Effects of vocabulary instruction on measures of language processing:
Comparing two approaches

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INTRODUCTION

There no longer seems to be much controversy in the idea that attention to vocabulary needs to begin early in children’s schooling, as early as kindergarten, and perhaps even as early as preschool. Evidence of the gap in vocabulary for children of different SES groups by age three (Hart and Risley, 1995) and consistent findings that children’s early vocabulary knowledge strongly predicts their later reading success demonstrates the urgency of getting young students off to an early start (Biemiller & Slonim, 2001; Cunningham & Stanovich, 1998, Hart & Risley, 1995; Wagner et al., 1997). Questions remain, however, about whether vocabulary instruction can be successful in promoting not only word knowledge but also children’s literacy potential.

This study has three major purposes. The first is to compare two types of vocabulary instruction that are common in research and practice for primary school children and which represent different theoretical orientations. The second is to examine the effects of vocabulary instruction along a progression of language processing, from recognition of word meaning to comprehension and production, and the third is to use innovative measures to examine points along this processing progression.

Empirical and Theoretical Foundation

A traditional vehicle for enhancing children’s language skills, including vocabulary, has been storybook reading. Positive correlations between being read to and eventual reading achievement have appeared in journals for over 50 years (Teale, 2003). Thus reading aloud seemed like a natural vehicle for developing ways to enhance vocabulary.
Investigations of storybook reading quickly moved from examining incidental word learning from a single reading of a storybook to enhancements such as assuring that the contexts supported word meanings (Robbins & Ehri, 1994), repeated readings of stories, and elaborating word meanings as a story was read (Biemiller & Boote, 2006; Elley, 1989; Justice, Meir, & Walpole, 2005; Penno, Wilkinson, & Moore, 2002). Gains in word knowledge were small for unenhanced readings, for example, no gain in Justice et al to 3% and 15% on two different stories in Elley. Repeated readings and providing word meaning brought substantial increases in word learning. These instructional enhancements chiefly utilized memory and association processes, helping students associate a word with its meaning and boosting the chances that the association would be remembered by offering repeated encounters.

Other vocabulary researchers have taken a different tack, initiating lessons for young learners with storybook readings, but placing the emphasis for vocabulary learning on activities that introduced additional contexts beyond the story and that called for active processing of word meanings (Beck & McKeown, 2007; Coyne, Simmons, Kame’enui, & Stoolmiller, 2004; Coyne, McCoach, Loftus, Zipoli, & Kapp, 2009; Silverman, 2007; Wasik & Bond, 2001). Instruction in these studies draws from a cognitive processing framework, which is a way to portray complex cognitive functioning. Such a framework entails pursuing cognitive goals--for example, understanding a text or learning a new concept—by selecting and engaging various processes and making decisions about the success of those processes. A cognitive processing orientation represents the theoretical notion that active processing and goal seeking are important to learning if the learner is to achieve the ability to use and apply
the new information (See for example, Brown, Bransford, Ferrera, & Campione, 1983; Miller, 2003; Sternberg, 1979, 1982). A cognitive processing orientation underlies several instructional techniques for vocabulary. For example, *semantic features analysis* (Anders, Bos, and Filip, 1984) and *semantic mapping* (Margosein et al., 1982) engage learners’ processing by having students examine how words are related through analysis and discussion of word characteristics (Johnson & Pearson, 1978, 1984). Both techniques have resulted in improved word learning and comprehension (Anders et al, 1984; Margosein et al., 1982).

Studies by Beck and McKeown and their colleagues with fourth grade students also reflected a cognitive processing orientation (Beck, Perfetti, McKeown, 1982; McKeown, Beck, Omanson, & Perfetti, 1983; McKeown, Beck, Omanson & Pople, 1985). Instruction was designed to promote fluent access to words meanings and rich semantic connections through the use of multiple exposures of target words in different contexts and activities to engage student processing. For example, students were asked to discuss if they would *berate* someone who had *inspired* them. Such a question prompts students to consider the meaning of the two words, activate the circumstances under which the berating is relevant and decide whether those circumstances fit a person who inspires one. The instruction was found to affect students’ higher-order language processing, including speed of access to taught words, ability to integrate new words into contexts, and comprehension of text that used the taught words.

Two reviews of vocabulary instructional research supported a cognitive processing orientation. Both Mezynski (1983) and Stahl and Fairbanks (1986) concluded that instruction that succeeded in affecting comprehension included: more than one or
two exposures to each word, both definitional and contextual information, and engagement of students in active, or deep, processing.

Vocabulary research featuring active processing had been conducted with students at intermediate grades through high school. But recently, some work with children in preschool through first grade has featured active processing (Beck & McKeown, 2007; Coyne, Simmons, Kame’enui, & Stoolmiller, 2004; Coyne, McCoach, Loftus, Zipoli, & Kapp, 2009; Silverman, 2007; Wasik & Bond, 2001). These studies prompt students to interact with target words through activities that pose questions about the words or ask students to create uses for the words. In Beck and McKeown’s studies, interactions were based on the instruction that they and their colleagues had developed for their vocabulary research with fourth graders. Coyne et al. (2004)’s approach included explanation of word meanings during reading and follow-up activities that promoted interaction, for example, “Is a rumpus more like sitting quietly or wild play?” Silverman used similar approaches, providing multiple contexts for children to reflect on and talk about. Wasik and Bond’s approach (2001) included introducing words before reading, interactive discussion during book reading prompted by questions such as “What can I do with this [pointing to object pictured in story]?” and follow-up activities related to the words. All of these studies found significant positive effects for learning the words taught.

Based on theory and prior research with older students, we might expect studies that feature active processing of vocabulary with younger students to impact higher-order abilities such as comprehension as well. However, studies with younger students have not examined the effect of these strategies on comprehension, with one recent exception.
That is a study by Coyne, McCoach, Loftus, Zipoli, Ruby, Crevecoeur, and Kapp (2010), which showed a trend (p = .11) toward enhanced comprehension on a story listening comprehension measure for kindergartners who learned vocabulary through interactive instruction relative to no treatment control students.

