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1983

ACADEMIC PRESS
A Subsidiary of Harcourt Brace Jovanovich, Publishers
New York London
Paris San Diego San Francisco São Paulo Sydney Tokyo Toronto

This book is based upon work supported by the National Institute of Education under Grant No. NIE-G-81-0009. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the Institute or the Department of Education.

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ACADEMIC PRESS, INC.
111 Fifth Avenue, New York, New York 10003

United Kingdom Edition published by
ACADEMIC PRESS, INC. (LONDON) LTD.
24/28 Oval Road, London NW1 7DX

Library of Congress Cataloging in Publication Data

Main entry under title:

Classroom computers and cognitive science.

(Educational technology series)
Includes bibliographical references and index.
1. Computer-assisted instruction--Congresses.
2. Individualized instruction--Congresses.
I. Wilkinson, Alex Cherry. II. Series.
LB1028.5.C525 1983 370'.28'5 83-8741
ISBN 0-12-752070-8

PRINTED IN THE UNITED STATES OF AMERICA

83 84 85 86 9 8 7 6 5 4 3 2 1

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Teaching Vocabulary-Building Skills: A Contextual Approach*

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Vocabulary-building skills are techniques for increasing one's sight vocabulary. They differ from techniques for teaching specific vocabulary in that they are intended not only for learning specific words (whose definitions are explicitly given), but also for learning words encountered in real-world contexts without explicit definitions. The purpose of our chapter is to consider some alternative methods for vocabulary-building skills, and to discuss in some detail the method we prefer, learning from context.[1]

*Preparation of this chapter was supported by Contract N0001478C0025 to Robert J. Sternberg from the Office of Naval Research.

[1]All of the methods discussed in this chapter have relevance to both first- and second-language learning. In order to keep the scope of the chapter within manageable bounds, we shall deal here only with first-language learning.

The theory of learning from context is described in relation to the theory of verbal comprehension in general in Sternberg, Powell, and Kaye (1982). The theory of external decontextualization represents a collaborative effort between Powell and Sternberg; the theory of internal decontextualization represents a collaborative effort between Kaye and Sternberg.

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ISBN 0-12-752070-8

Our chapter is divided into three parts. First, we briefly review three methods for teaching sight vocabulary. Next, we outline a theory of learning from context. Finally, we suggest how our approach could be implemented in a computer-assisted instructional package. Our general claim is that it is possible to learn vocabulary from context by a method that is theoretically based, practically feasible, and of great value to students in improving their skills of verbal comprehension.

ALTERNATIVE METHODS FOR VOCABULARY BUILDING

A number of different methods have been proposed for teaching vocabulary (see Gipe, 1979; Johnson & Pearson, 1978; Levin, 1981; O'Rourke, 1974). A full review of even a subset of these methods deserves a book-length presentation; indeed, the books by Johnson and Pearson and by O'Rourke are devoted almost exclusively to a consideration of methods for teaching vocabulary. We shall review here the three methods that seem to be of greatest interest today: (1) rote learning, which, despite its slightly unsavory connotations, remains by far the most widely-used method for teaching vocabulary; (2) the keyword method, which is a mnemonic method that makes heavy use of interactive imagery; and (3) learning from context, which is an extremely popular method of teaching vocabulary, but which is now being challenged by advocates of the keyword method. Our description of each method will have three parts. First, we shall briefly describe the method. Then we will evaluate it by three "armchair" criteria. Finally, we will review empirical data regarding the efficacy of the method.

Before discussing the methods, it would be worthwhile for us to describe the three armchair criteria we shall use in evaluating the methods. These are internal connectedness, external connectedness, and practical ease of use. The first two criteria, internal and external connectedness, derive from Mayer and Greeno (1972). These criteria are important because internally and externally connected knowledge tends to be durable and generalizable. By *internal connectedness* we refer to the richness and degree of integration attained for the cognitive structure built to define a single new vocabulary word. Rich and well-integrated definitions exhibiting high internal connectedness are found in references such as etymological dictionaries, which contain expansive accounts of the subtleties of word meanings and their derivations. Sparse and poorly integrated definitions exhibiting low internal connectedness are typically found in pocket dictionaries, especially for multiply defined words. By *external connectedness* we refer to the richness and degree of integration attained between the cognitive structure built to define

the new vocabulary word and other cognitive structures. Definitions that relate new words to old concepts, and thereby exhibit high external connectedness, are found in specialty dictionaries that list features such as etymologies, rhymes, antonyms, synonyms, and cognates for words. Definitions that only sparsely or ambiguously relate new words to old concepts are found in pocket dictionaries and some "junior" level dictionaries. We use *practical ease of use*, our third criterion, to refer to the extent to which an individual encountering a new word in the course of everyday experience could use a given method to learn and then retain the meaning of a given new word. The less time and effort expended to learn a new word, the more likely the individual is to employ the method and thereby have a chance of learning from the method.

Rote Learning

There are a number of variants of the rote-learning method for acquiring meanings of new words, but the basic idea is simple. The individual is somehow exposed to a word and its definition, and commits the word, the definition, and the association between them to memory. In some cases, the definition is supplied; in other cases, the definition must be sought after, for example, by consulting a dictionary. But in all cases, there is heavy reliance upon associative memory.

