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Technical Report No. 528

UNDERSTANDING DEFINITIONS

Judith A. Scott
Simon Fraser University

William E. Nagy
University of Illinois at Urbana-Champaign

April 1991

Center for the Study of Reading

TECHNICAL REPORTS

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The work upon which this publication was based was supported in part by the Office of Educational Research and Improvement under Cooperative Agreement No. G0087-C1001-90 with the Reading Research and Education Center. The publication does not necessarily reflect the views of the agency supporting the research.

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Abstract

A study examined children's misunderstandings in using definitions to comprehend the meaning of a new word. Upper elementary students have been found to have difficulty using definitions for unknown words when they are asked to write sentences containing those words (Miller & Gildea, 1987; Miller, 1986b; Deese, 1967). Miller and Gildea hypothesize that students' errors are the result of a substitution strategy: The student finds a familiar word or phrase in the definition of the new word, creates a sentence using that word or phrase, and then substitutes the new word in place of the old word in the sentence. Students appear to treat fragments taken from the definition without regard to its overall structure as suitable candidates for the substitution process.

In this study, fourth and sixth grade students were asked whether the way a nonce word was used in a sentence was compatible with a definition given for that word. The sentences either used the new word correctly according to the definition (correct); used the word incorrectly, the sentence being consistent with a meaning based on a fragment of the definition but not with the definition as a whole (fragment selection error); or used the new word incorrectly with no semantic overlap between the sentence and the definition (no semantic overlap). This task allowed us to determine whether errors based on the selection of only a piece of a definition as the meaning for a new word are a artifact of the difficulty of generating sentences from definitions, or whether such errors occur in a broader range of tasks and represent a more general, and hence more significant, problem.

In a first experiment, fourth graders were found to make errors analogous to those observed by Miller and Gildea, treating fragments of definitions as representing the meaning of the word defined. The tendency to make such errors was essentially the same at all levels of reading ability.

A second experiment examined the effect of definitional format on students' ability to determine whether a sentence appropriately reflects the whole definition of a new word or only a fragment of that definition. The three definitional formats studied were conventional definitions, conventional definitions plus example sentences, and nonconventional definitions in a format used in some recent children's dictionaries. Results indicate that students in both grades chose inappropriate sentences using fragments of definitions with regularity and that this type of error was not conditioned by definitional format.

UNDERSTANDING DEFINITIONS

The focus of the research outlined in this report is dictionary definitions and how children use and misuse the information in them when they are trying to figure out the meaning of an unfamiliar word. Although much vocabulary growth takes place through incidental learning of word meanings from context (Nagy, Anderson, & Herman, 1987), definitions play a central role in classrooms, particularly in vocabulary instruction (Shake, Allington, Gaskins, & Marr, 1987). From their earliest years of schooling, students learn to turn to the dictionary as the voice of authority for language learning. By the time students are in upper elementary school, they are expected to be able to use dictionaries and glossaries on their own to figure out the meanings of new words.

The experiments described in this report indicate that although definitions are central in teaching word meanings, there is good reason to believe that understanding and using the information in definitions is a complex process, and that this process breaks down more often than is generally recognized. In this report, we will discuss problems that have been identified when children try to process the information in definitions and explore possible causes of these problems. We will describe two experiments and then offer recommendations for future studies in this area.

Studies of Children's Processing of Definitions

Experimental data bearing most directly on children's processing of information in definitions is found in the work of Deese (1967), Miller (1986a, 1986b), Miller and Gildea (1987), and McKeown (in press). Miller and Gildea (1987) examined 2,000 sentences written by fifth and sixth graders, and documented the types of errors that students commonly make when they are asked to write a sentence from the definition of a new vocabulary word. Although Miller and Gildea found this exercise to be insightful as a research technique, they concluded that the pervasiveness of certain types of errors made the exercise of writing sentences from definitions pedagogically useless.