Rationale for the Study

The purpose of the present study was to use a within subject design to compare two approaches to vocabulary instruction for kindergarten children. The study addresses the following research questions:

1. Will measures of higher order language processing capture effects of vocabulary instruction based on a cognitive processing framework?
2. Will the effects be greater for cognitive processing instruction than for instruction based on repeated readings and definitions?

The approaches to vocabulary represented two types of instruction that are found in materials and research studies. One approach comprises repeated readings of a storybook with explanation of target word meanings during reading and later activities that review word meaning. The other approach provides one reading of a story and then focuses on interactions around word meanings in which children are invited to think about and respond to words. Both approaches provide a story context and provide explicit definitions for words selected from the story. However, the story context and the definitions are the only content of the repeated readings method. In contrast, the cognitive processing-based instruction offers additional contexts for the words and engages students in responding to the contexts and generating their own contexts. A definition can be viewed as a generalization of word meaning such that it provides a learner information
needed for comprehending a variety of uses and contexts for a word. A cognitive-processing perspective holds that learners need to interact with and integrate various specific contexts of word use themselves in order to form generalizations that are of sufficient quality to assist comprehension (Nagy & Scott, 2000; Perfetti & Hart, 2002).

There has been no research that compares instruction featuring cognitive processing interactions with instruction that relies on repeated readings and definitions. Such an investigation is valuable, as both approaches are prevalent in the instructional and research literature. Because the two approaches engage different processes, understanding the effects of each sheds light on the kind of processing that may promote different aspects of verbal functioning.

**Measuring Outcomes**

Assessment of what students learn from vocabulary instruction has been quite restricted (Pearson, Hiebert, & Kamil, 2007). Typically, studies employ measures of word knowledge that involve, essentially, knowing a definition for the words. Results of such assessments are limited in that we don’t know if they indicate that students have truly developed a generalized representation of what a word means, or if students are simply recalling a definition from instruction. Some studies also attempt to measure comprehension effects, often using standardized measures of text comprehension, usually with meager results (Elleman, et al, 2009). An issue is that positive results on a definition task and null results on a text comprehension task leave a wide gap in understanding what students can do with the words they have been taught. A key goal of this study was to gauge the impact of instruction on a progression of language processes, beginning with
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recognition of word meanings but including higher-order language processes of comprehension and production.

Higher-order processes involve complex mental behaviors such as acting on information and bringing knowledge to bear in order to evaluate, make decisions, draw inferences, etc. Higher-order processes go beyond lower-order processes, such as those involving perception, memory, and association, by requiring combinations of cognitive actions and use of information beyond what is given.

To assess the impact of the two instructional approaches being compared, we developed novel measures to tap into several aspects of higher-order processing. One aspect is the integration of word meanings within a context. Context integration is the ability to access relevant meanings of words in a context and fit those meanings together in a way that allows one to make sense of the context so that comprehension can proceed. For example, in the context “After the contest winners were announced, Sara ran up to console Meg,” the reader first needs to use knowledge of console to generate the implication of the context, that if Sara is consoling Meg, that means Meg must have lost the contest. In a study with fourth-graders that compared effects of instruction based on definitions to instruction based on active processing, McKeown et al (1985) presented contexts such as the Meg scenario followed by questions such as: “How do you think Meg did in the contest?” The active processing instruction group was significantly more able to respond to the questions. Students who experienced the definition instruction more often either simply provided the definition for the target word or responded to the general situation represented by the context—in this case, running up to someone after a contest by saying that Meg won.
Context integration was initially noted as an important component of comprehension by Jenkins, Pany, and Schreck (1978) and Kame’enui, Carnine, and Freschi (1982). More recently, studies by Perfetti and his colleagues (Perfetti, 2007) have shown that skilled comprehension is marked by more successful integration of meaning.

Another aspect of language processing is the ability to use words spontaneously to express meaning. Expressive, or productive, vocabulary represents higher-order processing than recognizing word meanings (Stahl, 1986). We designed a measure to assess whether students had developed sufficiently high-quality knowledge of words to make them accessible for production in a situation that suggested features of their meanings.

Comprehension of connected text is a complex processing event that calls on vocabulary knowledge, among other abilities. Successful comprehension of a text is generally indicative of high-level knowledge of the vocabulary within the passage. Thus texts containing instructed words have been used to measure comprehension effects of instruction (For example, Beck, et al, 1982; Coyne et al, 2010; Kame’enui et al, 1982; McKeown et al, 1985; Pany & Jenkins, 1978) In this study, we included a listening comprehension task based on students listening to and recalling a story that contained taught vocabulary words.

**Words Selected for Instruction**

The words we targeted for instruction are sophisticated words that we have labeled Tier 2 words, meaning that they fall into a level of utility in the language between everyday conversational words and low frequency words that apply to specific content domains (Beck, McKeown & Omanson, 1987). Tier 2 words have a great deal of overlap
with academic words (Coxhead, 2000) in that they are found across content domains and are more frequently found in text than in oral language. They are general utility words that label concepts that even young children are likely familiar with. For example, 

*reluctant* and *ponder* are Tier 2 words that young learners are unlikely to know. But young learners do understand the concepts that the words represent, for *reluctant*, of not particularly wanting to do something, like go to the dentist; and for *ponder*, thinking things over, such as which flavor ice cream to choose.

To describe the selected words more thoroughly, we checked their frequencies using Zeno, Ivins, Millard, & Duvvuri (1995). Table 1 presents the target words for each story and their frequency statistic, U, which indicates frequency of the word per million running words weighted by a dispersion measure, which indicates how broadly the word is used across content areas. All but 4 words had a frequency of 1 per million or higher, which represents the most frequent 13% of words in the language. The word of lowest frequency is *perfectionist*, but its root words are much more frequent (perfection, U = 5; perfect, U = 52). For the other low frequency words, two correspond well to known synonyms (*wonder* for *ponder*; *upset* for *distraught*) and the other, *rummage*, is a concrete and physically demonstrable word, a fact that was borne out in instruction, as students easily demonstrated rummaging through their desks, backpacks, etc. Interestingly, the word with the highest frequency is *appropriate*, which seems to represent a more abstract concept than words such as *distraught* and *rummage*.

