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for each word. Text properties included readability as measured by
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(Author/HOD)

CENTER FOR THE STUDY OF READING

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THE INFLUENCE OF WORD AND TEXT PROPERTIES
ON LEARNING FROM CONTEXT

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Abstract

This study investigated the effect of properties of words and texts on the incidental learning of word meanings during normal reading. A total of 352 students in third, fifth, and seventh grades read either expository or narative passages selected from grade-level textbooks, and after six days were tested on their knowledge of difficult words from the passages. Word properties investigated included length, morphological complexity, part of speech, conceptual difficulty, and the strength of contextual support for each word. Text properties included readability as measured by standard formulas, and several measures of density of difficult words. Among the word properties, only conceptual difficulty was significantly related to learning from context. Among the text properties, learning from context was most strongly influenced by the proportion of unfamiliar words that were conceptually difficult, and by the average length of difficult words.

The Influence of Word and Text Properties

on Learning from Context

Findings from our recent research (Nagy, Herman, & Anderson, 1985a, 1985b) confirm the belief that incidental learning from written context is a major avenue for vocabulary acquisition. Although the chance of learning the meaning of any particular new word from a single encounter while reading is relatively small, the cumulative benefits of learning from context appear to be large. Words learned during reading probably account for a third or more of the several thousand words learned annually by the average school child, and far more than could be covered by any program devoted specifically to vocabulary learning.

How much vocabulary a child actually gains from written context depends on three factors: The volume of a child's exposure to written language, the quality of the text, and the child's ability to infer and remember the meanings of new words encountered during reading.

Sheer volume of exposure to the language may be the single most important factor accounting for differences in the contribution of learning from context to vocabulary growth. Fielding, Wilson, and Anderson (in press), studying the reading habits of fifth grade students outside of school, found that the median child read about 650,000 words a year outside of school, while avid readers read as much as 5,850,000 words a year. At

the other end of the scale, many fifth grade students did almost no reading outside of school at all. The 90th percentile student has about 200 times more exposure to written language than the 10th percentile student.

Ability to infer word meanings from context is sure to play some role in how much vocabulary growth occurs while reading. However, the few studies that have looked specifically at incidental learning from natural texts have not given a clear picture of the role of ability in learning from context. Nagy, Herman, and Anderson (1985a, 1985b) did not find a significant relationship between ability and learning from context, although Herman (1985) did.

Instruction in inferring the meanings of new words from context may be helpful, but as yet no one has demonstrated any program of instruction to to be successful at increasing the likelihood of children's incidental word learning.

In short, our research leads us to believe that the most effective way to increase vocabulary growth is to get children to do lots of reading of good texts. But what constitutes a "good text" in this regard, one that promotes a high level of incidental learning, remains to be determined. To begin to answer this question, we considered properties of the words and texts used by Nagy, Herman and Anderson (1985b) that might be expected to influence the amount of learning from context.

Word Properties and Learning from Context

How much incidental learning from context occurs when a text is read will be in part a function of the properties of the individual unfamiliar words that are available to be learned. Much of the literature on learning from context has not taken this into account. Many studies have looked at learning from context in terms of the cloze task (e.g., Rankin & Overholser, 1969), or used nonsense words replacing real English words (e.g., Ames, 1966), or words such as altercation which have familiar synonyms. In such cases, "learning from context" simply requires identifying the already known word that goes fits in a blank or can be associated with a new word. Many words which readers encounter in text do not fit this pattern; some may require the reader to build entirely new concepts, or to assimilate factual information in the text not known to the student prior to reading that particular text. We hypothesize that the type of learning an unfamiliar word requires will influence how easily that word will be learned from context.

Another reason for looking at word properties has to do with the trade-off between learning from context and explicit vocabulary instruction. The number of words children must learn, and the number of unfamiliar words they will encounter in reading, is too great for all such words to be individually covered in vocabulary instruction. But even if, as we believe, the bulk of a child's vocabulary learning is from context, it may

be that specific types of words are resistant to learning from context, and hence prime candidates for explicit instruction.

Word difficulty. How likely it is that a given word is learned from context undoubtedly depends on how hard the word is to learn. How hard a word is to learn depends in turn on the state of the learner's knowledge. Jenkins and Dixon (1983) give four conditions that a learner may be in with respect to a new word:

Condition 1: The unknown word (e.g., altercation) has a simpler synonym (argument), and the student knows the concept referred to be the simpler synonym.

Condition 2: The unknown word (e.g., arcane) has a simpler synonym (obscure), but the student does not know the concept referred to by the simpler synonym.

Condition 3: The unknown word (odometer) does not have a simpler synonym, but the student reliably recognizes instances of the concept (e.g., the thing on the speedometer that tells how many miles you've gone).

Condition 4: The unknown word (legislature) does not have a simpler synonym, and the student indicates no knowledge of the concept referred to by the word.

Graves (1984) proposes a slightly different four-category classification of words:

Type One Words: Words which are in the students' oral vocabulary but which they cannot read.

Type Two Words: New meanings for words which are already in the students' reading vocabulary with one or more other meanings.

Type Three Words: Words which are in neither the students' oral vocabulary nor their reading vocabulary and for which they do not have an available concept but for which a concept can be easily built.

Type Four Words: Words which are in neither the students' oral vocabulary nor their reading vocabulary, for which they do not have an available concept, and for which a concept cannot be easily built.

Both Jenkins & Dixon's and Graves' category systems have as a critical dimension whether or not the learner already knows the concept with which the word to be learned is associated. Graves adds an additional dimension of concept difficulty. We hypothesize that these dimensions—whether or not the concept is already known, and how difficult it is to learn—will have a substantial effect on learning from context.

Part of speech. Another word property that may influence learning from context is part of speech. Gentner (1982) found evidence in a number of languages that nouns are learned in

greater numbers than verbs at the early stages of language acquisition. Quealy (1969) found significant effects of part of speech on high school students' ability to infer words from context. Unfortunately, the direction of the effects was not reported.

Morphological transparency. There is evidence that at least some children make use of morphological relationships when learning new words (Freyd & Baron, 1982), and it has been hypothesized (Nagy & Anderson, 1984) that much incidental learning from context depends on readers' ability to combine the information about new words available from morphology and context. However, in the one study known to us to have addressed this question experimentally (Wysocki & Jenkins, 1985) subjects did not appear to put together information from morphology and context.