In the studies by Miller and Gildea, and in findings reported earlier by Deese (1967), the common school task of creating sentences from definitions for unfamiliar words often resulted in curious sentences such as "My family erodes a lot." Miller and Gildea hypothesize that such sentences are the result of a particular strategy adopted by students, which they described as a substitution strategy: The student finds a familiar word or phrase in the definition of the new word, creates a sentence using that word or phrase, and then substitutes the new word in its place. Thus, the sentence "My family erodes a lot" was presumably generated when a student found "eat out or eat away" in the definition of *erode* and thought of the sentence "My family eats out a lot" (Miller, 1986b).

There are two types of problems students might have that would lead to the error in this example. In part, the error is due to the selection of the wrong sense of an ambiguous word or phrase. In this case, the student thought of the wrong meaning for the phrase "eat out." Miller (1986b) suggests that the substitution errors found in these studies are the result of an overextension of a word's meaning, much like the overextensions found in the word learning strategies of young children (Bowerman, 1982; Carey, 1978; Clark, 1982). Thus, this type of error might be considered to be primarily a "sense selection error."

On the other hand, such an error may also reflect failure to appreciate the overall structure of the definition; in taking a familiar word or phrase as the basis for the substitution strategy, the student has selected only a fragment of the definition, without regard to its overall structure. We will label this kind of problem in processing definitions "fragment selection errors."

Some of the errors cited by Miller and Gildea show clearly that students' problems with definitions are not simply the result of incorrect sense selection. Rather, they involved fragment selection errors; that

is, students often focus on only a fragment of a definition, apparently arbitrarily chosen, and treat that as the meaning of the word defined. For example, one student, given the definition of *usurp* as "to seize and hold (power, position, or authority) by force and without right," created the sentence "He has the usurp to put you in jail" (Miller & Gildea, 1985). This example clearly reflects the selection of a fragment of a definition as the source of the problem, rather than the misinterpretation of a polysemous word. The senses of *power, position*, and *authority* in the definition are the same as those apparently used for *usurp* in the sentence; the problem is that the student has misinterpreted, or ignored, the structure of the definition.

Sense selection errors and fragment selection errors are not mutually exclusive as explanations of the strange sentences students often generate in a writing-sentences-from-definitions task. However, we feel that fragment selection errors reflect a more basic, and serious, problem.

First of all, fragment selection errors are likely to be a contributing factor to incorrect sense selection. That is, one of the reasons a student might select the wrong sense of a word or phrase in a definition is that the student was focusing only on a fragment of the definition. Attention to the overall structure of the definition should, in principle, provide enough context for the student to select the correct sense.

More crucially, the selection of a fragment from a definition indicates disregard for crucial information in a definition, and lack of important knowledge about definitions, both of which would be necessary to use the definition successfully. The substitution strategy outlined by Miller and Gildea may work to approximate the meaning of a new word if students are able to select an appropriate synonym or superordinate from the definition. However, the prevalence of errors such as in the example above, in which the student selected "power" for the meaning of *usurp*, indicates that at least some students may regard any recognizable fragment from a definition as a suitable candidate for the meaning of a new word.

Extracting a familiar word or phrase from a definition may work well enough on a multiple-choice vocabulary test, or for vocabulary worksheets, to give the impression that the student has a reasonable grasp of the word meanings that are to be learned. This illusion of understanding is all the more likely to occur if definitions are extremely short, as they often are in glossaries and vocabulary worksheets. However, with the somewhat longer definitions typically found in school dictionaries, students who rely on such a strategy are unlikely to be successful at any task that requires real understanding of a definition. This would include not only production tasks, for example, writing sentences for new words based on their definitions, but also comprehension tasks, such as using the dictionary to understand a sentence containing an unfamiliar word.