[Insert Table 1 here]
Overview of the Study

The research reported here involved a study in which we developed, implemented, and compared instruction for kindergartners for two approaches to vocabulary development, and a control condition: Repetition, Interaction, and Control. To reflect a common practice of vocabulary instruction based on read alouds, in the Repetition condition each story was read three times, target words were explained during each reading and practiced on subsequent days. The Interaction condition provided one reading of the story, followed by explanation of target word meanings and subsequent opportunities for students to interact with the words. The Control condition comprised reading a story aloud one time, which is a customary way of using read alouds in classrooms (Beck & McKeown, 2007; Hoffman, Roser, & Battle, 1993; Lickteig & Russell, 1993). The Control condition represented the opportunity to encounter the words incidentally in a meaningful context. We chose this as a comparison condition because it enabled us to know that students had indeed heard the words, providing some opportunity to connect them with meaning. Interest was in how such incidental encounters would compare to learning from direct instruction.

There were 10 target words for each of three stories for a total of 30 words. Instruction in the Repetition and Interaction conditions occurred over seven school days. The Control condition occurred once a week for each set of words. The design was within subject, with each student experiencing each kind of instruction.

The following hypotheses underlay the study:

1. Repetition and Interactive conditions will be more effective than the Control condition for all measures.
2. Repetition and Interactive conditions will not differ for the Recognition Measure.

3. Measures designed to tap higher-order language processing (Content Integration, Production, and Listening Comprehension tasks) will differentiate the Interactive condition from the Repetition and Control conditions.

METHOD

Materials

Materials for the study were three high quality children’s tradebooks, 10 Tier 2 for each story, a friendly explanation for each target word, and activities for every word with which students engaged. The three stories were: Mr. Tanen’s Ties (Cocca-Leffler, 1999), Mrs. Potter’s Pig (Root, 1996) and A Pocket for Corduroy (Freeman, 1978). We examined each story for the presence of Tier 2 words and, in order to insure that we were able to teach 10 words for each story, identified places in the stories where Tier 2 words could be incorporated. We added words by substituting synonyms, for example, abruptly for suddenly, or by adding a word to describe some implied idea. For example, Mr. Tanen in Mr. Tanen’s Ties had an extensive and interesting collection of ties, and we added the word spectacular to describe it. Table 1 presents the target words from each story.

Explanations of word meaning were based on Beck, McKeown, and Kucan’s (2002) student friendly explanations model, in which word meanings are presented in everyday language. For example, admire was explained as: “If you admire someone, you think they are really special because of something they have or do.”

Instructional Activities in the Two Experimental Conditions
Activities in the Interactive condition were based on “robust instruction” that comprises activities that attempt to prompt students to think about and respond to situations with the taught words (Beck et al., 2002). For example, activities included asking students to make choices about the use of words and to explain the choice (e.g., “Which would be more astonishing: seeing a robin in the spring or hearing your dog say hello to you. . . Why?”) and to create contexts for words (e.g., “What could you do that might astonish your friends?”).

Activities in the Repetition condition focused on learning and practicing the meanings of the targeted words. The specific activities included game-like formats such as “Concentration,” in which students turned over cards to match words with definitions, “Yes/No” in which students had to signal whether a word was paired with its correct definition, and “Stop” in which the teacher presented a word or definition and read down a list of definitions or words and students were to call “stop” when the correct match was reached. Lessons in the Repetition condition concluded with an activity that asked students to choose which of two words went with each definition (“What’s the word that means . . . ? Is it reluctant or patient?”). The game-like formats were designed to engage students’ interest, although the only content of the activities was the definitions. (See Appendix A for examples of activities for each experimental condition). For the Control condition, no activities beyond the story reading were developed.

Lesson Design

We provided 12 encounters for each word, with an encounter defined as an opportunity to connect a word to its definition or to a context. An encounter was the word’s appearance in the story context or in one of the instructional activities. Twelve
was selected because that number of encounters had affected comprehension in a study with fourth-graders (McKeown, Beck, Omanson, & Pople, 1985). To accomplish this number of encounters, we planned a seven-day instructional cycle for each of the three stories that included a pattern of encounters for each word. The activities for each day of a cycle were also held constant for each cycle within the two conditions.

Lessons in all three conditions began with a story read aloud; hearing the words read in the context of the story was counted as one encounter. That was the only encounter for the Control condition.

**Repetition Condition**

In the Repetition condition, each time a target word was encountered in the story, the teacher stopped and read the friendly explanation for the word. After story reading on the first day of instruction, five of the 10 targeted words were presented by referring to the context from the story in which each had occurred, paraphrasing the context, and presenting the friendly explanation. On the second day, the story was read and each definition presented as the word was encountered, and after the story the other five words were presented in the same way as on Day 1. On the third day, again the story was read and each definition presented as the word was encountered. On Days 4 through 7, students were engaged in activities to practice the friendly definitions.

**Interactive Condition**

In the Interactive condition, the stories were read without interruption. On the first instructional day, after the story was read, five of the words were introduced, with the initial introduction the same as in the Repetition condition, by referring to the context from the story in which the word had occurred, paraphrasing the context, and presenting
the friendly explanation. This was followed by an activity to promote deeper processing in which students were asked to distinguish between examples and nonexamples of the word’s application. For instance, students were asked to say “reluctant” if the teacher said something they would be reluctant to do. The teacher then offered the following: “Holding a tarantula spider;” “Petting a kitten;” and “Jumping out of a tall tree.” On Day 2, the other five words were introduced in the same way and the first five words were reviewed.

Instruction in Days 3 through 7 included additional activities such as prompting students to make choices about the use of words and create and explain contexts for words. An example of making choices included judging whether sentences using target words made sense and explaining why/not, given sentences such as: “Chris and Michael never liked each other and were completely inseparable.” Creating and explaining contexts for words included responding to, for example, “Can you tell me a time when you need to be patient?” and “Why would you ponder your next move in checkers?”