This method does not fare particularly well on the three armchair criteria. Definitions provided for words in pocket dictionaries or in test-coaching books are typically short and concise to make it easier to remember them. But these single-word synonyms and unelaborated short phrases, while perhaps memorable, limit the reader's opportunity to build a highly internally connected cognitive representation for the word, reducing the likelihood that subtleties of the word's meaning will be understood and that the word will be used. On the other hand, richer, more elaborative definitions, while meeting the internal connectedness criterion, are difficult to memorize. So regardless of the type of definition provided for rote learning, odds are against the reader's constructing and retaining an elaborate cognitive representation of the word's meaning.

Poor elaboration in many definitions also reduces opportunities to develop an externally connected cognitive structure. The learning of word lists typically leads to the formation of some degree of subjective organization (Tulving, 1962, 1966) between pairs, triples, or higher-order units of new words, such that recall of a new word or a new word and its definition also touches off recall of other words and their definitions (Bower, 1970; Mandler, 1967; Tulving & Pearlstone, 1966). Operationally, the existence of sub-

jective organization is measured by words consistently tending to be recalled together or in close succession. The association between recalled words may be appropriate and even useful within the impoverished semantic context of a word list; but the associated words may have little semantic relation to each other, and the associations formed are not likely to have much long-term benefit when it becomes necessary to understand the new words outside the episodic and largely arbitrary context of the list in which they were learned.

The case of applying the rote method is variable, depending upon the variant used. A word list with words and their definitions is easy to use; requiring individuals to look up words in a dictionary is cumbersome. But whatever source is used for definitions, a problem arises when one's goal is to train for vocabulary-building skills as well as for specific vocabulary. By far the largest amount of vocabulary one learns is acquired through everyday interactions with words in conversation, newspapers, books, lectures, and the like. There is usually no dictionary readily available, and even if one makes a note to look up a specific word or list of words later, such notes are notoriously easy to misplace. It is extremely rare for a definition to be given directly in our daily interactions with words, other than in vocabulary-instructional programs. Consequently, rote learning by itself is unlikely to be sufficient for acquiring and retaining the meaning of a previously unknown word, or for enabling the reader to apply the word's meaning to its current context.

Some empirical evidence bears upon the usefulness of rote learning. Gipe (1979) compared two rote methods to a category-learning method and a context-learning method. One rote method presented a new word paired with a brief definition; the other rote method required the individual to look up the meaning of the new word in a dictionary. In this latter method, individuals were also required to write down the definitions, and to write sentences containing each word. Gipe found that for both third- and fifth-grade children, the association method was better than the dictionary method, but both methods were inferior to learning from context. Pressley and Levin (1981) and Pressley, Levin, and Miller (1981) compared the keyword method (to be described) to a control condition that encouraged, but did not require, rote recall of new vocabulary words. Subjects in both studies were college students. The investigators found that under specified conditions, the control group (which, presumably, employed primarily rote learning) performed at a lower level than did the keyword group. Thus, the admittedly skimpy evidence comparing rote learning to alternative methods of learning does not show favorable results for the rote method. These results, combined with the armchair analysis, encourage one to investigate

alternative methods of teaching vocabulary and vocabulary-building skills. One such alternative method is the method we consider next, the keyword method.

The Keyword Method

The keyword method was originally introduced for the purpose of teaching foreign languages (Atkinson, 1975; Atkinson & Raugh, 1975; Raugh & Atkinson, 1975), but has been adapted to teaching first-language vocabulary by Levin, Pressley, and their colleagues (Levin, 1981; Pressley & Levin, 1981; Pressley, Levin, & Miller, 1981a, 1981b, 1982). The keyword method is a mnemonic technique based upon the finding that interactive imagery can facilitate learning (Bower, 1972; Paivio, 1971). (See Paivio & Desrochers, in press, for a critical review of the literature on mnemonic techniques in *second-language* learning.)

The keyword method consists of two stages, an *acoustic-link stage* and an *imagery-link stage*. We shall illustrate the method for acquiring English vocabulary with the example, *carlin*, which means *old woman* (Pressley & Levin, 1981). In the acoustic-link stage, the individual acquires a "keyword," which is a familiar English word that (1) sounds like a salient part of the unfamiliar word and (2) is visualizable through a mental image. For the word *carlin*, one might use *car* as a keyword, in that *car* is both a salient phonetic part of the word to be learned and a visualizable concept. In the imagery-link stage, one forms a visual image in which the familiar keyword and the unfamiliar word are visualized as interacting in some manner; for example, one might imagine an old woman driving a car.

The keyword method has a solid foundation in learning theory. Psychological principles drawn upon by the keyword method are that (1) meaningful stimuli are more reliably encoded than are nonmeaningful stimuli; (2) interacting items are more reliably associated than noninteracting items; (3) the greater the similarity between two stimuli, the more reliably one will evoke the other; and (4) thematic interactions are reliably retrieved from appropriate cues (Levin, 1981). Given this base of psychological theory, one might expect the keyword method to fare better than the rote method on both our armchair and our empirical criteria, and, in fact, it does.