The evidence from errors in sentence generation tasks, as discussed by Miller and Gildea, suggests that children's problems reflect not just incorrect guesses about the intended meanings of ambiguous words, but a fundamental inability on the part of upper elementary students to deal with the structure of moderately complex definitions such as those typically found in school dictionaries. Given the pervasive role of definitions in word learning, this is an issue of substantial pedagogical importance.

The Structure of Definitions

A dictionary definition is a description of a word meaning. It is an interpretation of the meaning of a word based on a large sample of instances in which the word has been used. That is, the least common denominator of meaning has been abstracted from the numerous ways that the word has been used in the past (Deighton, 1959; Landau, 1984).

The classical form of a definition consists of a "genus" word designating a superordinate class to which the word being defined (the definiendum) belongs, and the "differentia" that distinguishes it from other

words in the same class (Ayto, 1983). Thus, *bachelor* is defined as "a man (genus) who has not married (differentia)."

Knowing the classical form of a definition allows a learner to place the new word in an appropriate semantic category. Disregarding this convention could result in the selection of an inappropriate fragment of a definition as the meaning of a new word.

The current practice of lexicography is largely the result of tradition that has generally proceeded in a theoretical vacuum (Wierzbicka, 1985) without regard for the cognitive processes involved in using definitions. Many of the characteristics and conventions of lexicography have no clear theoretical basis (Geeraerts, 1987). Despite this lack of theory, certain routines, practices, and devices for defining words have developed over the last two centuries (Wierzbicka, 1985; Zgusta, 1971). Most of these practices and characteristics of defining can be traced to the need to conserve space in publishing (Landau, 1984). If there is an average of two lines per definition and the design for a dictionary calls for 160 column-lines per page, it would take 1,875 pages to provide space for 150,000 definitions. Cutting the average number of lines per entry to 1.7 would enable the same number of entries to fit into fewer than 1,600 pages, saving the publishing company an enormous amount of money (Landau, 1984).

In achieving the abstractness and brevity characteristics of dictionary definitions, quite a bit of information about the word is lost. A definition cannot convey all of the information about the meaning of a word that is accessible to people who use the word in everyday language (Aitchison, 1987). For instance, Fodor (1981) points out that the verb *paint* can be defined as

> to cover the surface of (object) with paint. But knocking over a paint bucket and covering the surface of the floor with paint does not constitute painting the floor. Adding an element of intention is still inadequate to capture the meaning of *paint*, because when Michelangelo dipped his brush into Cerulean Blue, he thereby covered the surface of his brush with paint and did so with the primary intention that his brush should be covered with paint in consequence of his having so dipped it. But Michelangelo was not, for all that, painting his paintbrush. (p. 288)

More generally, it has been argued by many that what a word contributes to the meaning of a sentence cannot be limited to a concise set of defining features (e.g., Anderson & Nagy, 1991; Bolinger, 1965; Fodor, Garrett, Walker, & Parkes, 1980).

Defining is a metalinguistic act. It involves the use of language to talk about language (Watson, 1985). Understanding definitions, then, requires reflective attention to language itself--something that is distinct from the normal communicative function of language.

Furthermore, the definitions that are used in school are generally decontextualized. Rather than providing an explanation of what a sentence means, or even what a word means in a particular sentence, school definitions are most likely to try to explain what a word means in general, in the abstract. Thus, teaching word meanings from definitions assumes that definitions and exemplary sentences are self-contained bits of knowledge that can be abstracted from a communicative situation (Brown, Collins, & Duguid, 1989). This in itself is a potential source of difficulty for processing definitions; many studies suggest that the ability to deal with language on an abstract level, separate from communicative intent, develops only gradually, and should not be assumed as linguistic knowledge (Anglin, 1977; Borkowski, Ryan, Kurtz, & Reid, 1983; Nelson, 1985; Olson, 1977).

Problems with Definitions

Recent research on definitions has focused on the characteristics of definitions that prevent them from being useful to learners. Watson (1985) argues that problems with defining and the use of definitions

is due, in a large part, to lack of understanding of the conventions of defining. In other words, she suggests, students gradually learn a schema for defining based on the conventions that are set up by dictionaries.