**Participants**

Participants were 131 students and their teachers in 8 kindergarten classrooms from a school district in western Pennsylvania. The school district population represents four working class communities, and approximately 50% of the students receive free or reduced-price lunch. Approximately 75% of the students were European-American and 25% were African-American. All students spoke English as their first language. The Peabody Picture Vocabulary Test (PPVT-4) (Dunn & Dunn, 2007), which was given to all students for descriptive purposes, showed a mean of 101 and a standard deviation of 19. There was a wide range of 145, with a minimum of 9 and a maximum of 154.
All 8 kindergarten teachers in the district, housed at an Early Learning Center, were invited to participate in the study and all agreed to do so. All teachers were white females. The number of years of teaching experience ranged from 2 years to 25 years. All teachers had spent their entire teaching careers in the district in which the study occurred. The teachers each received a $300 stipend for their participation. Initially we conducted a three-hour workshop with the teachers to explain the study in general terms, introduce our approach to vocabulary development, and present the lesson material.

Measures

To measure outcomes of vocabulary instruction along a progression of language processing, students were assessed with experimenter-designed measures of meaning recognition, context integration, listening comprehension, and production.

Recognition Measure

The Recognition Measure assessed an initial level of word knowledge that included recognizing a paraphrase of word meaning and typical use of the word.

Development. We based this measure on a format developed for previous work (Beck & McKeown, 2007) and that has been used by Coyne’s research group (Coyne, McCoach, & Kapp, 2007; Coyne, McCoach, Loftus, Zipoli, & Kapp, 2009). The measure uses four questions for each of the 30 instructed words, two that ask about the definition and two that ask about use of the word in context, each with a true and a false item. For example, the items for insist are: Does insist mean that you had to do something? (definition—true). Does insist mean drawing a picture? (definition—false). If your mother made you clean up your room right now, would she be insisting? (context—true). If your teacher tells you she likes your jacket, is she insisting?
(context—false). The pretest contained 120 items for the 30 target words and 10 items created for familiar words to make the test more accessible for young students.

The internal consistency reliability of the Recognition Measure was calculated using the pretest scores, because all students had received all items at the same time prior to instruction. The analysis yielded a reliability coefficient (alpha) of .644. Measures using the same format, but with different words and number of items (80 per grade), with a much larger sample of students obtained coefficients ranging from .77 for kindergarten to .87 for grade 4 (Apthorp, et al, in press). Approximately 1,100 students were tested per grade in that study.

**Administration.** The pretest was presented to students in whole class format in 5 sessions across 3 days. Students marked an answer sheet by drawing an X over a smile face for yes answers and over a frown face for no answers. Several practice items were introduced before the actual test began. The test was administered by one of the researchers and monitored by the classroom teacher.

Posttests consisted of the items for the words in the particular instructional cycle just completed, and thus contained 40 items each. These tests were the first tests presented after instruction in each cycle. Each posttest was presented to students in whole class format in a single session.

**Scoring.** One point was awarded for each correct answer, for a total score of 40 for each cycle. The familiar items on the pretest were not scored.

**Comprehension Measures**

Two measures were developed to tap comprehension processing, Context Integration and Listening Comprehension.
**Context Integration.** The Context Integration Measure was developed to assess students’ ability to accommodate a word’s meaning within a sentence context in order to make sense of the context. The measure consisted of sentences with an instructed word, each followed by a question that asked students to infer implications of the context. The rationale for this task was the key role of context integration in the comprehension process, as demonstrated by researchers across several decades (Jenkins et al, 1978; Kame’enui et al, 1982; Perfetti, 2007). An example from the present study is: “Sam was *stunned* when he looked into the doghouse. What do you think Sam saw?” For this item students would have to access their understanding that stunned meant very surprised and then connect that to something about a doghouse that might cause that reaction, such as, “his dog and four puppies.”

The contexts in this task were developed to be situations familiar to children, and to be neutral or even shade toward the opposite emotion conveyed by the vocabulary word. The item about Sam being stunned seemed neutral, as someone might have any number of reactions to looking into a doghouse; the specific reaction is governed by accommodating *stunned* into one’s interpretation. An item context and target word might suggest opposite emotions was: “Jim had to *insist* that Freddy go on the Merry-Go-Round. What did Freddy think about the merry-go-round?” Our hunch was that most young students would respond positively to a carnival ride, and thus being able to accommodate the concept of *insisting* was critical to correctly responding to the question.

**Development.** An item was developed for each word. We conducted several rounds of pilot testing. First, as we had never used this format with young students, we tried items using only familiar words to see if 5 and 6-year-olds could answer questions
such as “Sam was surprised [rather than the target word stunned] when he looked into the doghouse. What do you think Sam saw?” We found that the children did well with the format. We then used target words and tested moderately high ability children who were entering kindergarten and first grade, and found that they were generally able to respond to these items.

The internal consistency reliability of the Context Integration Measure was calculated using all students’ posttest scores. The analysis yielded a reliability coefficient (alpha) of .777.

Administration. Context Integration Measures were administered as posttests after each cycle of instruction following that cycle’s Recognition Measure. The measure was administered individually by a research staff member who recorded the student’s responses. To elicit maximum information from the students, the researcher followed up each question, asking how the student’s response fit with the word. So, for example, after a student responded to the item for stunned illustrated above, the researcher asked “How does that fit with being stunned?”

Scoring. Responses were awarded 1 point if they indicated understanding of the target word within the context. For example, for the item: “Mrs. Thomas was distraught when she looked at her garden. How did the garden look?” responses that were scored correct indicated that the garden did not look good—causing Mrs. Thomas to feel distraught. Sample correct responses included: “It was all messed up,” and “footprints and maybe animals sneaked into her yard.” Responses to the follow-up questions (“How does that fit with . . . ?”) were used to help evaluate responses that seemed ambiguous or too sparse to enable a judgment of appropriateness.
Responses were scored by one team member and 20% were scored by a second team member to determine inter-rater reliability. For responses for all three cycles, agreement of 96% was reached (96%, 98%, 94% for each cycle respectively). Differences for the 20% were resolved through consensus.

**Listening Comprehension.** The Listening Comprehension Measure consisted of stories for each cycle that contained target words, for which students were asked to recall and respond to questions.