The definitions provided in the keyword method are no more verbally elaborated than the definitions provided in the rote method, but they are more visually elaborated through the use of imagery. In the *carlin* example, for instance, not only is the definition of a carlin as an old woman learned, but the old woman is visualized, in this case driving a car. If one assumes

a dual memory system with both visual and verbal codes (Paivio, 1971), then one would expect the addition of the visual information to provide an additional retrieval cue for recall of a word and its definition. Almost any other multicomponent model of memory traces (e.g., Bower, 1967) will also predict improved memory by the addition of the visual component to the memory trace. The more elaborate and richer memory trace provides an integration between verbal and imagery components of the word's representation, and would thus seem to be more internally connected than the trace typically provided by rote learning.

Formation of an interactive image also provides increased external connectedness via the interaction of the image of the target word with some other well-known word. In the example, an old woman is associated with a car. This external connection offers no meaningful semantic association, but does provide a visual association. Again, the use of visual imagery is responsible for an improvement over the rote method.

The ease of using the keyword method seems to be variable. Generally, subjects are provided with keywords; providing them facilitates use of the method. In normal reading and listening, however, keywords are not automatically supplied, and especially for abstract words, the keywords may be hard for students spontaneously to generate. This is not, however, to say that the keyword method will not work for abstract words (see Delaney, 1978; Pressley, Levin, & Miller, 1981b). The method requires some mental effort to generate and use the keyword for each new word, and also assumes that somehow the individual has a definition of the word to be learned. As noted earlier in our discussion of the rote method, this assumption is rarely true. Thus, the keyword method, like the rote method, is less useful in everyday situations than in academic situations where preformed word lists are explicitly provided for the learner.

The keyword method has been empirically tested by Levin, Pressley, and their colleagues (Levin, McCormick, Miller, Berry, & Pressley, 1982; Levin, Pressley, McCormick, Miller, & Shriberg, 1979; Pressley & Levin, 1981; Pressley, Levin, & Delaney, 1982; Pressley, Levin, Kuiper, Bryant, & Michener, 1982; Pressley, Levin, & Miller, 1981a, 1981b, 1982). The method has been compared both to control conditions in which no explicit instruction is given (and in which subjects presumably employ rote learning) and to several variants of the learning-from-context method to be described. The outcome of these studies is that the keyword method is at least as effective as, and usually more effective than, the alternative methods against which it has been compared. This finding holds up over age levels and across some variation in word types. But Hall, Wilson, and Patterson (1981), using simultaneous rather than the usual successive presentation of (Spanish) vocabulary words, but also group rather than individual presentation of words, found free study to be superior to keyword study. The data thus appear not to be wholly conclusive. Moreover, we shall claim that the extant tests of the learning-from-context method are not wholly adequate.

Learning from Context

The learning-from-context approach to vocabulary teaching has its theoretical origins in research on incidental learning of vocabulary. Werner and Kaplan (1952) proposed that children acquire the meanings of words primarily in two ways: by explicit reference to names of objects and concepts, and by implicit contextual reference. Their now-famous monograph examined how learning in context takes place for children ranging from 8 to 13 years of age. This early work has given rise to many subsequent studies of contextual learning of vocabulary (e.g., Cook, Heim, & Watts, 1963; Daalen-Kapteijns & Elshout-Mohr, 1981; Keil, 1981; Marshalek, 1981).

In typical studies of learning from context, individuals are presented with several sentences that employ the word to be learned in ways that help elucidate the word's meaning. The individual is required to infer the word's meaning, and then often to use the word in a sentence that shows comprehension of the meaning but is different from the given sentences. An example of this approach is given by Gipe (1979) for the word *barbarian:* "The *barbarian* kicked the dog and hit the owner in the nose. Any person who acts mean to anybody or to anything is a *barbarian. Barbarian* means a person who is very mean (p. 630)." After reading these sentences, the individual is asked to write something that a *barbarian* might do at a dinner table. Gipe's example, especially in the last given sentence, is more directive regarding the meaning of *barbarian* than is sometimes the case, which may account for the success of the context method in Gipe's work (to be discussed below).

The learning-from-context method, like the keyword method, fares reasonably well on our armchair criteria. The method can be strong with respect to facilitating the development of an internally connected cognitive structure for the meaning of the word because one is exposed to some of the richness of the word in its various possible uses in real-world contexts. The individual is thus encouraged to learn the shadings of meaning associated with the word, and to interconnect these meanings by relating the various presented sentences. However, the learning-from-context method can also have some problems with respect to internal connectedness, because the degree to which an individual can form an internally connected representation depends on the ability of the individual and the facilitation provided by the context. Because most occurrences of words in context are

less directive as to the word's meaning than is the case in the example from Gipe (1979), a student may get only a rough idea of the word's meaning, especially if the student is unskilled in using context. This potential problem could be overcome, however, as we will argue later, by training people in how to use context.

The method is especially strong in its facilitation of the development of an externally connected cognitive representation of word meaning. The given sentences generally relate the new word to a variety of other concepts, so that it is possible to understand how the concept represented by the word interacts with other concepts. Indeed, it is from its emphasis on the interrelation of the word to the conceptual environment surrounding the word that the method of learning-from-context takes its name. If the given sentences are highly imageable, then the learner is provided with the additional benefit of being able to supplement verbal learning with visual imagery. For example, the sentence, "The barbarian kicked the dog and hit the owner in the nose," potentially provides a rich visual image to associate with the meaning of the word *barbarian*.