McKeown (in press) has taken the stance that, even if students have an appropriate schema for definitions, the definitions found in student dictionaries are so poorly written as to be useless. McKeown has rewritten definitions to eliminate some of the problems she identified such as weak differentiation of the target word from other words in the same semantic domain; words with low explanatory power being used to define the target word; use of words with a familiar sense used in an unfamiliar way to define an unknown word; and multiple definitions that offer a disjointed view of the target word. Her revised definitions were, in fact, more helpful to students.

Although we agree with the points raised by Watson (1985) and McKeown (in press), we would suggest an additional problem that might contribute to the difficulties students have in using definitions to understand the meaning of new words. Students need to recognize how a definition fits into the slot of the unknown word in a sentence. However, there are often pieces of information in a definition that don't map directly from the definition to the context sentence. Thus, a verb like *put* might be defined as "to move into or onto a specified position." In the sentence "Put the rabbit in its hutch," the reader must recognize that the hutch *is* the specified position referred to in the definition, and that the sentence does not mean "Move the rabbit into a specified position in its hutch" (Whitcut, 1986).

Integrating information in a definition with the sentence in which the defined word occurs is also complicated by the fact that the object of a verb is often omitted from the defining phrase. Although some dictionaries mark the space where an object logically belongs (e.g., *smell*: to become aware of *something* by using the nose) it is more common to omit the object entirely (*smell*: to become aware of by using the nose). This convention could be problematic if students are unaware of how to relate the object in the sentence to the implicit slot in the definition.

For example, consider the process of integrating a definition for *evade* ("to get away from by trickery") with the context sentence "Alex evaded Ted and went out the back door." The agent in the sentence is Alex, and Ted is the object of the predicate *evade*. To integrate the meaning of the definition for *evade* with the sentence, a reader must recognize that the object is missing from the definition and figure out how the object from the sentence (in this case Ted) fit in with the meaning of the word: Alex (got away from) Ted (by trickery) and went out the back door.

Thus, integrating the information in a definition with the context sentence is a potentially difficult process, involving a complex mapping of elements in the definition onto the structure of the sentence. There is evidence to suggest that this type of mapping may be difficult for younger and less able students. McKeown (1985), studying fifth graders' use of context in inferring the meanings of new words, found that less proficient readers had trouble utilizing the structure of the context sentence to constrain the possible meanings of a new word. Werner and Kaplan (1952) found similar errors.

The task in McKeown's study was to judge whether a particular meaning--and in specific, a one-word synonym for a nonce word--was consistent with a context sentence containing that nonce word. This task is similar to, though simpler than, the problem of integrating a multiword definition with a sentence context. Thus, the findings of McKeown (1985) provide reason to believe that at least some upper-elementary students will have substantial difficulties using definitions to figure out the meanings of sentences containing unfamiliar words.

Miller (1986b) points out that the task of using a dictionary to determine the meaning of an unfamiliar word encountered in context is metacognitively demanding in a number of ways, beyond the problem of integrating the definition with the context sentence:

> Using a dictionary requires considerable sophistication. Interrupting your reading to find an unfamiliar word in an alphabetical list, all the while holding the original context in mind so that you can compare it with the list of alternative senses given in the dictionary, then selecting the sense that is most appropriate in the original context--that is a high-level cognitive task. (p. 415)

In summary, it seems that there are several specific types of knowledge about definitions that would be necessary to use a dictionary to interpret a new word. The task of using a definition to interpret a sentence containing a new word--a prototypical instance of dictionary use--is a complex one, potentially difficult for upper elementary and even older students. The difficulty of the task stems both from the nature of definitions and from the difficulty of integrating information from two sources.