*Development.* A story was developed for each cycle that used all 10 of the target words. The stories were similar in length, difficulty, and structure. All three were simple conflict-resolution narratives, contained two main characters, and were about two-thirds description and one-third dialogue. The number of words ranged from 232-239 and Flesch-Kincaid grade level readability ranged from 2.3-2.6. Ten questions were developed for each story. The questions were either framed around a target word or required a response that called upon the use of a target word in the story.

*Administration.* Each story was read aloud to students individually in separate sessions that occurred after the Context Integration sessions for that cycle. After a story was read, the student was asked to recall the story and to answer a set of 10 open-ended questions. The recall and question responses were audio recorded for later transcription.

*Scoring.* Recalls were scored for length and quality. Scoring for both dimensions involved dividing the stories and student recalls into content units, units of text about a clause in length (Omanon, 1982), which we have used in previous work (Author, 1982; Author, 2009). The level of importance of each unit was the basis for the quality measure.
Importance was determined by categorizing each unit as major, support, or detail. A major unit was defined as containing important ideas that are a key component of a good summary. A supporting unit holds main ideas together and adds elaborative information to the major units. A summary could do without these ideas, but it would be less complete. A detail was defined as less essential information. These ideas do not hold the story together and a summary would be complete without them. Major units were assigned a value of three points, supporting units two points, and details one point. The rationale for this weighting is the expectation that recall indicative of successful comprehension will consist mostly of important units that comprise the gist of the story. The story for cycle 1 had 47 units, 6 main, 12 support, and 29 details for a possible total score of 71; the story for cycle 2 had 43 units, 6 main, 11 support, and 26 details for a possible total score of 66; the story for cycle 3 had 43 units, 6 main, 11 support, and 23 details for a possible total score of 66.

Recalls were scored by one team member and 20% were scored by a second team member to determine inter-rater reliability. Differences for the 20% were resolved through consensus. Across the three stories, 93% agreement was reached (91%, 95%, 94% for each story separately).

To score the questions, researchers met as a group to decide on acceptable answers. Question responses were then scored by one team member and 20% were scored by a second team member to determine inter-rater reliability. Differences for the 20% were resolved through consensus. Across the sets of questions for all three stories, 93% agreement was reached (94%, 100%, 85% for each story separately).

Production Measures
The Production Measure for each cycle presented a picture of a scene designed to prompt use of the target words for that cycle. Students were asked to talk about what they saw happening in them.

$\textit{Development}$. A picture was developed for each cycle’s set of words to depict an action or person that could be described by each word. Each picture included places and activities familiar to children and included both children and adults. The picture for cycle 1 was a sidewalk scene with several centers of activity including a man with a guitar sitting on a bench next to a boy who was grinning and waving his hands around, to represent being $\textit{gleeful}$, two girls on a bench nearby with their arms around each other to represent $\textit{inseparable}$, and a woman clenching her purse. The picture for cycle 2 showed a birthday party with children seated around a table. A girl was opening a present and appeared to $\textit{rummage}$ through the wrapping, one boy sat $\textit{patiently}$, with his hands folded in his lap, a mother and child hugged in an $\textit{affectionate}$ way. The picture for cycle 3 showed people at a park. Included were a boy scratching his head and looking puzzled to represent $\textit{perplexed}$, a woman with an unhappy expression and crossed arms representing $\textit{stern}$, and a boy reading a book under a tree to represent $\textit{concentrating}$.

$\textit{Administration}$. Each Production Task was administered to students individually by a staff researcher in separate sessions that occurred after the Listening Comprehension sessions for that cycle. Each session was audio recorded for later transcription. At the beginning of the session, the researcher said, “I know you learned some new words this week. Let’s see, you learned: [named each target word]. Did you use any of these words when you were talking to people?” The researcher then explained that she would show a picture and ask the student to talk about it and then ask some questions about the people
in the picture. For example, questions about the “stern” woman were: “What can you tell me about this lady? What can you tell by looking at her face?”

Scoring. A point was awarded for each target word that was used in talking about the picture.

Procedures

All students who returned parental consent forms participated in the study. Consent forms were sent home with 139 students. Eight students did not return forms and thus did not participate. The number of students per classroom ranged from 14 to 18. The instructional conditions were treated as within subject factors, allowing each student to be exposed to one cycle of each condition; Intervention instruction, Repetition instruction, and the control condition. This design treated each student as his/her own control, thus reducing error variance and increasing statistical power. Further, because students within each classroom were exposed to each instructional intervention, the data for each instructional intervention can be pooled across the 8 classrooms.

Implementation

At a workshop that was conducted before implementation began, teachers were provided a folder for each of the three stories. The folder contained the storybook and scripted instructional activities for that story, tailored for their assigned condition. All teachers taught the same story during each cycle. The study consisted of three cycles, the first based on Pocket for Corduroy (Freeman, 1978), the second on Mrs. Potter’s Pig (Root, 1996) and the third on Mr. Tanen’s Ties (Cocca-Leffler, 1999). Each cycle included instruction—seven days for the Repetition and Intervention conditions and one day for the Control condition.
Data Collection

The Recognition Measure was given as a pretest, and appropriate items from the pretest were used for the posttests for each cycle. All other measures were given as posttests. Because of the within subject design, posttesting was conducted after the instruction for each cycle. Thus words from each story were tested following the instruction associated with that story. The tests were administered in a fixed order: recognition, context integration, listening comprehension, and production. Posttesting took place about five days after instruction ended depending on the day of the week instruction was completed. Thus, we had three cycles of instruction, delay, and testing.

Fidelity of Implementation

During the intervention, we observed classrooms weekly and met with the teachers after observations to provide feedback as needed on the fidelity to the approach and to elicit teacher comments and concerns. From initial observations it was judged that teachers were conducting the scripted lessons as designed. All lessons were audio recorded and subsequently transcribed, allowing us to conduct a systematic review for fidelity. We examined transcripts of lessons of teachers in the Interactive and Repetition conditions for one story, *Pocket for Corduroy*, which was the second story in the implementation. We checked whether each item in the lesson was presented, whether an appropriate student response had been obtained, and whether appropriate follow-up was then provided. Lesson items corresponded to what the teacher was directed to say about a word meaning or use and the question students were asked about it. Each item, response, and follow-up was scored 0 if not present, 1 if present but not complete, and 2 if
complete and appropriate. Fidelity for the Repetition lessons was 100%, and for the Interactive lessons averaged 99.7% (part of one question was omitted in one lesson).