Text Properties

How likely a given word is to be learned from context while reading depends not only on properties of that individual word, but also on properties of the text in which it is embedded.

Strength of contextual support. How much information does the text provide about the meaning of a potentially unfamiliar word? This can be operationalized in terms of raters' judgements as to how informative a context is. Not surprisingly, Beck, McKeown, and McCaslin (1983) found that rated strength of contextual support for a given word was correlated with success

at identifying that word correctly in a cloze version of the passage.

Strength of contextual support, measured by adult raters, can be taken as a sum of the various more specific types of contextal clues, categories for which have been suggested by Ames (1966) and Sternberg and Powell (1983). Strength of contextual support is not the only factor determining the likelihood of a word being learned from context. Sternberg and Powell (1983) give a list of "mediating variables," additional word and text properties which determine how effectively the information offered by the context can be utilized.

Readability. How much a person learns while reading a text might be expected to be a function of its "readability." Conflicting hypotheses about the nature of the relationship can be framed, however. On the one hand, one might expect more learning from easier texts; on the other hand, easier texts also leave the reader with fewer hard words to learn.

Most readability formulas are based on two measures of text difficulty: sentence length and word difficulty. Although word difficulty is sometimes defined in terms of a list of familiar words, in the many formulas it is represented by a measure of average word length, either in letters or syllables. In this study we examine both some standard readability formulas, and the independent effects of sentence length and word length.

Density of hard words. Density of difficult or unfamiliar words is mentioned specifically by Sternberg and Powell (1983) as a "mediating variable" which may determine the likelihood of a new word being learned from context. In this study we shall examine the effects of density of difficult or unfamiliar words in terms measures of several different measures of word familiarty and difficulty.

Method

Subjects

Subjects were 418 children attending suburban midwestern schools: 157 in third grade, 100 in fifth grade, and 161 in seventh grade. Only subjects who participated in all three experimental sessions were included in the data analyses, leaving 129 subjects in third grade, 85 in fifth grade, and 138 in seventh grade. Reading ability was represented by percentiles from the Vocabulary and Reading Comprehension subscales of the SRA Achievement Series (1978) taken from school files. For 50 subjects for whom standardized test scores were not available, values were estimated (via a linear regression equation) from their performance on the general vocabulary component of the vocabulary checklist pretest administered in the study (see Materials). At each grade, a range of comprehension ability was represented (third grade $M = 63$, range 15 to 90; fifth grade $M = 66$, range 18 to 98; seventh grade $M = 66$, range 11 to 97).

Subjects were assigned randomly to read either the expository or narrative texts selected for their grade (see Materials), and to one of the versions of the vocabulary checklist pretest and multiple-choice posttest.

Materials

Texts. All texts were taken from grade-level books. Both easier and harder texts were chosen for each grade so that floor and ceiling effects would be avoided. "Easy" was based on a broad judgment of how familiar the topic was for a particular age group. For example, the third grade story about a mother mouse was judged to be more familiar than a story about an African farmer visiting a big city. Tables 1, 2, and 3 list titles, numbers of words, and target words for the texts.

Insert Tables 1, 2 and 3 about here.

Four texts were chosen for the third grade. "Bear Mouse in Winter" (Freschet, 1984) in Ten Times Round features a mother mouse looking for food during winter. She is almost caught by an owl and a bobcat. "The Great Minu" (Wilson, 1979) in A Place Called Morning describes an African farmer's first visit to Accra, Ghana. Of these two narratives, the mouse story was judged to be easier than the farmer story.

Finding appropriate third-grade expositions proved to be challenging, as most social studies and science books we looked

at did not contain passages that were long enough. One science book did, Exploring Science (Blecha, Gega, & Green, 1982). From this book, an easier and a harder exposition was chosen using the familiarity criteria. The easier text, "Water is Necessary" (pp. 34-38), details functions of water in sweat, saliva, washing, cooking, and making electricity. "On the Moon" (pp. 21-24), the harder, less familiar text, deals with more sophisticated concepts, conditions on the moon's surface.

Four texts were identified for fifth grade. The easier narrative, "The Railroad Ghost" (Pringle, 1974) in Images is a mystery: A mysterious flagman stops a train just short of a washed out bridge. The harder narrative, "State Lore" in But Life is Calling You (Leach, 1971), contains tall tales and legends from several states. Most of the tales are set in Colonial times. The easier exposition, "Vanishing Giants" in Patterns (Eller & Hester, 1980) describes how overhunting has left few whales. The less familiar, "A Brazilian Plantation" in America Past and Present (Schreiber, Stepien, Patrick, Remey, Gay, & Hoffman, 1983), served as the harder exposition.

Finally, four seventh-grade texts were chosen. A narration about a man's attempt to keep two burros in a pen, "My Battle with the Burros" (Oboler, 1968) in New Reading Skill Builder, was the easier text. For the harder narrative, a science fiction tale, "Security Check" (Clarke, 1974) in Serendipity was chosen. From the seventh-grade health book, Choosing Good Health (Merki,

1983) tw(adjacent sections were chosen, "The Respiratory System"
and "The Circulatory System" (pp. 89-92). These sections served
as the easier exposition. "The Iceberg Cometh" (pp. 80-83) in
Serendipity (Durr, Pescosolido, & Poetter, 1974), the harder
exposition, describes how icebergs could be towed from the South
Pole to supply California with fresh water.

All texts were typed verbatim on plain, white paper, except
for "Security Check." Two introductory paragraphs were deleted
from this text in order to make its length comparable to the
length of the other seventh-grade narrative. The third-grade
texts were printed in larger type than the fifth and seventh
grade texts.

Target words. The most difficult words from each text were
selected as target words. All words except common function words
(e.g., the, which, into) were reprinted in alphabetized columns
by text and by grade level. Teachers with experience at each
grade were given the lists and asked to circle any word they
believed that an average student in that grade would find
difficult to define. Words identified by all seven raters were
included among the target words. For some of the easier, shorter
texts, words identified by five or six of the raters were
included to bring the number of target words up to a minimum of
fifteen.

We believe that the complete set of words constitutes a
representative sample of the difficult words that children

encounter during reading. As can be seen from Tables 1, 2 and 3, a variety of word types was represented; for example, proper nouns (Ghana, Catholicism), verbs (slunk, riffle), nouns, adjectives, a conjunction (notwithstanding), two-word compounds (warm-blooded, carbon dioxide), and words with affixes (reassure, inaccessible).