We conducted two experiments to test the hypothesis that fragment selection errors are not an artifact of a production task but are symptomatic of more fundamental problems students have in using the information in definitions to understand the meaning of a new word. Hence, we expect to find analogous errors in comprehension tasks. In these studies we use a task in which children are asked to judge whether a given definition is compatible with the way a word is used in a sentence. The first experiment examines two different task conditions. The second focuses on the conventions of definitional format. In both experiments, the definitions used are definitions of verbs, to avoid the confounding influence of different parts of speech.

Experiment 1

In our first experiment, we used two similar judgment tasks. In one task, a definition was given for a nonce word. Underneath the definition students saw a sentence and were asked whether the given sentence made sense for the given definition. This task can be considered analogous to the sentence-generation task used by Miller and Gildea (1987), except that the sentence was to be judged, rather than produced.

In the other task, the sentence was given first, with the definition below it. Students were asked to judge whether the definition made sense for the new word in the sentence. This task is similar to that of choosing which of several meanings in the definition of a word is appropriate for the context in which the word occurs. In the task used here, there is only one meaning to be considered; but both for this task and the task of selecting among alternative meanings, the student must attempt to integrate the definition with the sentence context and to see whether a coherent meaning for the sentence can be derived.

Method

Subjects

The subjects for this experiment were 60 fourth-grade students (38 males and 22 females) from four classes in a medium-sized Midwestern town. The school that the subjects attended was composed of a mixed population with 65% of the students at or below poverty level, and 43% from minority populations. The abilities of the subjects ranged from the second percentile to the 99th percentile in total language skills and from the 3rd percentile to the 99th percentile in total reading skills as measured by the Stanford 7Plus Achievement Test, Form E, administered by the school district.

Materials

Definitions used in this experiment were based on actual definitions taken from school and children's dictionaries. Some were copied verbatim, or with minor modifications in the direction of simplification. Others were constructed using existing definitions as a model for the form, but making a change in the

content to create a novel meaning. The word being defined was replaced by an English-like nonce word, so that the definition appeared to be the definition for an unfamiliar word. Each definition gave only a single meaning for the word defined.

For each definition, three sentences were constructed. One sentence used the word correctly and two sentences used the word incorrectly. The correct usage sentence was the example sentence given in the original definition in the dictionary, whenever a sentence was given, with the nonce word replacing the original word in the sentence.

One type of sentence that used the word incorrectly, called fragment selection sentences, was constructed by choosing a salient but inappropriate word (i.e., one that did not constitute a synonym for the word defined) from the definition, writing a sentence using that word, and then replacing that word with the nonce word. (In other words, the generation of this sentence type parallels the process by which students are hypothesized to create the type of erroneous sentences noted by Miller and Gildea, 1987).

The other type of sentence that used the word incorrectly, called no semantic overlap sentences, consisted of sentences that were either made up or taken from the definition of another word, such that neither the correct meaning of the word nor any fragment from the definition could be used to interpret the sentence in a meaningful fashion. An example of a definition and the three types of sentences is given in Table 1.

[Insert Table 1 about here.]

Seventy-two such definitions, with their associated sentences, were constructed and were divided into two blocks. Each subject saw a given definition with only one sentence type; the pairing of definitions with sentence types was counterbalanced across the different versions of the test. Within each block, there were 12 sentences that were correct, 12 fragment selection sentences, and 12 no semantic overlap sentences.

Two different experimental tasks were used. In one, the definition was given first, with the sentence below it, and the subjects were asked to judge whether the sentence made sense for that definition. In the other task, the sentence was given first, and the subjects were asked to judge whether the definition made sense for that sentence. In both cases, the task was a forced-choice task, to circle "Yes" or "No" to indicate whether the combination of sentence and definition made sense. An example of an item each of these two task conditions is given in Table 2.

[Insert Table 2 about here.]

Each subject saw one block of the materials in one of these conditions, and the other block in the other. Block, order of task, and pairing of sentence type with definition were all counterbalanced, resulting in 12 versions of the materials. All subjects received an equal number of items in all conditions but saw a given item in only one condition.