**Results**

The question of interest was whether effects of specific variations in vocabulary instruction for kindergarten students would be demonstrated on students’ word learning, comprehension processes, and production. To account for within-subject nesting of vocabulary instruction and assessments, data were analyzed using linear mixed-effect model analyses of variance (ANOVA). Subject was treated as a random effect, and story cycle was treated as a repeated measure for all analyses of vocabulary assessments. Story and Condition had a consistent interaction effect so scores on all assessments were covaried by story. Post-hoc analyses of means were run using Least Significant Difference (LSD).

**Recognition Measures**

For the Recognition Measures, pre/post test as a repeated measure was added to the ANOVA. The analysis showed significant differences across conditions. Post-hoc analyses (LSD) revealed that the Control condition differed significantly from both the Repetition (p = .003; d = .35) and Interaction (p < .001; d = .44) conditions, which did not differ significantly from each other. The results are presented in Table 2. Mean scores represent the growth in the number of correct items from pretest to posttest that students experienced within each condition of instruction. So, for example, the Interaction mean of 4.97 can be interpreted to mean that children got about 5 more items correct on the posttest of the 40 items that corresponded to the words they encountered within the Interaction instruction.
Context Integration Measures

For the Context Integration Measures, the ANOVA showed significant differences across conditions. Post-hoc analyses (LSD) revealed that the Control condition differed significantly from both the Repetition (p = .03; d = .27) and Interaction (p < .001; d = .48) conditions. In addition, scores trended in favor of the Interaction condition over the Repetition (p = .07; d = .21). The results are presented in Table 3. Mean scores represent number of correct items out of the 10 items that students were tested on for each condition.

Listening Comprehension Measures

The separate ANOVA’s conducted for recall length and quality and for questions showed no differences among conditions. The results are shown in Tables 4 and 5. Mean scores for length represent number of units recalled for a story, and mean quality score represents the recalled units for a story weighted by level of importance.

Production Measures

For the Production Measures, the ANOVA showed significant differences across conditions. Post-hoc analyses (LSD) revealed that the Control condition differed significantly from both the Repetition (p = .001; d = .44) and Interaction (< .001; d = 70) conditions. In addition, the Interaction condition scores were significantly higher than those for the Repetition condition (p = .03; d = .26). The results are presented in Table 6. Mean scores represent number of target words students used for each condition.
Discussion

The purpose of this study was to compare two approaches to vocabulary instruction, and a control condition, on a progression of language processing tasks. Both the Repetition and Interaction approaches had been used in earlier studies with young children and have been found effective on measures of knowledge of word meanings (e.g., Biemiller & Boote, 2006; McKeown et al, 1985). But the effects of instruction on aspects of higher-order language processing had not been assessed for young learners with either approach.

Our selection of measures was designed to represent a progression from knowledge of word meanings to higher-order processing, including context integration, listening comprehension, and finally to expressive word knowledge (production). Thus our interest was in exploring the extent to which instruction influenced the kinds of abilities that are essential to literacy. We found that, as hypothesized, both approaches to instruction showed significant advantage over the Control condition for students’ recognition of word meanings and uses and their higher order processing. Also as hypothesized, we found that the Interactive instruction better enabled students to integrate words into context and to produce words associated with a picture, relative to the Repetition instruction. Contrary to our hypothesis, the listening comprehension measure showed no differences among conditions. In the rest of this section, we discuss what the assessment measures revealed about students’ understanding and use of words following instruction. Then we consider some limitations and finally the implications of the study.

Recognition Measure Findings
We initiated the progression of assessments with the Recognition Measure as an attempt to establish an initial level of words knowledge. The finding that the Control condition differed from the instructional conditions was not surprising. Although simply reading aloud to children likely enhances their vocabulary, these effects are minimal after only one passive encounter with words in a story context.

The lack of difference between outcomes on the Recognition measure for the Repetition and Interactive conditions was expected. It has been shown previously that instruction that provides practice on definitions is successful in affecting students’ word knowledge (McKeown, et al, 1985).

**Context Integration Outcomes**

The Context Integration assessment represented semantic processes that learners use for comprehension. Recall the item discussed earlier, “Jim had to *insist* that Freddy go on the Merry-Go-Round. What did Freddy think about the Merry-Go-Round?”

Students in the Interactive condition were more likely to accommodate the idea of *insisting* into a scenario of going on a carnival ride, providing responses such as, “Maybe he got sick to his stomach” and “It was scary—it went too fast.” A response more common in the Repetition and particularly the Control condition was “It was fun.” Such responses suggested that students reacted to the general context of going on a Merry-Go-Round with little consideration of how *insist* affected the meaning.

We can speculate on why the two instructional conditions might have led to the trend of an advantage for the Interactive condition. The variety of encounters with the word in the Interactive instruction may have prompted students to build a richer set of connections to each word. Such connections might have allowed students to, for example,
override the conventional reaction to a Merry-Go-Round and enabled them to build a mental model of Merry-Go-Round riding that accommodated the potentially incongruent idea of *insisting* a child go on the ride.

**Listening Comprehension Outcomes**

The Listening Comprehension task represented text comprehension, which is a major eventual goal of vocabulary instruction. We assessed listening comprehension with recall and questions. We have used such text comprehension tasks with success in past research with third, fourth, and fifth graders. (For example, Author, 1982; Author, 2009). However, many factors influence text comprehension beyond vocabulary knowledge, such as ability to sequence ideas, knowledge of story structure, knowledge of syntax, short-term memory limits, and referential understanding, that may overwhelm semantic processing. This may particularly be the case with students as young as kindergarten, who may be less likely to have these other aspects under control. Perhaps this is part of the reason that we found no differences among the conditions in the current study for our measures of listening comprehension.

The data from our study demonstrate that our participants found the recall task particularly difficult. Consider that the students in our study produced sparse recalls, averaging about 14% of the text across all conditions. Contrast this with between 27% (McKeown et al, 1985) and 33% (McKeown, Beck, Omanson, Perfetti, 1983) of a text containing newly taught words recalled for fourth graders in past vocabulary studies. There are also indications in the literature that young children have difficulty with recall tasks. Studies by Blank and Frank (1971) and Tucker (2001) found that kindergarten children produced very little language in response to recall prompts.
Students in our study also scored low on questions for the listening comprehension task. This result differed from Coyne et al’s (2010) finding for their narrative comprehension task. Their findings of a positive trend in favor of the intervention group over a no treatment control might be traced to two distinct differences from ours, one a task difference and the other a treatment difference. The task difference is that in Coyne et al, the oral reading of the story narrative was accompanied by showing a wordless picture book, which represented the story line. The treatment difference was that Coyne et al’s intervention was considerably longer. Each of our instructional cycles was seven days, whereas the treatment in Coyne et al’s work was 18 weeks in length. Length of the intervention may make a difference as, perhaps, as accumulation of experiences over the course of an intervention in making connections to new words, and extended practice with fitting new words into their language may provide general benefits to learners’ comprehension of connected text.

Thus we are left with three possibilities for our lack of differences on the listening comprehension task. One is that the students in the instructional conditions did not learn the words well enough to impact text comprehension performance. The second possibility is that a longer intervention is needed to yield text comprehension effects in order to influence general as well as word-specific processing. And the third possibility is that the tasks of recalling and responding to questions about a text are too difficult for many students as young as kindergarten, possibly because the semantic aspects of the task are overshadowed by other requirements.

Sorting out the three possibilities is not possible in the present case. Engaging in pilot work, as we did with the Content Integration task, might have allowed us to either
discover that the task was a poor fit for kindergartners or be able to rule out its difficulty as the cause of poor performance.

**Production Task Outcomes**

The Production task explored students’ ability to use newly learned words in response to a picture that depicted features related to the words. Learning words well enough to express them is an important learning goal, and having words in one’s productive vocabulary is generally viewed as a good measure of word ownership. In addition, this task represents another process related to comprehension, that of ease of access to word meanings. If a reader or listener is to understand a word within a stream of language, he or she must be able to readily access a meaning for the word that fits the context. Being able to produce the word when seeing something that can be associated with the word suggests an ease of access that may make way for comprehension.

**Limitations**

We acknowledge a number of limitations to the study, some caused by necessary choices, others that could be resolved in future work, and still others that are inherent to work in the vocabulary field. One decision that could have affected outcomes and their magnitude was the length of the interventions. For each student, instruction in each condition lasted seven days. Our intent with this research was to focus on distinct differences in instruction and try to pinpoint the differential effects. But the brevity of the interventions may have inhibited our ability to capture effects that may accumulate from ongoing attention to vocabulary in classroom instruction.

An issue in the design of the intervention was balancing encounters with each taught word across instructional conditions. We chose to do that by using the number of
encounters—the number of activities in which a word was presented or discussed. Another method that has been used is “instructional intensity” (Baumann, 2009). Instructional intensity comprises time spent on each word. Yet prescribing amount of time to be spent in activities can be difficult with instruction that is not rote. For example, some activities might produce longer discussion, or students might spend more time recalling a certain word’s definition or generating an associated word or definition.

Our choices in types of assessments made for some limitations. First and foremost, we chose to use experimenter-designed measures in order to capture aspects of language processing that are not captured by extant measures. The psychometric properties of such measures may not be as strong, but their relevance to the outcomes sought is much greater than with standardized measures. Another measurement limitation was the lack of a delayed condition. Clearly, the ultimate goal of vocabulary instruction is for students to sustain the knowledge they gain. However, in making decisions about assessments, the amount of student and classroom time devoted to testing needs to be considered. We chose to present a range of assessments, which limited our flexibility to add a delayed testing condition.

Our use of story recall, as discussed earlier, limited the conclusions we could make about the outcomes. Because students’ recall was so low overall, we were not able to discern if the issues lay in the task itself or whether there was no effect on text comprehension. We could address this issue in future work in several ways. We could add a story with only common words, which would inform the difficulty of the task of recall itself; we could make the task more accessible by using a picture book to accompany it, as Coyne et al did (2010).
Implications

Implications from the present study relate to two areas, vocabulary instruction and assessment for vocabulary. The consensus about effective vocabulary instruction that has been reached over recent decades is that the most effective instruction for higher-order goals calls for a set of three features, (a) both definitional and contextual information about taught words, (b) multiple encounters with the words, and (c) attention to active processing. Our results support and extend this consensus. Repetition instruction introduced context and definitional information, and provided as many encounters as the Interactive condition, but offered no opportunities for active processing. The active processing requirements of the Interactive instruction may have influenced higher-order aspects of processing in the context integration and production tasks.

Another aspect of the instruction that may have had impact is the variety of contexts and encounters with the words in the Interactive instruction. In contrast, the encounters with the words in the Repetition condition were multiple in number only; their content consisted of a single context, that of the story, and definitional information. In their comparison of vocabulary learning from multiple varied contexts versus repetition of a single context, Bolger, Balass, Landen, & Perfetti (2008) found advantages for context variation. In particular they found that experiencing varied contexts allowed learners to make more rapid decisions about the fit of a new word to a new context. Similarly, learning from the Interactive instruction may have promoted speed of processing that assisted students in accessing words associated with a picture in the Production task.
Our results extend the consensus about effective vocabulary instruction by demonstrating that instruction that prompts active processing allowed children as young as kindergarten to have more success in tasks that tapped higher-order language processing relative to instruction that offered repeated readings and word meaning practice or story reading only. Further, the results demonstrate that young children can learn Tier 2 words, the kinds of words that are characteristic of written language, and can learn them to the extent that enhances their ability to comprehend contexts in which such words are used. These results are important because we know that children’s level of vocabulary in kindergarten influences their later literacy, and that at this young age, a wide gap in vocabulary levels exists among children in different SES groups. Thus influencing young children’s literacy potential may be a step toward closing that gap, or at least keeping it from widening at such a pace. But reaching such outcomes likely calls for children to experience long-term, ongoing attention to vocabulary in school.