Another indication of the representativeness of the words is that, unlike the words examined in most other studies, some were already partially known by many of the subjects. To prevent variation among subjects in prior knowledge of the words from diminishing the sensitivity of the experiment, it was designed so that learning from context was a within-subject factor in which subjects "served as their own controls." Also, a target word pretest in the form of a checklist task (see below) served as the basis for statistical control of individual patterns of variation in prior knowledge of the words.

Checklist vocabulary test. For a measure of vocabulary knowledge prior to the subjects' reading of the experimental texts, a checklist test was developed using guidelines suggested by Anderson and Freebody (1983).

The checklist test was chosen for two reasons. Most importantly, it gives the student no information or feedback about the meanings of the words tested. Secondly, it is sensitive to partial word knowledge. Subjects tend to mark a word as known if they have even a partial grasp of its meaning

(Anderson & Freebody, 1983); so if a subject fails to mark a word as known, one can be fairly confident that the subject knows very little about that word. A weakness of this instrument is that it is not suitable for use as both a pre- and posttest.

Three, grade-level checklist vocabulary tests were constructed with 191 items for third grade, 194 items for fifth grade, and 203 items for seventh grade. Details of the construction of this test can be found in Nagy, Herman, & Anderson (1985b). Three versions of the checklist vocabulary test were constructed for each grade. The versions were identical except for the order in which the items were presented.

Multiple-choice test. A multiple-choice test was constructed for each grade that contained all the target words for that grade. Each multiple-choice question contained the correct answer, three distractors, and a "don't know" option. Position of the correct answer was assigned in quasi-random fashion with correct answers occurring with equal frequency in the first four positions. The "don't know" option was always in the last (fifth) position. Examples of questions for the three grades are given in Table 4.

Insert Table 4 about here.

Multiple-choice questions were constructed in the following way: First, a concise definition was chosen to serve as the

correct answer. For example, from the fifth-grade test, the definition for _ridicule_ was "to laugh at, make fun of." For _outskirts_ in the third grade test, it was "the area away from the main part of a city."

Second, three distractors were created for each question, consisting of concise definitions of words semantically similar to the target word and of the same part of speech. No distractors were meant to be tricky or extremely difficult. In Table 4, for example, one can see that the distractors for _slink_ in the third-grade test were all definitions of verbs characterizing kinds of motion. The distractors for _headlamp_ in the fifth-grade test were all definitions of nouns representing types of man-made lights. Finally, in the seventh-grade test, the distractors for _indignant_ represented definitions of adjectives and all had to do with moods or emotions.

With two exceptions, the distractors for all target words represented definitions of real words to insure that legimate, possible meanings were used. However, for _fishery_ in the fifth-grade test and _earstroking_ in the seventh-grade test, it was impossible to find definitions of existing words that were judged to be at the same level of difficulty as other questions in the test. For these questions, plausible distractors were invented. _Ear-stroking_, for instance, had these phrases as distractors: "soft and pleasant sounding," "a style of rowing used in boat races," "pulling someone's ears as punishment."

For each grade, three versions of the test were prepared in which the questions were arranged in different orders.

Procedures

Two weeks before the main part of the study, the grade appropriate checklist test was administered to all participating classes by the researchers. Care was taken that adjacent students received different test versions. A researcher read the direction page to the class, and then students completed the test on their own. All students finished within 15 minutes.

The main study consisted of two sessions one week apart. Classroom teachers were specifically instructed not to tell their students about the second session.

In the first session, students were asked to read two narratives or two expositions. Booklets were arranged so that the easier of the two selections appeared first to minimize frustration. Students seated adjacent to one another received selections from different genre. Before reading, students were told that we were interested in finding out how children learn from reading. No mention of vocabulary was made. Then students were asked to read the first story. No help was given to students while reading. When done, they were told to sit quietly or to reread until all other students had finished reading the first story. Next students read the second story. After all had finished, instructions were read aloud for the six questions assessing a student's familiarity, interest, and ease

of reading of the two stories (see Table 5 for sample questions).

Upon finishing these questions, students were done with the first

session. We hoped they would feel that the questions concluded

the study.

Insert Table 5 about here.

One week later, the researchers returned for a surprise

visit. The multiple-choice vocabulary test was passed out,

alternating test versions between students. A researcher read

aloud the test directions, which explained how to do the test and

provided students with two examples. One example illustrated

when to use the "Don't know" option. Students worked at their

own pace. Third- and fifth-grade students circled answers

directly in the test booklet. This was done to minimize the

younger students' marking answers in the wrong place. Seventh-

grade students were provided with answer sheets.

Measures of Word Properties

Word properties were coded by trained raters with graduate

training in linguistics or educational psychology. All raters

coded all words; differences were resolved in conference.

Number of occurrences. How often a word occurs in the text

reflects both the number of opportunities the reader has to learn

the word from context, and how important that word is relative to

the theme of the text. In the analyses reported here, the square

root of the number of occurrences was used; this was found to be a stronger predictor of learning from context than the untransformed value.

Length of target word. Word length was measured in syllables.

Part of speech. Categories were Noun, Verb, Adjective, Adverb, and Preposition. If a word occurred in more than one part of speech class in the text, raters were instructed to rate it according to the part of speech which the word would be assumed to have if it were seen in isolation (assuming the meaning that occurred in the text). For example, bound occurred as both a noun and a verb in one text (in both cases meaning "jump"), and was classed as a verb.

Morphological transparency. Words were coded on a scale of four degrees of morphological transparency:

(i)   unanalysable, e.g., force, lore, membrane;

(ii)   has a suffix which indicates part of speech, e.g.,
        destination, indignant, particular;

(iii)   can be broken into recognizable parts which contribute
        at least something to the meaning of the whole, e.g.,
        outskirts, earshot, operatic, recital;

(iv)   meaning of the whole is a compositional function of the
        meanings of the parts, and the meanings of the parts
        are likely to be familiar to the reader, e.g.,
        nonliving, unsteered, frantically, extinction.

Conceptual difficulty. Words were placed into four
categories, on the basis of what a reader in the grade for which
the text was intended could be assumed to know about the
associated concepts:

(i)   Reader already knows the concept and knows a one word
      synonym (e.g., learning that altercation means the
      same as fight).

(ii) Reader already knows the concept, but there is not a
      one word synonym. The concept can, however, be
      expressed in terms of a familiar phrase (e.g.,
      learning that apologize means to say you're sorry).