Procedure

Subjects were tested in their normal classrooms as a group. The test contained two sections. The directions for each section of the test were read aloud. Subjects who finished early on the first section were given a filler task so that all the subjects could receive the instructions for the second section at the same time. For both sections, subjects were instructed to ask about the meaning of any unfamiliar words, other than the target words, that they encountered in the definitions or sentences.

Design and Analysis

Hierarchical multiple regression was used, following the logic of mixed analysis of variance. The dependent measure was proportion of correct answers, that is, correct acceptance of correct usage sentences, and correct rejections of fragments selection and no semantic overlap sentences. (Proportions were normalized using an arcsine transformation.)

Block, order of presentation (which block came first), task (sentence first or definition first), and sentence type (correct usage, fragment selection or no semantic overlap) were within-subject variables. Language ability, represented by the Total Language score from the Stanford Achievement Test, was a between-subjects variable.

Results

Results of the hierarchical multiple regression analysis are given in Table 3. As can be seen, there is a highly significant main effect of sentence type. The main effects of block and language ability are also significant, and there was a interaction of sentence type and language ability.

[Insert Table 3 about here.]

The main effect of language ability indicates that more able students answered more items correctly on the experimental task. The main effect of block appears to indicate simply that some items were more difficult than others, and that item difficulty was not evenly distributed between blocks. The difference in means represented by main effect of sentence type can be seen clearly in Table 4. (Because block did not interact with any other variables, results are collapsed across blocks. Means are given separately for the two task conditions, although there was no significant main effect or interaction involving task, to make it clear how similar performance on the two tasks was.)

[Insert Table 4 about here.]

As can be seen in the table, subjects were fairly successful at correctly accepting the correct usage sentences, and correctly rejecting the no semantic overlap sentences. Their performance for the fragment selection sentences, on the other hand, was poor. Given that chance performance on this forced-choice task would result in a score of .50, it appears that the subjects were unable to determine whether the fragment selection sentence items were correct or not.

To interpret the interaction of language ability and sentence type, we performed separate regression analyses to examine the relationship of language ability to performance on each of the sentence types. In each case, the relationship was linear; quadratic and cubic components were not significant.

The regression lines representing the relationship of language ability to performance for the three sentence types are given in Figure 1. As can be seen from the figure, there is a correlation between language ability and proportion correct for both correct usage sentences and no semantic overlap sentences. In each of these cases, this relationship is statistically significant; for correct usage sentences, $r = .50$, $p < .001$; for no semantic overlap sentences, $r = .67$, $p < .001$. For fragment selection sentences, on the other hand, the relationship between ability and proportion correct is less pronounced, and not statistically significant, $r = .24$, $p = .067$. In other words, the tendency to incorrectly accept fragment selection sentences is found to roughly the same extent at all ability levels.

[Insert Figure 1 about here.]

Discussion

The primary finding of this experiment is that subjects were unable to determine whether the fragment selection sentences represented correct or incorrect uses of the words, on the basis of the definitions. The relatively high scores for correct usage and no semantic overlap sentences shows that subjects did understand the task, and were able to gain some information from the definitions. The problem appears to be that the subjects are willing to accept fragments of definitions as representing the meaning of the word defined.

Almost identical results were found for the two task conditions used in this experiment. In one, the definition was given first, and then the sentence. Subjects were asked whether the sentence made sense, given the definition. This task can be taken as a receptive version of the sentence production task used by Miller and Gildea (1987). In the other task, the sentence was given first, followed by the definition; subjects were asked whether the definition made sense, given the sentence. This task is more analogous to the typical use of the dictionary in understanding a sentence containing a new word. It also represents a subskill necessary for one typical problem in dictionary use, namely, determining which of several meanings of a word fits with the context in which the word has been encountered. In both tasks, the subject is faced with the problem of integrating information from a definition with information in a sentence, which is essential for any dictionary use that goes beyond parroting back definitions.