Regarding vocabulary assessment, Pearson, Hiebert, and Kamil (2007) have noted that this area of study is “undernourished.” A key aspect of the undernourishment is that studies of vocabulary frequently measure only meaning recognition-type outcomes that require only association with a definition. If studies provide multiple measures, additional measures are often global, standardized tests of general vocabulary or comprehension, which are not sensitive to short-term vocabulary growth, or passage-level comprehension tests (Elleman, Lindo, Morphy, and Compton, 2009). Recognition and text comprehension measures seem to represent two ends of a continuum of what might be measured from vocabulary learning, leaving a wide gap in our ability to understand the learning that took place. In order to learn more about what instruction may provide, we
need intervening measures that require more than a definitional association but do not call for the complex set of processes needed for comprehending connected text.

By creating measures that tapped different points along a continuum of processing, we believe we have provided some of the “nourishment” for assessment that Pearson et al call for. We see the Context Integration task as a particularly apt measure for semantic processing in that it taps what a reader frequently needs to do when meeting a word in a novel context, at the point of occurrence of that process. The task calls on the student to make sense of the context based on the implications of the word’s meaning.

We also may have provoked some assessment nourishment by identifying issues with using text comprehension measures with young children. Perhaps our use of the measure and the issues we identified will further nourish a more productive and informative use of such measures in future studies.

The articles by Elleman et al (2009) and Pearson et al (2007) serve to highlight challenges in the field’s search for resolving the relationship between vocabulary and comprehension. Pearson et al posit that current measures of vocabulary are inadequate to document the relationship between word learning and global comprehension. Elleman et al echo the conclusion of Pearson et al, citing the inadequacy of measurement to fully capture the vocabulary/comprehension relationship as a major obstacle to identifying the qualities of effective vocabulary instruction. We see the development of novel assessments as vital to furthering our understanding of the role of vocabulary in comprehension and language development.
Table 1: Target words from each story and their frequency per million words (U)

<table>
<thead>
<tr>
<th>Mr. Tanen’s Ties</th>
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</thead>
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<td><strong>Word</strong></td>
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<tr>
<td>appropriate</td>
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<td>charming</td>
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<tr>
<td>stern</td>
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<td>concentrate</td>
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<tr>
<td>gazed</td>
</tr>
<tr>
<td>perplexed</td>
</tr>
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<td>spectacular</td>
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<td>timidly</td>
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<td>abruptly</td>
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<th>Pocket for Corduroy</th>
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<td><strong>Word</strong></td>
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<td>Reluctant</td>
</tr>
<tr>
<td>Insisted</td>
</tr>
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<td>Affectionate</td>
</tr>
<tr>
<td>Patiently</td>
</tr>
<tr>
<td>Precious</td>
</tr>
<tr>
<td>Distraught</td>
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Effects of Vocabulary Instruction
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<td>Eager</td>
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**Mrs. Potter’s Pig**

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<td>clutch</td>
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<td>Curious</td>
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<tr>
<td>Stunned</td>
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<td>Perfectionist</td>
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<td>Devoured</td>
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<td>Inseparable</td>
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<td>Plead</td>
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Table 2. Means (SE) and Analysis of Variance Results for Recognition Measure

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<th>p</th>
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<tbody>
<tr>
<td>Interaction</td>
<td>4.92 (.45)</td>
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<td>.001</td>
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<td>Repetition</td>
<td>4.44 (.44)</td>
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<tr>
<td>Control</td>
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Table 3. Means (SE) and Analysis of Variance Results for Context Integration Measures

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<td>Control</td>
<td>3.70 (.229)</td>
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Table 4. Means (SE) and Analysis of Variance Results for Recall Length and Quality Measures

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</thead>
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<td>Interaction</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Repetition</td>
<td></td>
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<td>Control</td>
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<table>
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<th>Quality</th>
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<th>Quality</th>
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<tbody>
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<tr>
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<td>Control</td>
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<td>8.21</td>
<td>.68</td>
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Table 5. Mean Percent (SE) and Analysis of Variance Results for Questions Measures

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<td>.350</td>
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<tr>
<td>Repetition</td>
<td>27.40 (1.74)</td>
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<td>Control</td>
<td>24.32 (1.80)</td>
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Table 6. Means (SE) and Analysis of Variance Results for Production Measures

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<th>Condition</th>
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<tr>
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<td>15.261</td>
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<tr>
<td>Control</td>
<td>.61 (.175)</td>
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</tr>
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</table>
References


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Effects of Vocabulary Instruction


Effects of Vocabulary Instruction


Effects of Vocabulary Instruction


Appendix A

Examples of Activities for Interactive and Repetition Conditions
for Two Items in each Activity on Day 4

INTERACTIVE CONDITION

Day 4—Situations and Examples: (Show card for each word.)

1) Think about the word affectionate. If your cousin who you hadn’t seen in a long
time came into town, you might be affectionate with her.
   • Can you tell me another time when you might act affectionate? [why]

2) Think about the word patient.
   • Can you tell me a time when you need to be patient? [why]

Actions with Words: (Show card for each word.)

1) Think about the word inspired. If you were feeling inspired what would you look
like? Make a face like you were just inspired to do something.
   • Look at (student who is acting really well). Who can tell me what (student
name) is doing and why that goes with inspired?

2) Now think about the word eager. If I asked you a question and you knew the
answer and were eager to say it, what would you do?
   • Act like I just asked you a question and you were eager to answer.

REPETITION CONDITION

Day 4 Yes/No (Show card for each item)

I’m going to read some definitions. If you think they match [with one of the six
words on the board], put your thumb up. If not, put your thumb down.

1) Does patient mean staying calm and not getting bothered? (Up)

2) Does distraught mean to feel very hyper and excited? (Down) No,
distraught means to feel very upset and bothered.

Stop

1) I’m looking for a word that means: Being calm and not getting bothered. Say “stop”
when I get to the word that matches. (Start going down the list, say each word as
you reach it, and pause briefly. If needed, repeat definition.) patient

2) Now, I’m looking for a word that means: Something that is special to you and means
a lot to you. Say “stop” when I get to the word that matches.