(iii) Concept is not known, but can be learned on the basis
      of experiences and information already available to
      the reader. (For example naive may be a new concept
      to the reader, but it can be understood in terms of
      experiences and concepts already available.)

(iv) Concept is not known, and learning it requires new
      factual information, or learning a related system of
      concepts. For example, the term divide (in the sense
      of "boundary between drainage basins") cannot be
      learned apart from information about river systems.

This scale proved fairly workable. Two raters agreed
perfectly on only 57% of the words rated. However, 40% of the
disagreements were between categories (2) and (3), and another
33% were between (3) and (4). Most of the remaining

disagreements were between (1) and (2). With respect to distinction between category (4) and the other categories--the distinction that turned out to be of greatest importance--there was 86% agreement between the two raters.

Some other word properties could be defined in terms of our pretest and posttest measures:

Word familiarity. This is the proportion of subjects who indicated that they knew the meaning of the word on the checklist pretest.

Item difficulty. This is the proportion of subjects correctly answering the multiple choice question for a given word. For this measure the Word Grand Mean was used, that is, a mean computed using both subjects who had read and who had not read the text containing the word. This measure actually reflects a number of factors that could contribute to item difficulty, for example, choice of distractors, and proportion of subjects who already knew the word.

Measures of Text Properties

Strength of contextual support. Contextual support was evaluated by four trained adult raters. Raters were given copies of the experimental passages with all occurrences of target words underlined, and were asked to rate the extent to which a reader not familiar with the meaning of the target word would be able to infer its meaning from the rest of the text. Ratings were recorded on an 8-point Likert scale adapted from the one used by

Beck, McKeown, and McCaslin (1983). Beck et al. rated contexts
as Misdirective, Nondirective, General, or Directive. Raters
were given examples of these levels of contextual support taken
from that article. Our scale included an additional category,
Explicit, which was used for contexts which explicitly defined
the target word. The scale also included intermediate points
between the four categories used by Beck et al.

Correlations among the four raters were all greater than .59.
This was considered a high level of agreement, given that ratings
were expressed in terms of an 8-point scale. The mean rating for
each word over the four raters was calculated; this mean was used
in the analyses.

Readability. Four readability measures were computed for
each text: the Kinkaid formula (Smith & Kincaid, 1970); the
Automated Readability Index (Kincaid, Fishburne, Rogers &
Chissom, 1975); the Coleman-Liau Formula (Coleman & Liau, 1975);
and the Flesch Reading Ease Score (Flesch, 1948). Readability
values were computed for the entire texts using automated
versions of these formulas in the STYLE program (Cherry &
Vesterman, 1979).

For each text, three additional readability-related measures
were calculated: Average length of words in characters, average
sentence length in characters, and average sentence length in
words.

Density of difficult words. We constructed several measures
of the density of unfamiliar or difficult words, based on word
properties discussed above. In all cases, we were considering in
effect the average difficulty of the target words in the texts.

(1) Overall or text-level word familiarity, that is, the
proportion of target words in a text checked as known by subjects
in the vocabulary checklist pretest.

(2) Text-level word difficulty--the mean proportion of
target words in a text that were answered correctly on the
multiple-choice posttest.

(3) Mean length of the target words in a text, in syllables.

(4) Proportion of conceptually difficult words, that is the
proportion of target words in a text that fell into category (4),
the highest level of conceptual difficulty. This is a measure of
the conceptual novelty or conceptual complexity of a text--that
is, the extent to which it presents the reader with new systems
of concepts and previously unfamiliar factual information.

For a number of these measures, i', was decided to examine
values relative to grade level means. For example, for average
length of target words in syllables, a grade-adjusted variable
was constructed by subtracting from each text's score the mean
for that grade. Both grade-adjusted and unadjusted versions of
the text-property variables were explored in the analyses--all
the readability formulas, the measures of word and sentence
length and all the measures of density of difficult words.

Design and Analysis

Data were analysed using heirarchical regression procedures using the target word as the unit of analysis. The dependent measure was the proportion of students that answered correctly on the multiple-choice post test, corrected for guessing. The comparisonwise alpha level was set at .01 to keep the experimentwise error rate within reasonable bounds.

In all the regression analyses, the grand mean for a word (proportion of all subjects answering correctly for that word, whether they read the passage or not) was entered first in the equation to remove variance associated with differences among words. Next, Comprehension, the mean comprehension percentile for the subjects represented in a cell mean, entered. This variable was entered to remove any variance resulting from the fact that in any grade, despite random assignment of texts to students, the groups that read and did not read a passage were not perfectly matched in ability. In preliminary analyses, the next variable entered was Previous Knowedge of Target Word, that is, the proportion of subjects from each group reporting that they knew the word on the Checklist pretest. However, this variable was not significant, and so was excluded from the analyses reported. Learning from Context was entered next, that is, the contrast between the means for subjects who read a passage and the means of those who did not. Next are entered variables representing the word or text property under

consideration. Variance associated with these is already accounted for by the Word Grand Mean; the word or text property variables must be entered here prior to entering the interactions of these variables with Learning from Context. Interactions of Learning from Context with word or text property variables were entered last. These interactions are the point of real interest, representing the extent to which the various word and text properties influence the likelihood that a word will be learned from context.

Because of possible difficulties raised by correlations among word variables, our first step of analysis was to conduct a initial regression for each word or text property separately. This procedure may increase the risk of several intercorrelated variables all appearing to be significant, but reduces the risk of missing a potentially significant variable.

Morphological Decomposability, Learning Situation, Conceptual Difficulty, and Part of Speech were treated as sets of orthogonal contrasts. Because number of occurrences and length of target word in syllables were not distributed normally, analyses were performed using both the square root and the untransformed value for each of these variables.

For variables defined at the passage level, additional analyses were performed using the passage as the unit of analysis. The dependent measure was the mean proportion of

students answering correctly on the multiple-choice post-test for the words in the passage.

Results

Learning from Context was highly significant, but only a few of the word and text properties under investigation had significant interactions with Learning From Context.

Word Properties

Only one word property, Conceptual Difficulty, was found to significantly affect learning from context. The combined F for the set of contrast codes for this variable was 8.5, $p < .01$. The strongest effect was for the contrast between the conceptually most difficult words (Level 4) and all other words; details of the analysis are given in Table 6.

Insert Table 6 about here.