If one had only the results of this study to go on, the objection might be raised that the errors for fragment selection sentences were task-induced. That is, it might be argued that these sentences deliberately misled students to focus on words or phrases in the definition that had strong associative ties with the sentence context. However, the fact that Miller and Gildea found the same types of errors to be characteristic of a production task shows that these errors are not the artifact of a particular type of task. The lack of even a hint of any effect of task in our results corroborates this point. Thus, we are dealing with a fundamental problem in understanding definitions, which is likely to show up in any task that requires students to integrate information in a definition with a sentence.

The lack of any strong relationship between performance on fragment selection sentences and language ability further demonstrates the generality of the finding. The means for the bottom, middle, and upper third of the subjects grouped by language ability for fragment selection sentences were .43 (*SD* = .14), .46 (*SD* = .10), and .51 (*SD* = .14), respectively. Although there is an apparent, though nonsignificant, trend for more-able students to correctly reject fragment selection sentences more often, students in the highest group were still performing at a level indistinguishable from chance. Inspection of a scatterplot of the data shows that even at the highest levels of ability (90th percentile and above), there is a wide range of scores.

Our results, consistent with those of Miller and Gildea (1987), suggest that fourth graders generally take fragments of the definition as representing the meaning of the word defined, without taking the larger structure of the definition into account. Think-aloud protocols were collected from 11 additional fourth graders to help shed some light on the thought processes leading to the fragment selection errors we observed.

One of the items was "*podiate*: to act in response to a signal" (a definition for one of the senses of *answer*, taken from a school dictionary). Given the sentence "A red light is a podiate to stop," eight out of the 11 students said the sentence made sense. Some of their comments were:

> "A red light is a podiate to stop. Yes, because that means to respond to a signal, you should respond to the red light which means to stop."
>
> "Red means stop and it's a signal to tell people to stop at the red light."

Another of the items was "*rudge*: to put in a secret or safe place." Given the sentence "Julie told her friend a rudge," five out of the 11 subjects said the sentence made sense. Among their comments were:

> "Julie told her friend a secret place to hide, a safe place"
>
> "Julie told her friend a secret place or a safe place to be, in case something happens"
>
> "Julie could be telling her friend to go to a place that is a secret."

Such responses show that the students are in fact using fragments of definitions and ignoring the overall structure of the definition. These fragments are often larger than a single word, but fail to include important information--in these examples, information from the genus that specifies the part of speech and basic semantic category of the word being defined.

Experiment 2

The Effect of Changes in Definitional Format

A second experiment was undertaken because it was hypothesized that part of the problem students have processing definitions could be traced to the conventional format of definitions. Research indicates that students need to learn the conventions of defining (Watson, 1985: Watson & Olson, 1987). The purpose of this experiment was to examine the structural properties of definitions that might affect the process of successfully integrating the information in a definition with a new word in a sentence. The second experiment also included both fourth- and sixth-grade subjects, to see if children's proneness to fragment selection errors, and any effects of definitional format, were conditioned by grade level.

In this experiment three formats for definitions were compared to find out whether the form of the definition makes a difference in the propensity to use only a fragment of a definition as the meaning of a new word. These formats are illustrated in Table 5. The first definitional format is a conventional format taken from a traditional children's dictionary. This is the information students usually have to cope with, and is the same format that was used in the Experiment 1. Because no difference was found between the two conditions in Experiment 1, only one condition, the definition first condition, was used in this experiment (see Table 2).

[Insert Table 5 about here.]

The second format for the definitions adds an illustrative example sentence to the conventional definition. This is often done in children's dictionaries to give students a context for the meaning. This second definitional condition was included to see whether students would make fewer fragment selection errors when they saw the word being used appropriately in the example sentence. Research indicates that illustrative sentences may be more helpful than definitions for learning new vocabulary words (Miller & Gildea, 1985; Wurtenberg & