) in the

spring of Year 1. The TOIW-V is an orally group-administered instrument developed specifically to assess recognition and understanding of *EOR-V* Tier-2 words. Each grade level of the TOIW-V assessed students' knowledge of 20 Tier-2 words randomly sampled from the first 15 lessons of *EOR-Vocabulary*. The TOIW-V was based on a verbal task format that two members of the research team developed for an earlier study (Beck and McKeown, 2007) and that has been used by Coyne's research group (Coyne, McCoach, Loftus, Zipoli, & Kapp, 2009). The test is designed to engage students in recognition of word meaning and judging correctness of word-use based on understanding of word meaning. Students are asked to respond yes or no to four questions about each word. Two questions (one true and one false) ask whether a presented meaning matched a given word (e.g., "Does extraordinary mean very special?" "Does extraordinary mean very hungry?"). Two questions ask whether a brief context is appropriate for a word (e.g., "Would it be extraordinary to see a monkey at the zoo?" "Would it be extraordinary to see a monkey teaching school?").

The comprehension test (TOIW-C) was developed to engage students in listening to or reading brief narratives with an emphasis on using their knowledge of target words in the passage to understand what was happening and why (Beck and McKeown, 2007). For example, in one passage, two children want to do something *humane* to help families who lost their belongings in a fire. So they make an *ambitious* plan and collect items from their neighbors, who *graciously* donate so much that the children's garage *resembles* a department store. Looking at all they've collected, the children feel so good they get *giddy*. The test at each level comprised four passages, each using five target words from the first 15 lessons of *EOR-V* program. Each passage was a brief narrative involving one, two or three characters at school, at someone's home, or in a community setting (e.g., the bakery). Five multiple-choice, "what," "how" and "why" comprehension questions followed each passage. The questions asked about important events, descriptions, and feelings in the passage and addressed concepts expressed by the target words. The kindergarten and first grade TOIW-C was administered orally with each passage read aloud twice. The students answered questions by selecting one of three pictures which they viewed as the question was asked orally (e.g., "Which picture shows what the town did on the day of the parade?"). The third and fourth grade TOIW-C was administered as a paper-and-pencil assessment; students read passages and answered written multiple choice questions on a page following each passage.

An item analysis was conducted on the TOIW-V and TOIW-C at each grade level. A minimum point-biserial correlation (pb(r) > 0.10) was used to eliminate items that showed weak associations with student's overall score. Item analyses were conducted separately on each instrument. As an index of discrimination, items (question responses) with a point biserial correlation (pbr) < 0.10 were removed from the calculation of the composite score for that assessment for grades 1, 3, and 4. The results of these analyses are presented in Table 2. Due to low overall pb(r) scores on the grade-K instruments, all items were retained. Reliability coefficients (alpha) for all instruments ranged from 0.41to 0.87. The lowest reliability was found on the K and grade-1 TOIW-Comprehension instruments.

To examine proximal effects in Year 1, the average effects of *EOR-V* on instructed word knowledge and comprehension were estimated via 2-level hierarchical models with students (Level 1) nested within schools (Level 2). The model was run separately using TOIW-V and TOIW-C scores as the dependent variable at each grade level.

**Findings / Results (Fidelity of Implementation):** Researchers examined fidelity of implementation of *EOR-V* with regard to two aspects of fidelity: dosage and adherence. Each of

these aspects of fidelity is defined below. The measurement of each aspect also is explained and results of the fidelity evaluation are presented. In addition, researchers examined generic fidelity by focusing on program differentiation. Researchers sought to verify that the unique features of the intervention were implemented and evaluated the extent to which *EOR-V* instruction differed from the counterfactual instruction.

*Dosage.* Typically, "dosage is defined as the frequency and duration of an intervention" (Hamre, et al., 2009, p. 2). Dosage was measured using number of *EOR-V* lessons completed. At each grade level, the *EOR-V* classroom kit includes 24 lessons intended for one full-school year of implementation. On average, classrooms implemented 12 lessons during Year 1 (see Table 3). Low average dosage was associated with the late start to implementation.

*Adherence.* Adherence is the extent to which program elements are used as intended or prescribed (Hamre et al., 2009). The *EOR-V* teacher's guide presents, and training for this study reinforced, 10 lesson elements to be implemented for each 5-day lesson. In Day 1, two elements are intended for use to introduce words (Read-aloud; Explain meaning). Across Days 2, 3 and 4, five elements are intended for use to provide multiple exposures to and opportunities for use of the words (Word Snapshots, Word Chat, Student Book, Graphic Organizers, and Writing). On Day 5, the two elements involved Review and Assessment. The tenth element of the *EOR-V* program, Depth of Processing, is intended for use across all days; teachers are expected to ask students "why" follow-up questions to prompt thinking and reasoning.

To evaluate adherence, researchers used data collected in the weekly *EOR-V* lesson-logs. The lesson logs asked teachers whether or the extent to which they implemented an element. For each element, the criterion for Adequate Fidelity was defined as a response of "yes, implemented," or "implemented to a great extent." Three lesson logs were randomly selected (one from each of the first quarters of the 24 lesson set). The percent of teachers meeting the adequate fidelity criterion per lesson was computed and averaged across the three lessons to report percent of teachers adhering to the element's fidelity as prescribed.

More than 80 percent of teachers demonstrated Adequate Adherence Fidelity for six of the 10 program elements (see Table 4): Read-aloud, Student Book, Graphic Organizers, Review, Assessment, and the use of photo cards, Word Snapshots.

Fidelity for two of the elements, Word Chat, and Depth of Processing (i.e., ask "why" follow-up questions), was adequate for roughly three-quarters of teachers (see Table 4). Fidelity for Writing was lower, except for grade 4. Teachers reported that they often did not have time for the writing activity. At grade 4, however, writing is an important part of the curriculum; in fact, there is a state-wide writing test for all 4$^{th}$ grade students. The 4$^{th}$ grade teachers were observed and frequently reported that they used the EOR-V writing prompts as preparation for the 4$^{th}$ grade state assessment. For the final element, Explain Meaning, between 47 and 63 percent of teachers (1$^{st}$ and 4$^{th}$ grade, respectively) demonstrated adequate adherence (see Table 4).

*Program Differentiation.* Based on earlier research and development in robust vocabulary instruction (Beck, Perfetti, & McKeown, 1982; McKeown, Beck, Omanson, & Perfetti, 1983; McKeown, Beck, Omanson, & Pople, 1985), the *EOR-V* authors included word chat prompts in the *EOR-V* teachers' guides and lesson plans that are intended to engage students in deep processing of words. The word chat prompts ask students to make decisions about which contexts fit a word's meaning, compare words, and relate words to one another. For example, the directions prompt students to discuss whether a swim coach could *verify* that a swimmer's dive was *audacious*, or, why owls have a *reputation* for being *subtle* birds.

The word chat prompts are a unique feature of *EOR-V.* Using Year 1 data, researchers evaluated the extent to which instructional conversations with students in both treatment and control classrooms prompted deep processing of words during a vocabulary lesson. A random sample of one teacher per grade and school was asked to audio-record a vocabulary lesson in April 2008. The sample included both treatment and control teachers. Margaret McKeown and Isabel Beck developed a Depth of Processing Taxonomy to analyze the audio-taped lessons. Teacher questions were categorized into one of six categories (Read/repeat, recall, connect, generate/locate, integrate, and explain reasoning. The McKeown and Beck research team read and scored the audio-taped transcripts blind (without treatment or control identification) using the Depth of Processing Taxonomy. Distinct and statistically significant differences in the quality of the treatment (EOR-V) and control teachers' question/answer interactions were documented, especially at the lowest and highest levels. Control classrooms were characterized by processing at literal levels, questions that required little more than recall of instructed definitions. Treatment classrooms had substantially less of such questions, and showed significantly more processing at the higher levels, with questions that asked students to explain examples of word use or their reasons for choosing contexts as appropriate for new words. Control classrooms generally lacked this type of processing.

**Findings / Results (*Proximal Effects on Vocabulary and Comprehension*):** As shown in Table 5, the students in the treatment condition performed significantly higher on both TOIW-V and TOIW-C. As also can be seen in Table 5, effect sizes were greater for estimating the impact of *EOR-V* on vocabulary than on comprehension. Using the Benjamini-Hochberg Correction for multiple comparisons, all results remained statistically significant at the 0.05 level.

**Conclusions:** Results for adherence to program elements demonstrate that not all elements were used to a high level. However, lessons were still significantly different from control classrooms as demonstrated by the Depth of Processing analysis of classroom discussion. Results for dosage indicated that many teachers used only half the available lessons. Yet, despite the low dosage and the less than ideal adherence fidelity, the intervention still seemed effective enough to promote significant differences in achievement in both knowledge of the target words and comprehension using the target words at both primary and intermediate grade levels. The magnitude of the present proximal effects on vocabulary was as great as or greater than the average proximal effect reported for vocabulary interventions (0.79) in a recent meta-analysis (Elleman, Lindo, Morphy & Compton, 2009).

Findings confirm recommendations for vocabulary instruction that provides multiple contexts and engages students' processing of meaning to achieve the goals of increased vocabulary knowledge and comprehension. The findings demonstrate that such recommendations apply to primary and intermediate grades students. Further, findings suggest that expected knowledge and comprehension results can occur even when implementation is less intense than usually prescribed. The limitations are related to measurement and implementation issues. The low reliability estimates and pb(r) scores of the TOIW-C measures in kindergarten and 1$^{st}$ grade indicate that at these grade levels, the intended outcomes may not be well-represented by the scores. The levels of dosage and adherence fidelity obtained may have limited discovering the extent to which robust vocabulary instruction can affect comprehension.

# Appendices

## Appendix A. References


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## Appendix B. Tables and Figures

### Table 1. Research Design

| | | School Group | | | |
|---|---|---|---|---|---|
| | | Primary Intervention | | Intermediate Intervention | |
| | | 2008-09 | 2009-10 | 2008-09 | 2009-10 |
| Study 1 | K | TK | Nonpart Ss | CK | Nonpart Ss |
| | 1 | T1 | TK | C1 | CK |
| | 2 | Nonpart Ss* | T1 | Nonpart Ss | C1 |
| Study 2 | 3 | C3 | Nonpart Ss | T3 | Nonpart Ss |
| | 4 | C4 | C3 | T4 | T3 |
| | 5 | Nonpart Ss | C4 | Nonpart Ss | T4 |

* Nonpart Ss are students not participating in assessments.
T = Treatment; C = Control

**Table 2. Reliability of Test of Instructed Words (TOIW)**

| INSTRUMENT | FINAL ALPHA | TOTAL NUMBER OF ITEMS USED | NO. OF ITEMS ELIMINATED [PB(R) > .10] |
|---|---|---|---|
| TOIW - VOCABULARY | | | |
| GRADE K | .77 | 80 | -- |
| GRADE 1 | .84 | 75 | 5 |
| GRADE 3 | .84 | 78 | 2 |
| GRADE 4 | .87 | 93 | 3 |
| TOIW – COMPREHENSION | | | |
| GRADE K | .41 | 20 | -- |
| GRADE 1 | .46 | 15 | 5 |
| GRADE 3 | .72 | 19 | 1 |
| GRADE 4 | .76 | 24 | 0 |

## Table 3. Implementation Fidelity Results by Grade: Dosage

| **Year 1 (2008-2009) *EOR-V* Average Number of Lessons Completed by Level** | | |
|---|---|---|
| Level | N | Average number of Logs Completed |
| K (Kindergarten) | 112 | 12.6 |
| A (1st grade) | 136 | 12 |
| C (3rd grade) | 129 | 13 |
| D (4th grade) | 96 | 12.1 |

**Table 4. Implementation Fidelity Results by Grade: Adherence**

| | | Percentage of Treatment Teachers Demonstrating Adequate Fidelity of *EOR-V* Implementation: Adherence | | | |
|---|---|---|---|---|---|
| | | Primary Grade Study | | Intermediate Grade Study | |
| Day of the week | Adherence Element | *EOR-V* Level K Kindergarten N = 83 | *EOR-V* Level A 1st grade N = 87 | *EOR-V* Level C 3rd grade N = 103 | *EOR-V* Level D 4th grade N = 72 |
| 1 | Read-aloud | 99 | 98 | 99 | 100 |
| | Explain Meaning | 61 | 47 | 54 | 63 |
| 2, 3 & 4 | Word Snapshots (photo cards) | 91 | 89 | 87 | 94 |
| | Word Chat | 79 | 79 | 73 | 84 |
| | | | | | 97 |
| | Student Book | 90 | 87 | 88 | 84 |
| | Graphic Organizers | 87 | 85 | 84 | 82 |
| | Writing | 61 | 68 | 61 | 86 |
| 5 | Review | 89 | 92 | 89 | 84 |
| | Assessment | 91 | 92 | 99 | 93 |
| All days | Depth of Processing (ask "why" follow-up questions) | 71 | 70 | 73 | 70 |

**Table 5. Year 1 Proximal Effects of *EOR-V***

| | TREATMENT MEAN | CONTROL MEAN | ESTIMATED DIFFERENCE | 95% CI OF THE ESTIMATED DIFFERENCE | | Δ |
|---|---|---|---|---|---|---|
| | | | | LOWER | UPPER | |
| TOIW – VOCABULARY | | | | | | |
| KINDERGARTEN | 48.60 (.59) | 41.72 (.57) | 6.89* (.82) | 5.23 | 8.55 | 0.86 |
| FIRST GRADE | 55.53 (.80) | 48.30 (.77) | 7.23* (1.16) | 4.89 | 9.57 | 0.81 |
| THIRD GRADE | 60.80 (.76) | 52.28 (.77) | 8.52* (1.09) | 5.93 | 6.30 | 0.87 |
| FOURTH GRADE | 71.67 (.85) | 61.32 (.92) | 10.34* (1.06) | 8.17 | 12.52 | 0.98 |
| TOIW – COMPREHENSION | | | | | | |
| KINDERGARTEN | 10.26 (.16) | 9.29 (.16) | 0.95* (.22) | 0.50 | 1.41 | 0.35 |
| FIRST GRADE | 9.62 (.13) | 8.94 (.13) | 0.68* (.19) | 0.31 | 1.06 | 0.28 |
| THIRD GRADE | 10.38 (.11) | 9.80 (.11) | 0.58* (.16) | 0.26 | 0.89 | 0.16 |
| FOURTH GRADE | 13.71 (.29) | 11.72 (.29) | 1.98* (.41) | 1.15 | 2.82 | 0.52 |

* $p < .001$ ( ) Standard error