Table 7 makes it clear what the interaction of conceptual difficulty with learning from context means. There was simply no learning from context for words at the highest level of conceptual difficulty.

Insert Table 7 about here.

Text Properties

Strength of contextual support. Strength of Contextual

Support did not interact with learning from context ($p > .1$).

Readability measures. The four measures of readability were

highly intercorrelated (rs between .87 and .98), as would be

expected. In only two cases did interactions with learning from

context approach significance, for the Kinkaid formula and the

Automated Readability Index (ps $< .05$). The relationship was

only evident when readability was measured relative to the grade

level, that is, when the mean readability of experimental texts

at a grade level was subtracted from the readability level of

each text. In all cases, there was a negative relationship

between learning from context and text difficulty as measured by

the readability formulas; the more difficult the text, the fewer

unknown words were learned.

Individual variables contributing to readability were also

examined, i.e., average word length in characters, average

sentence length in characters, and average sentence length in

words. These did not interact significantly with learning from

context, although the interactions of all three approached

significance ($p < .08$) when they were adjusted for grade level.

As was the case with the readability formulas, all three of these

measures had a negative relationship with learning from context;

the longer the sentences and words, the less was learned from

context.

Density of difficult words. Among the measures representing density of difficult or unfamiliar words in the text, two were significant, and two were not.

When density of difficult or unfamiliar words was measured in terms of the checklist pretest or multiple choice posttest, there was no significant interation with learning from context (both Fs < 1.0).

Passage-Level Conceptual Difficulty--the proportion of target words rated as being conceptually difficult (Conceptual Difficulty category 4)--interacted significantly with learning from context. Fewer words were learned from context in texts which had a higher proportion of conceptually difficult words. Table 8 gives the details of this analysis.

Insert Table 8 about here.

Average Length of Target Words in Syllables for a text (adjusted for grade level) also interacted significantly with learning from context. The longer the average length of a target word in a text, the less likely any target word is to be learned from context. Details of this analysis are given in Table 9.

Insert Table 9 about here.

Average Length of Target Words in Syllables and Passage-Level

Conceptual Difficulty--the two passage-level measures of word

difficulty which interact significantly with learning from

context--are also highly correlated ($\underline{r}$ = .6). In other words,

texts with more conceptually difficult words tend to have more

long words, and vice versa. In an attempt to tease apart the

relative contribution of these two variables to learning from

context, two further analyses were performed, in which both

variables and their interactions with learning from context were

entered, in two different orders. When Average Length of Target

Words in Syllables was entered before Passage-Level Conceptual

Difficulty, the latter variable still approached significance ($\underline{F}$

= 5.0, $\underline{p}$ < .025). When Passage-Level Conceptual Difficulty was

entered before Average Length of Target Words in Syllables, the

second variable was still significant ($\underline{F}$ = 7.3, $\underline{p}$ < .01).

Thus, although these two variables overlap substantially, each

appears to have some independent effect on learning from context.

One effect of Conceptual Difficulty may have been to mask

the effect of other variables on learning from context. For

example, words with greater contextual support also tended to be

more conceptually difficult. If the effects of conceptual

difficulty were controlled for by first entering the Passage-

Level Conceptual Difficulty x Learning from Context interaction

into the regression equation, the interaction of Learning from

Context with Strength of Contextual Support might then be signficant.

This possibility was explored for the other variables by performing another set of regressions parallel to those already done, in which the Learning from Context x Passage-Level Conceptual Difficulty interaction was entered, followed by the interaction of Learning from Context with one of the other variables.

Most importantly, when the conceptual difficulty of the text is thus controlled for, the interaction of Learning from Context with Strength of Contextual Support was found to be highly significant. Details of this regression analysis are given in Table 10.

Insert Table 10 about here.

Conceptual difficulty also seemed to mask the effects of readability. When entered after Proportion of Conceptually Difficult Words, of the four readability formulas interacted significantly with learning from context--the Kinkaid formula (F = 10.5, p < .01), and the Flesch Reading Ease Score (F = 10.7, p < .01). Likewise, when entered after Proportion of Conceptually Difficult Words, both measures of sentence length interacted significantly with learning from context, when adjusted for grade level--Sentence Length in Characters (F = 8.6, p < 0.01) and

Sentence Length in Words ($\underline{F} = 8.2$, $\underline{p} < 0.01$). Word length, i.e., the average length of all the words in a passage, did not interact with learning from context.

Additional analyses were performed in which the interaction of learning from context with Average Length of Target Words in Syllables (adjusted for grade) was entered before the interaction of learning from context with other word and text properties, to see if Average Length of Target Words in Syllables had masked the effects of other variables in the way that Proportion of Conceptually Difficult Words did. However, only one interaction even approached significance when entered after the interaction of learning from context with Average Length of Target Words in Syllables. This was the interaction of learning from context with Strength of Contextual Support ($\underline{F} = 4.7$, $\underline{p} < .05$). Thus, although passage-level conceptual difficulty and average length of target words in syllables are highly correlated, only the former variable masks the effects of other variables on learning from context.

Further analysis also revealed that conceptual difficulty at the level of individual target words did not mask the effects of any other variables.

Table 11 gives the means for each text for strength of contextual support, passage-level conceptual difficulty, and average length of target words in syllables.

Insert Table 11 about here.

Genre Differences

Additional analyses were performed to see to what extent the
effects reported above held for both narratives and expositions.
Doing analyses separately for narratives and expositions would
limit the number of texts too severaly to draw any valid
conclusions. A more stringent test of genre-related differences
is the three-way interaction between Genre, Learning from
Context, and the word and text property under consideration.
Such analyses were performed for the variables found to interact
significantly with Learning From Context in the previous
analyses. In only one case did a three-way interaction approach
significance: There was a nearly-significant interaction of
Genre x Learning from Context x Strength of Contextual Support (F
= 5.0, p < .05), if and only if the interaction of Learning From
Context x Passage-Level Conceptual Difficulty was entered
earlier. Separate analyses for expositions and narratives showed
that Strength of Contextual Support was associated with learning
from context in expositions (F = 13.8, p < .001), but not in
narratives (F < 1), again only if entered after the interaction
of learning from context with Passage-Level Conceptual
Difficulty.

Analyses with Passage as the Unit of Analysis

For variables defined at the passage level, secondary analyses were performed with the passage as the unit of analysis. Results were essentially the same as those already reported, with the exception that interactions of learning from context with readability measures and the associated word-length and sentence length variables were not significant.

Discussion

The two variables in our study which had the strongest effect on learning from context were Passage-Level Conceptual Difficulty (that is, the proportion of target words that were rated as being at the highest level of conceptual difficulty), and Average Length of Target Words in Syllables (the latter variable adjusted for grade level). Although correlated, the two variables appear to have an independent effect on learning from context. It is only Passage-Level Conceptual Difficulty that masks the effects of the other variables found to interact significantly with learning from context--Strength of Contextual Support, and readability as measured by standard formulas.

Implications for Research on Learning from Context

Most studies on learning word meanings from context seem to have utilized tasks in which "learning from context" is equated with finding a known word that matches the nonce word, blank, or low frequency word in an experimental text (e.g., Ames, 1966; McKeown, 1985; Werner & Kaplan, 1952). Our results indicate that

such tasks are not representative of the learning conceptually
difficult words. Our results also suggest that there may be
qualitative differences in the way wcrd meanings are learned from
expository and narrative text.

More generally, our results suggest that variables which
seem to be most directly related to learning from context--
strength of contextual support, and presumably the various
categories of context clues reflected by this measure--do not
influence learning from context as strongly as more global
measures of the conceptual difficulty of the text.

The Role of Schemata in Learning from Context

Our results show the importance of a schema-theoretic
understanding of vocabulary acquisition. That is, there are a
number of reasons to believe that the most important factor in
learning from context is the degree to ich the reader can
integrate information in a passage into a coherent system
consistent with his or her prior knowledge.

First, there is the fact that of all the word properties we
looked at, only conceptual difficulty interacted significantly
with learning from context, and in fact, only the distinction
between words at the highest level of conceptual difficulty from
the others. The property distinguishing the conceptually most
difficult words from others is that they can only be learned as
part of a system of concepts.

It is important to note that word familiarity or multiple choice question difficulty had no relationship with learning from context. Thus, the relevant measure of text difficulty is not the volume of new information in the text, but the type of learning that the text requires. The presence of unfamiliar words alone did not diminish learning from context; the obstacle posed by conceptual difficulty is the need to acquire new systems of concepts.

Second is the fact that word length had a strong effect on learning from context at the passage level, but none at all at the level of individual words. The fact that an individual word was long did not lessen the likelihood that it would be learned from context, but learning from context was diminished for texts with a preponderance of longer words. It appears that word length interferes with learning from context when it affects the reader's ability to integrate information in the passage. In contrast, conceptual difficulty is significantly related to learning from context both at the word level and at the passage level.

Third, our results give us grounds for hypothesizing that a schema-based measure of the conceptual difficulty of a text, if refined, could be as strong a predictor of incidental learning as average length of target words in syllables, or even stronger. The measure of word length in syllables is, except for the possibility of mistakes in counting or transcription, without

error. The measure of conceptual difficulty, on the other hand,
has several potential areas for improvement. The current measure
was based on only the target words, which were representative of,
but did not exhaust, the difficult words in the texts. Inter-
rater reliability on the crucial distinction between the hardest
category of words (level 4) and all others was relatively high
(86%), but could be improved with more explicit criteria and
training. Furthermore, the measure used here--the proportion of
difficult words that are conceptually difficult--does not
directly represent many aspects of conceptual difficulty at the
passage level, e.g., the complexity of the relationships among
the concepts in the passage.

Fourth, there is the evidence from Herman's (1985)
research on the type of changes that produce increase learning
from context in expository text. The revised text in her study
which produced a significant increase in learning from context
could be called "schematically explicit." That is, in this
version the schematic structure of the content--the relationships
among the individual concepts--was made explicit.

Fifth, there is the fact that rated strength of contextual
support is significant only after passage-level conceptual
difficulty has been entered into the equation. This relationship
between conceptual difficulty and contextual support indicates
that authors of children's texts are at least in part sensitive
to the needs of their readers; thus conceptually difficult texts

tended to have a higher level of contextual support for difficult words.

Our results concerning conceptual difficulty and strength of contextual support show that a schema-based measure of text difficulty is a better predictor of learning from context than strength of contextual support. How easily a reader learns a new word depends in part on the degree to which the context immediately surrounding a new word gives information about that word; but far more important is the degree to which that concept requires the student to go beyond his or her current level of knowledge, to integrate new factual information with prior knowledge, and learn new conceptual distinctions.

Our finding that a conceptually-based mesaure of text difficulty is one of the strongest predictors of learning from context parallels findings of studies which have shown subject's background knowledge, or their ability to apply their background knowledge in understanding a text, to be a major determinant of comprehension. Using texts with varying degrees of artificiality, researchers such as Bransford and Johnson (1972), Dooling and Lachman (1971), Spilich, Vesonder, Chiesi, & Voss (1979), and Steffenson, Joag-dev and Anderson (1979) have made powerful demonstrations of the fact that comprehension is dependent on the reader's ability to integrate information in text with existing knowledge structures. Using real U.S. Naval training texts, Sticht, Armijo, Weitzman, Koffman, Roberson,

Chang and Moracco (1986) have shown that differences in background knowledge have a large effect on what level of reading ability is necessary for the comprehension of difficult text.

Incidental Word Learning from Expositions

Although incidental learning of word meanings from context during reading has been found to be broadly generalizable both over subjects and over words (Nagy, Herman, & Anderson, 1985b), the results of the present study show that not all words are equally likely to be learned from context, nor do all texts promote incidental word learning.

It is rather surprising to see that there was no learning from context for the conceptually most difficult words (see Table 3), and little or no learning from several of the experimental passages, those with a preponderance of long or conceptually difficult words (see Table 11). Learning from context was consistently highest in the easy narratives, but nonexistant for several of the expositions. This is somewhat unexpected, since easy narratives are not written primarily for the purpose of teaching word meanings, whereas expositions have the explicit purpose of conveying new information and concepts.

Can children infer the meanings of conceptually difficult words from context? Can expository text produce any long-term gains in vocabulary knowledge? Our results certainly indicate that such learning is not guaranteed. However, there is also evidence that children can sometimes acquire vocabulary knowledge

incidentally from expositions. In an earlier study, we found

equal amounts of incidental word learning from two passages, one

narrative and one expository (Nagy, Herman, & Anderson, 1985a).

The quality of the expository text is obviously a factor. Herman

(1985) found that expository text can be rewritten to increase

the incidental learning of word meanings. Specifically, she

found that expository texts rewritten to be "conceptually

explicit" resulted in signifcantly greater learning of target

words from context. In her conceptually explicit texts,

interrelationships among concepts were clearly described, and

examples and non-examples given where appropriate.