The ease of use of the learning-from-context method depends upon the degree of facilitation provided by the context in which the word occurs: Some contexts (such as Gipe's) essentially define the word; others leave its meaning murky. Training contexts will probably tend to be more defining than natural contexts. Thus, vocabulary building programs may not always provide the learner with realistic expectations regarding the ease of learning from context in real-world verbal environments. But the learning-from-context method does have the advantage that it can always be used (with greater or lesser success) in real-world environments that provide words in context but that rarely give explicit definitions.

As noted earlier, Gipe (1979) compared learning from context to two rote methods and a category-learning method. The third- and fifth-graders in the study did better in the learning-from-context condition than in any of the other conditions. This finding must at present be interpreted with some caution because it is based only on a single data set whose replicability is not clear. But Pressley *et al.* (1982) compared several variants of the context method to the keyword method, and found that the keyword method worked better for college students. The conclusion they would have us draw is that the keyword method is superior, at least when explicit definitions can be available. The question therefore arises of whether the very popular learning-from-context method has been oversold. Our own belief is that current versions of the method may well have been oversold, but that better versions can be devised. We are not arguing that *any single* method of teaching vocabulary is best for all purposes. We do think, however, that the learning-from-context method can be an important component in a

comprehensive vocabulary teaching program. In the next section, we discuss modifications of the learning-from-context method, and explain our belief in its potential.

A THEORY OF LEARNING FROM CONTEXT

A vocabulary training program that uses learning from context is incomplete if it fails to provide instruction in how to use the context. According to the theory to be proposed here, utilization of context is a distinctly nontrivial feat. The instructional programs tested by Pressley *et al.* (1982) were incomplete, as were many others (but not all others; see e.g., Johnson & Pearson, 1978). In the keyword method, one is specifically taught how to form and use keywords. Fair comparison of this method to the context method requires comparable instruction in the context method regarding how context can be used to infer word meanings. Although individuals can be expected to have some ideas about how to use context, just as they can be expected to have some ideas about how to use images, these ideas will almost certainly be incomplete and, in some cases, may be incorrect. Thus, we propose here the specific cues we believe individuals should be taught to use prior to their actual learning from context, and certainly prior to their being tested in research on the effectiveness of the method. We divide our system of cues into two subsystems: *external cues*, found in the context surrounding the word, and *internal cues* provided by the morphemes within the word (see also O'Rourke, 1974). Some of the cues draw directly upon aspects of the text; others draw upon the usefulness of these in various situations.

Decoding of External Context

By external context, we refer to the verbal context surrounding a given new word. The methods of learning from context that we have discussed all have dealt exclusively with external context.

Textual Cues

Our model specifies the particular kinds of cues that individuals can use to figure out the meanings of new words from the contexts in which the words are embedded. Not every cue can be applied in every situation, and

even when a given cue can be utilized, its usefulness will be moderated by factors to be described shortly.

Context cues are hints contained in a passage that can facilitate, but might also impede, deciphering the meaning of an unknown word. We propose that context cues can be classified into eight categories, depending upon the kind of information they provide (cf. Ames, 1966; McCullough, 1958; Miller & Johnson-Laird, 1976; and Sternberg, 1974). Our eight categories are:

1. Temporal cues. Cues regarding the duration or frequency of *X* (the unknown word), or regarding when *X* can occur; alternatively, cues describing *X* as a temporal property (such as a duration or frequency) of some *Y* (usually a known word in the passage).
2. Spatial cues. Cues regarding the general or specific location of *X*, or possible locations in which *X* can sometimes be found; alternatively, cues describing *X* as a spatial property (such as general or specific location) of some *Y*.
3. Value cues. Cues regarding the worth or desirability of *X*, or regarding the kinds of affects *X* arouses; alternatively, cues describing *X* as a value (such as worth or desirability) of some *Y*.
4. Attribute cues. Cues regarding the properties of *X* (such as size, shape, color, odor, feel, etc.); alternatively, cues describing *X* as a descriptive property (such as shape or color) of some *Y*.
5. Functional cues. Cues regarding possible purposes of *X*, actions *X* can perform, or potential uses of *X;* alternatively, cues describing *X* as a possible purpose, action, or use of *Y*.
6. Enablement cues. Cues regarding possible causes of or enabling conditions for *X;* alternatively, cues describing *X* as a possible cause or enabling condition for *Y*.
7. Class cues. Cues regarding one or more classes to which *X* belongs, or other members of one or more classes of which *X* is a member; alternatively, cues describing *X* as a class of which *Y* is a member.
8. Equivalence cues. Cues regarding the meaning of *X*, or contrasts (such as antonymy) to the meaning of *X;* alternatively, cues describing *X* as the meaning (or a contrast in meaning) of some *Y*.

An example of the use of some of these cues in textual analysis might help concretize our descriptive framework. Consider the sentence, "At dawn, *sol* arose on the horizon and shone brightly." This sentence contains several external contextual cues that could facilitate one's inferring that *sol* refers to the sun. "At dawn" provides a temporal cue, describing when the arising of *sol* occurred; "arose" provides a functional cue, describing an action that *sol* can perform; "on the horizon" provides a spatial cue, describing where the arising of *sol* took place; "shone" provides another

functional cue, describing a second action that *sol* can do; finally, "brightly" provides an attribute cue, describing a property (brightness) of the shining of *sol*. With all these different cues, it is no wonder that most people would find it easy to figure out that *sol* refers to the sun.

We make no claim that the categories we have suggested are mutually exclusive, exhaustive, or independent. Nor do we claim that they in any sense represent a "true" categorization of context cues. We have, however, found this classification scheme useful in understanding people's strategies in deriving meanings of words from context. Collectively, they are some tools that comprise a person's competence in inferring word meanings.

Factors Moderating the Usefulness of the Textual Cues

Consider some moderating variables that can affect, either positively or negatively, the application of the textual cues in a given situation.

1. Number of occurrences of the unknown word. A given kind of cue may be absent or of little use in a given occurrence of a previously unknown word, but may be present or of considerable use in another occurrence. Multiple occurrences of an unknown word increase the number of available cues and can actually increase the usefulness of individual cues if readers integrate information obtained from cues surrounding the multiple occurrences of the word. For example, the meaning of a given temporal cue may be enhanced by a spatial cue associated with a subsequent appearance of the unknown word, or the temporal cue may gain in usefulness if it appears more than once in conjunction with the unknown word. On the other hand, multiple occurrences of an unfamiliar word can be detrimental if the student has difficulty integrating the information gained from cues surrounding separate appearances of the word, or if the student notices only peripheral features of the unfamiliar word.

2. Variability of contexts in which multiple occurrences of the unknown word appear. Different types of contexts, such as different topics or writing styles, and different contexts of a given type, such as two illustrations within a given text of how a word can be used, are likely to supply a variety of information about the unknown word. Variability of contexts increases the likelihood that a wide range of cues will be supplied about a given word, and thus increases the probability that a reader will get a full picture of the scope of a given word's meaning. In contrast, mere repetition of an unknown word in essentially identical contexts is unlikely to be helpful, because few or no really new cues are provided regarding the word's meaning. Variability can, however, present a problem in some situations and for some

individuals: If the information is presented in a way that makes it difficult to integrate across appearances of the word, or if a given individual has difficulties in making such integrations, then the variable repetitions may actually obfuscate rather than clarify the word's meaning. In some situations and for some individuals, the overload of information may reduce rather than increase understanding.

3. Importance of the unknown word to understanding the context in which it is embedded. If a given unknown word is judged to be necessary for understanding the surrounding material in which it is embedded, the student's incentive for figuring out the word's meaning is increased. If the word is judged to be unimportant to understanding what one is reading or hearing, one is unlikely to invest much effort in figuring out what the word means. Although in explicit vocabulary building situations the individual may always be motivated to infer word meanings, in real-world situations, there may be little such motivation. Thus, a question of interest from the perspective of our model is the extent to which an individual reader can recognize which words are important to a passage, and which are not. In some cases, it may not be worth the individual's time to figure out a word's meaning. It is possible to distinguish between importance at different levels of text organization. We distinguish between the sentence and paragraph levels, that is, the importance of a given word to understanding the meaning of the sentence in which it occurs, and to understanding the meaning of the paragraph in which it occurs. The ability to recognize the importance of a word to understanding context may be seen as a form of comprehension monitoring (Collins & Smith, 1982; Flavell, 1981; Markman, 1977, 1979, 1981).

4. Helpfulness of surrounding context in understanding the meaning of the unknown word. The helpfulness of a cue depends upon the nature of the word whose meaning is to be inferred and upon the location of the cue in the text relative to the word whose meaning is to be inferred. For example, a temporal cue describing when a *diurnal* event occurs would probably be more helpful than a spatial cue describing where the event occurs in aiding an individual to figure out that *diurnal* means *daily*. In contrast, a spatial cue would probably be more helpful than a temporal cue in figuring out that *ing* means *a low-lying pasture*. It is unrealistic to expect a given kind of cue to be equally helpful in figuring out the meanings of all words. Although the nature of the word is important in these examples, the location of the cue can also be important. If a given cue occurs close to the word whose meaning is unknown, then it is probably likely to be recognized as relevant to inferring the unknown word's meaning. If the cue is located far from the unknown word, the relevance of the cue may never be recognized. The helpfulness of context cues may also be mediated by whether the cue comes before or after the unknown word. Rubin (1976), for example, found that context occurring before a blank was more helpful to figuring out what word should go in the blank than was context occurring after the blank.

5. Density of unknown words. A reader who is confronted with a high density of previously unknown words may be overwhelmed and be unwilling or unable to use available cues to best advantage. When the density of unknown words is high, relatively more text is occupied by unknown and therefore unhelpful words (for figuring out meanings of other words), and it can be difficult to discern which of the available cues apply to which of the unknown words. In such a situation, utilization of a given cue may depend upon figuring out the meaning of some other unknown word, in which case the usefulness of that cue is decreased.

6. Concreteness of the unknown word and the surrounding context. Concrete concepts are generally easier to apprehend, in part because they have a simpler meaning structure. Familiar concrete concepts such as *tree, chair,* and *pencil* are relatively easy to define in ways that would satisfy most people, but familiar abstract concepts such as *truth, love,* and *justice* are extremely difficult to define in ways that would satisfy large numbers of people. Moreover, the ease of inferring the meaning of the word will depend upon the concreteness of the surrounding description. A concrete concept such as *ing* might appear more opaque in a passage about the nature of reality than in a passage about the nature of food sources; similarly, an abstract concept such as *pulchritude* (i.e., *beauty*) might be more easily apprehended in a passage about fashion models than in one about eternal versus ephemeral qualities.

7. Usefulness of previously known information in cue utilization. Inevitably, the usefulness of a cue will depend upon the extent to which past knowledge can be brought to bear upon the cue and its relation to the unknown word. The usefulness of prior information will depend in large part upon a given individual's ability to retrieve the information, to recognize its relevance, and then to apply it appropriately.

Decoding of Internal Context

By internal context, we refer to the morphemes within a word that combine to give the word its meaning.

Textual Cues

What particular kinds of context cues can individuals use to figure out the meanings of new words? Because internal context is much more impoverished than is external context, the diversity of kinds of cues is much more restricted (see, e.g., Johnson & Pearson, 1978; O'Rourke, 1974). The four kinds of cues constituting our scheme are:

1. Prefix cues. Prefix cues generally facilitate decoding of a word's meaning. Occasionally, the prefix has a special meaning or what appears to be a prefix really is not (e.g., *pre-* in *predator*); in these cases, the perceived cue may be deceptive.
2. Stem cues. Stem cues are present in every word, in the sense that every word has a stem. Again, such cues may be deceptive if a given stem has multiple meanings and the wrong one is assigned.
3. Suffix cues. Suffix cues, too, generally facilitate decoding of a word's meaning; in unusual cases where the suffix takes on an atypical meaning, or in cases where what appears to be a suffix really is not (e.g., *-s* in *dais*), the perceived cue may be deceptive.
4. Interactive cues. Interactive cues are formed when two or even three of the word parts described above convey information in combination that is not conveyed by a given cue considered in isolation from the rest of the word.

The usefulness of internal cues in decoding meaning can be shown by an example. Suppose one's task is to infer the meaning of the word *thermoluminescence* (see Just & Carpenter, 1980). The word is probably unfamiliar to most people. But many people know that the prefix *thermo-* refers to heat, that the root *luminesce* is a verb meaning *to give off light,* and that the suffix *-ence* is often used to form abstract nouns. Moreover, a reasonable interpretation of a possible relation between *thermo-* and *luminesce* would draw on one's knowledge that heat typically results in some degree of light. Note that this cue derives from an interaction between the prefix and stem. Neither element in itself would suggest that the light emitted from heat would be a relevant property for inferring word meaning. These cues might be combined to infer that *thermoluminescence* refers to the property of light emission from heated objects. This inference would be correct.

We make no claim that this simple (and unoriginal) parsing of internal contextual cues represents the only possible classification scheme, although we think it represents one plausible parsing. Collectively, internal cues provide a basis for a person to exercise his or her competence in inferring word meanings.

Factors Moderating the Use of the Textual Cues

Again, consider some relations between a previously unknown word and the context in which it occurs that moderate the usefulness of cues. Our model includes five variables that affect cue usefulness. These variables are similar but not identical to those considered for external context:

1. Number of occurrences of the unknown word. In the case of internal contextual analysis, the context cues are the same on every presentation of a word. However, one's incentive to try to figure out the word's meaning is likely to be increased for a word that keeps reappearing.
2. Importance of the unknown word to understanding the context in which it is embedded. Again, a word that is important for understanding the context in which it occurs is more likely to be worth the attention it needs for figuring out its meaning. One can easily skip unimportant words, and often does. As before, importance can be subdivided into the importance of the unknown word to the sentence and to the paragraph in which it is embedded.
3. Density of unknown words. If unknown words occur at high density, one may be overwhelmed at the difficulty of having to figure out so many words and give up. Yet, it is possible that the greater the density of unfamiliar words in a passage, the more difficulty the reader will have in applying external context cues, and hence the more important will be internal context cues. A high density of unfamiliar words may encourage word-by-word processing and a greater focus on cues internal to the unfamiliar words. This performance variable interacts with the next one to be considered.
4. Density of decomposable unknown words. Because internal decontextualization may not be a regularly used skill in many individuals' repertoires, individuals may need to be primed for its use. The presence of multiple decomposable unknown words can serve this function, helping the individual become aware that use of internal context cues is possible and feasible. In this case, the strategy is primed by repeated cues regarding its applicability.
5. Usefulness of previously known information in cue utilization. Again, one's knowledge of words, word cognates, and word parts will play an important part in use of internal cues. The sparsity of information provided by such cues almost guarantees an important role for prior information.

To summarize, our theory of learning from context specifies kinds of external and internal cues that individuals can use in inferring meanings of previously unknown words. It also identifies variables that affect how well these cues can be utilized in actual attempted applications. We have out-

lined a set of variables that (according to our theory) might be present in a given external or internal context. However, these variables are not sufficient for describing *actual* utilization of context. We have therefore specified additional variables that will determine the differential application of the set of textual cues both across texts for a single individual, and within a single text across individuals.

Tests of the Theory

Our theory of learning from context has been tested in its role as a description of what people actually do in inferring meanings of words from context, but not in its role as a prescriptive model for teaching vocabulary and vocabulary-building skills. We plan to conduct research on the prescriptive model among Venezuelan school children. The research on the descriptive model has been conducted among United States students in junior high school (internal context), high school (external context), and college (internal context). These tests are described in detail in Sternberg, Powell, and Kaye (1982), Sternberg and Powell (in press), and Kaye and Sternberg (1981).

The theory of external decontextualization was tested by asking 123 students to read passages of roughly 125 words in length that contained embedded within them from 1 to 4 extremely low-frequency words. A given word could be repeated either within a given passage or between multiple passages, but not both. The students' task was to define as best they could each of the low-frequency words occurring within each passage (except for multiple occurrences of a single word within a given passage, which required only a single definition). Ratings of various competence and performance variables as they applied to the low-frequency words in the set of 32 passages were used to predict ratings of definition goodness via linear multiple regression. Separate regressions were computed for each of four types of passage style, because preliminary analyses showed regression weights to be different in each case. At issue was how much of the variance in the difficulty of the low-frequency words could be accounted for by a model combining the competence and performance variables. The combined model accounted for 84% of the variance in the difficulty of words in literary passages, for 55% of the variance in the difficulty of words in newspaper passages, for 72% of the variance in the difficulty of words in science passages, and for 60% of the variance in the difficulty of words in history passages. All of these values of R^2 differed significantly from zero. The mean rated quality of subjects' written definitions on the learning-from-context task were correlated with scores on standardized tests of intelligence, vocabulary, and reading comprehension. Correlations for the various passage types combined were .62 with IQ, .56 with vocabulary, and .65 with reading comprehension, suggesting that the task provided a good measure of verbal skills. Correlations with standardized tests were quite similar for learning-from-context scores computed for the individual passage types.

The theory of internal cue use was tested by asking 58 secondary-school students and 50 college-level students to figure out meanings of words such as *exsect* and *promove* on the basis of internal context cues. All of the 58 words were real, but of very low frequency. All words were prefixed, but none were suffixed. Subjects were tested on the meanings of the words via a multiple-choice format, where one option was totally correct (e.g., *to cut out* for *exsect*), one option was correct with respect to the prefix but not the stem (e.g., *to throw out* for *exsect*), one option was correct with respect to the stem but not the prefix (e.g., *to cut against* for *exsect*), and one option was totally incorrect (e.g., *to throw against* for *exsect*). A hierarchical multiple regression procedure was used to predict scores both on the learning-from-context cognitive task and on meaningfulness ratings of stems and of prefixes. The results suggested that college students, but not high-school students, were able to use internal context to help infer word meanings. Values of R^2 for the college students were generally lower than in the external context study. Significant R^2 values for the college students ranged from .32 to .61. A few of the analyses failed to yield significant results.

To summarize, the data we have collected so far suggest that our theory has some promise in accounting for how individuals learn from context. Obviously, the tests are incomplete, and are presented only as preliminary indications of theoretical validity. We believe that the results are sufficiently auspicious to encourage further tests of the theory, and to suggest that the theory may indeed have implications for how vocabulary can be taught. These implications are discussed next.

INSTRUCTIONAL PACKAGE FOR TRAINING IN VOCABULARY-BUILDING SKILLS

In this final section, we describe the tentative format of a training program based upon the theory we have proposed. The program seeks to increase both vocabulary and, more importantly, verbal comprehension skills needed for vocabulary building (see Curtis, 1981; Sternberg *et al.*, 1982). This training program has not yet been implemented, and, indeed, is still in its plan-

ning stage. However, our present thinking suggests that the final program might look something like the following.

The training program will consist of three parts. The first and second parts of the program teach the use of the competence cues for internal and external contexts, respectively. The third part of the program teaches a general strategy for using context to infer the meanings of unfamiliar words; this part teaches the application of performance cues to the already learned competence cues. Overall, the program relies heavily on the use of examples and guided practice for teaching each type of cue, and for teaching the general strategy for combining internal and external competence and performance cues. The program is intended for secondary-school students.

Internal Context

The internal-context module consists of a four-step sequence for learning each cue in the competence model and how to use it. There is a heavy emphasis upon teaching specific roots and affixes.

1. Introduction to the cue. A given type of cue, for example, prefix, suffix, or root, is named and described.
2. Exemplification of the cue. Examples of the kind of cue and how it can be used are presented.
3. Cue training. A given affix or stem, according to the cue being trained, is presented and defined. Examples of the word part are given embedded in real words, and the meanings of these words plus the relation of the cue to the meanings are given. Students are given practice in recognizing and constructing word meanings on the bases of the cue embedded in real words and of knowledge about the other word parts. Emphasis is placed on logical integration of word parts. Further examples of the word part are given in conjunction with other previously learned word parts. The student must use all of his or her prior knowledge based upon learning of word parts to infer the meaning of the new word. This step is cycled through for as many different word parts as are relevant for teaching of a given cue. For example, it would be cycled through 20 times if one wished to teach 20 different prefixes.
4. Cue review. Each of the specific instantiations (e.g., individual prefixes) of the cue are reviewed via re-presentation of meaning and possible use in decontextualization. This step occurs only after all instantiations of a given cue have been taught.