Although the conceptual difficulty of the target words and

texts in Herman's study has not been rated, we would judge that

the texts she used (on river systems and the human circulatory

system) are comparable to the most conceptually difficult texts

in the present study. Thus, incidental word learning is possible

from conceptually dense texts, if the relationships among the

concepts are made clear.

The low level of learning from context in the expositions in

the present study may be in part a result of the length of texts

used. While the experimental texts were all selected to be

coherent when read in isolation, the narratives in fact were

probably more self-contained than the expositions. The latter

were likely to have been more integrated with preceding sections

of the books from which they were taken; at least some of the

difficult vocabulary in the expositions was likely to have been explicitly defined or explained earlier in the book.

Our results give some indication that there may be qualitative as well as quantitative differences in the learning of word meanings from expository and narrative text. For example, strength of contextual support was found to be related to learning from context only in the expository passages. One might suppose that this simply reflects a difference in the range of strength of contextual support. Narratives might be expected to have a consistently low level of contextual support, while expositions would contain a range of levels of support, including more explicitly defined terms. However, as can be seen from Table 11, there is consistent no difference between the narrative and expository texts either in the absolute level of contextual support, or in the range of levels of support, as reflected in the standard deviations.

Overall conceptual difficulty appears to be the factor most clearly differentiating the narrative and expository passages in this study. New conceptual structures are not acquired quickly or easily. Learning from expositions is especially dependent on relationships among concepts being made clear, and it may take repeated exposure, not just to the words, but to the system of ideas in a new domain, to produce a significant level of incidental learning. Our results certainly suggest that teachers

cannot rely on a single reading of an expository passage to communicate new conceptual domains to their students.

Incidental Word Learning from Narratives

As we have argued elsewhere (Nagy, Herman, & Anderson, 1985a, 1985b), although the absolute magnititude of learning from context is small, even a relatively small amount of reading will result in large annual gains in vocabulary size, greater than could be attained through even an intensive program of vocabulary instruction.

Most of the target words in this study (70%) occurred only once in the experimental passages, and there was no relationship between number of occurrences and amount of learning from context. Thus even a single exposure to a word in context results in significant learning. We acknowledge, of course, that multiple encounters with a word in a variety of meaningful contexts is necessary to produce the depth of word knowledge that will measurably increase comprehension during subsequent reading. However, the results of this and our earlier studies indicate that wide, regular reading will itself provide the necessary exposures to words in a variety of meaningful context.

Given narratives within the range of a student's reading ability, even with only one exposure in context, one unfamiliar word in ten can be learned to the extent that the student will successfully answer a multiple-choice question about the meaning of that word a week later. At this rate of learning, reading for

pleasure also constitutes reading for large-scale vocabulary

growth.

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Table 1

Summary of Passages

Total Words and Target Words for Third Grade

Passage	Total Words in story	Target Words
Narrative:		
"Bear Mouse"[a]	620	bill, bound, cardinal, crouch, desperate, exhausted, forepaw, heave, huddle, pounce, scent, slightest, slunk, snarl, storehouse, tuft, wedge
"Great Minu"	566	Accra, bystander, fashionably, Ghana, harbor, impressive, inquire, latch, mahogany, mourner, outskirts, procession, puzzled, thatched, trudge, wail, yam
Expository:		
"Water is Necessary"[a]	498	electricity, evaporate, fact, important, liquid, necessary, nonliving, radio, raise, saliva, stomach, swallow, sweat, vapor, weight
"On the Moon"	642	astronaut, basalt, billion, breccia, condition, crater, force, geologist, gravity, kilometer, lava, meteorite, natural, plain, soil, surface, telescope

[a]The "easier" text

Table 2

Summary of Passages

Total Words and Target Words for Fifth Grade

Passage	Total Words	Target Words
Narrative:		
"Railroad Ghost"[a]	588	absolutely, cloak, convince, dense, desperate, flagged, frantically, gasp, headlamp, particular, phantom, plunge, resemble, scant, topple, triumphantly, Victoria
"State Lore"	704	anecdote, austere, coverlet, destination, earshot, emaciated, exorbitant, jaunty, lore, maniac, ragamuffin, ridicule, taciturn, unanimous, unsteered, wares
Expository:		
"Vanishing Giants"[a]	629	blubber, cruise, extinction, fishery, gear, hardy, harpoon, overhunting, prey, profitable, refuse, regulations, sonar, species, vanishing, warm-blooded, whaler
"Brazilian Plantation"	715	alternate, Amazon, Brasilia, Brazilian, cacao, Catholicism, descent, feud, homespun, mestizo, plateau, Portuguese, prosper, Rio de Janeiro, rotate, tract, Uruguay, ward off

[a]The "easier" text

Table 3

Summary of Passages

Total Words and Target Words for Seventh Grade

Passage	Total Words	Target Words
Narrative:		
"My Battle with the Burros"[a]	1170	axle, barbed, bray, dignified, dismay, earstroking, expel, foreleg, fuse, gaze, infancy, operatic, pruning, pursuit, quarters, reassure, romp, truce
"Security Check"	1490	access, authenticity, Bavarian, credentials, decor, deteriorate, disconcerting, disintegrator, ensure, gullet, indignant, legion, naive, notwithstanding, portfolio, prototype, proton, realism, recital, render, riffle, sheaf, tedious, Victorian
Expository:		
"Respiratory System" "Circulatory System"[a]	661	alveoli, aorta, artery, atrium, bronchi, capillary, carbon dioxide, cilia, circultory, filter, membrane, mucus, nutrient, oxidation, respiratory, sacs, trachea, valve, ventricle
"The Iceberg Cometh"	672	analysis, appreciably, aqueduct, auxiliary, blight, conveyor, craggy, current, devise, exert, finance, growler, inaccessible, lasso, latitude, literally, scheme

[a] The "easier" text

Table 4

Examples of Multiple-choice Items for Third, Fifth and Seventh Grades

---

Third Grade

slink

    a) to move in a quiet, sneaky way

    b) to walk in a proud, boastful way

    c) to become perfectly still

    d) to shiver or shake

    e) don't know

Fifth Grade

headlamp

    a) a tower with a bright light to warn and guide ships

    b) a small electric light powered by batteries

    c) a light on the front of a train, car, or truck

    d) a set of electric lights used to control traffic

    e) don't know

Seventh Grade

indignant

    a) very sure; confident

    b) giving in easily; not resisting

    c) full of pep and energy

    d) angry because something seems unfair

    e) don't know

Table 5

Examples of story questions

_____

How much have you read about this subject before?

    a) a whole lot

    b) some

    c) very little

    d) nothing at all

How interesting was this story to you?

    a) very interesting

    b) a little bit interesting

    c) a little boring

    d) very boring

How many words were there in the story that you didn't know?

    a) so many it made the story hard to understand

    b) some words I didn't know

    c) one or two words I didn't know

    d) no words I didn't know

_____

Table 6

Interaction of Learning from Context with Conceptual Difficulty

(of individual target words)

Variable	B	% Within-word Variance	F
Mean Comprehension Percentile of Subject Group	.005	5.8	27.3 *
Learning from Context[a]	-.031	9.4	44.5 *
Conceptual Difficultly Contrast 1[b] (Level 1 vs. Levels 2,3,4)	-.014	----	0.0
Conceptual Difficulty Contrast 2[c] (Level 3 vs. Levels 1 & 2)	-.005	----	0.1
Conceptual Difficulty Contrast 3[d] (Level 1 vs. Level 2)	.021	----	0.0
Learning from Context X Contrast 1	.009	2.5	11.7 *
Learning from Context X Contrast 3	-.014	0.9	4.1
Learning from Context X Contrast 2	.003	0.2	0.8
Constant/Residual	-.250	81.2	

[a]Coded +1 mean for subjects who had read passage; -1 mean for subjects who had not read passage

[b]Coded +3 for conceptually difficult words (Level 4), -1 for other words (Levels 1,2 & 3)

[c]Coded +2 for Level 3, -1 for Levels 1 & 2, and 0 for Level 4

[d]Coded +1 for Level 2, -1 for Level 1, and 0 for Levels 3 & 4

*$p < .001$

Table 7

Learning from Context at Different Levels of Conceptual Difficulty

Level of Conceptual Difficulty	Number of Words at This Level	Percentage of Subjects Answering Correctly on Multiple Choice Posttest		Gain in Postest	Probability of Learning Word from Context[a]
		Read Passage	Didn't Read		
1	23	45.3	41.7	3.6	.06
2	58	49.6	43.9	5.8	.10
3	79	35.7	32.1	3.6	.05
4	52	45.5	46.2	−0.7	−.01
TOTAL	212	42.7	39.8	2.9	.05

[a] Probability of learning a word from context is defined as
(READ − NOT READ)/(1 − NOT READ) where READ and NOT READ are
the proportions of subjects scoring correctly on the multiple
choice posttest, who read or did not read the passage.

Table 8

Interaction of Learning from Context with Passage-Level Conceptual Difficulty

(Proportion of Conceptually Difficult Target Words)

Variable	B	% Within-word Variance	F
Mean Comprehension Percentile of Subject Group	.003	5.8	27.3 *
Learning from Context[a]	.027	9.4	44.5 *
Passage-Level Conceptual Difficulty[b]	-.00ι	---	0.0
Learning from Context X Passage-Level Conceptual Difficulty	-.046	3.5	16.6 *
Constant/Residual	-.215	81.3	

[a]Coded +1 mean for subjects who had read passage;
      -1 mean for subjects who had not read passage

[b]Represented as the proportion of target words coded as
      conceptually difficult (Level 4).

*$p < .001$

Table 9

Interaction of Learning from Context with Passage-Level Word Length

(Average Length of Target Words in Syllables, Adjusted for Grade)

Variable	B	% Within-word Variance	F
Mean Comprehension Percentile of Subject Group	.003	5.8	27.5 *
Learning from Context[a]	.016	9.4	44.8 *
Average Length of Target Words in Syllables[b]	-.000	----	0.0
Learning from Context X Average Length of Target Words in Syllables	-.033	4.0	19.0 *
Constant/Residual	-.200	80.8	

[a]Coded +1 mean for subjects who had read passage;
    -1 mean for subjects who had not read passage

[b]Adjusted for grade level by subtracting mean for all
    passages at a grade level from value for each passage.

* $p < .001$

Table 10

Interactions of Learning from Context with Passage-Level

Conceptual Difficulty and Strength of Contextual Support

Variable	B	% Within-word Variance	F
Mean Comprehension Percentile of Subject Group	.003	5.8	28.2 *
Learning from Context[a]	-.000	9.4	45.9 *
Strength of Contextual Support[b]	.001	----	0.0
Passage-Level Conceptual Difficulty	-.003	----	0.3
Learning from Context X Passage-Level Conceptual Difficulty	-.066	3.5	17.0 *
Learning from Context X Strength of Contextual Support	.007	2.3	11.2 *
Constant/Residual	-.203	78.9	

[a] Coded +1 mean for subjects who had read passage; -1 mean for subjects who had not read passage

[b] Mean rating on a scale of 8 = strongest contextual support, 1 = weakest contextual support

* $p < .001$

Table 11

Passage-Level Properties and Learning from Context

Grade	Genre	Percentage of Conceptually of Difficult Words	Average # of Syllables per Target Word	Strength of Contextual Support	Probability of Learning From Context
3	Narrative #1	0.0%	1.6	4.7 (1.1)[a]	.085[b]
3	Narrative #2	11.8%	2.1	5.0 (1.1)	.031
3	Exposition #1	20.0%	2.5	4.9 (1.4)	.011
3	Exposition #2	52.9%	2.5	6.5 (1.4)	.011
5	Narrative #1	5.9%	2.3	5.2 (1.2)	.118
5	Narrative #2	11.8%	2.8	4.7 (1.1)	.062
5	Exposition #1	29.4%	2.4	4.8 (1.2)	.081
5	Exposition #2	35.3%	2.8	4.3 (0.9)	.091
7	Narrative #1	5.6%	2.0	4.2 (1.2)	.132
7	Narrative #2	20.8%	3.0	4.5 (1.1)	-.021
7	Exposition #1	84.2%	3.1	6.7 (1.0)	-.033
7	Exposition #2	11.8%	2.8	4.4 (1.1)	.025

[a]Mean strength of contextual support for each text; standard deviations are in parentheses.

[b]Probability of learning a target word from context calculated as in Table 3, but with passage means corrected for differences in prior word knowledge and reading comprehension ability.