External Context

The external-context module consists of a five-step sequence for learning each cue in the competence model.

1. Introduction to cue. A given cue is named and described.
2. Exemplification of cue. Examples of the use of the cue are presented.
3. Cue finding. Short passages with single low-frequency words are presented exemplifying the given cue; location of the cue with respect to the low-frequency word is varied. Students must locate the cue in each passage. Practice is provided for both single and multiple appearances of a cue type within a passage.
4. Cue utilization. Students are given practice in recognizing correct inferences drawn from the cue, and in actually finding and utilizing cues to infer features of unfamiliar words.
5. Multiple cue utilization. Students are given practice in locating and using multiple types of external context cues presented for a given unfamiliar word in a single passage. This step progresses from the recognition of defining features inferred from external cues, to construction of definitions using external context cues.

General Strategy for Context Usage

The general strategy for context usage is derived by combining the textual cues and variables affecting use of cues in actual specific contexts. The following presentation follows the format needed for a training module, rather than the format outlined in our presentation of our theory; that is, specific performance components are combined for the student into a suggested optimal strategy for using context, rather than being presented separately. However, the performance components involved in some of the steps are listed parenthetically. In the general strategy training module, the student is guided through the following seven steps for applying internal and external textual cues to infer the meaning of an unfamiliar word.

1. Attempt to infer the meaning of the unknown word from the general context preceding the word. (This step combines the mediating variables of helpfulness of the surrounding context, concreteness of the word and its context, and application of previous knowledge.) The student is guided in identifying and summarizing the main ideas expressed in the passage up to the encounter with the unfamiliar word, and in making hypotheses, based on this general context and on his or her world knowledge, as to the domain to which the word's meaning might apply.

2. Read on: Attempt to infer the meaning of the unfamiliar word from the general context that follows the word. (This step combines the same mediating variables as the preceding one: helpfulness of the surrounding context, concreteness of the word and its context, and application of general world knowledge.) The student is guided in recognizing what additional general ideas have been presented in the part of the passage following the unknown word, and in reassessing the main ideas of the sentence or passage involved.

3. Attempt to infer the meaning of the unknown word by looking at the word parts. The student is reminded of the internal textual cues trained in the first of the context training modules.

4. Judge whether or not it is necessary to understand the word's meaning in order to understand the passage or the sentence in which it is used. If it is necessary, estimate how definite a definition is required; if it is not necessary, further attempts to define the word are optional. (The performance variables, number of occurrences of the unknown word, density of the unfamiliar words, and importance of the word to passage and sentence understanding, come into play in this step of the general strategy.) This step teaches the student to assess his or her comprehension, and if a lack of comprehension is occurring, to locate the source of the trouble. Students are asked to locate and attempt to connect the key concepts in the passage. Practice is given in recognizing inconsistencies and abrupt transitions in the main ideas expressed. Students are taught to backtrack in the case of poor understanding, and to attempt to decide whether the poor understanding was due to careless reading or to inability to understand a central concept expressed by an unfamiliar word.

5. Attempt to infer the meaning of the unknown word by looking for specific cues in the surrounding context. In this step the student is reminded of the external textual cues taught in the preceding module.

6. Attempt to construct a coherent definition, using internal and external cues, as well as the general ideas expressed by the passage and general world knowledge. (A large number of the variables are combined in this step of the general strategy, including the number of occurrences of the unknown word, the variability and helpfulness of the contexts, the concreteness of the unknown word and its surrounding context, the density of the unfamiliar words, and the application of previous world knowledge.) Students are introduced to the concept of internal connectedness of a definition. They are then given practice in recognizing definitions that are not internally consistent, and in attempting to reconcile such definitions by (1) re-checking to see that features were correctly inferred from the internal and external contexts, and (2) marking those features that are unreconcilable as tentative information.

7. Check definition to see if meaning is appropriate for each appearance of the word in the context, and with general knowledge concerning the passage. (Here the performance variables of number of occurrences, variability of contexts, and application of world knowledge, are combined.) Students are introduced to the concept of external connectedness of a definition. They are given practice in applying a definition to multiple contexts, and in recognizing the need for, and implementing, modifications in the definition when appropriate. If modifications are required, the student is instructed to recheck for internal connectedness of the modified definition.

Following the presentation of the general strategy training module, students are given practice in internal and external context cue finding and utilization. Emphasis in this practice is on integrating cues from multiple sources. Students are asked explicitly to describe how they use the cues in different instances, as well as to provide definitions. Along with the computer-assisted practice, students are asked to find examples of unknown words in their everyday reading, and to share with other class members the strategies they used to infer the meanings of the unknown words, and the criteria they used for evaluating the necessity of defining the word and for assessing internal and external connectedness.

To summarize, we have presented an outline of a computer-assisted training program for the development of vocabulary-building skills. We believe that this theoretically based method, used in combination with other vocabulary-building methods (such as rote learning and the keyword method), can provide potentially significant benefits to students learning to learn vocabulary. The thrust of our work has been primarily theoretical and pedagogical rather than technological: We do not present our program as a new innovation in computer-assisted instruction. Yet, we see such instruction as providing a way of presenting the instructional package in an individualized and interesting way.

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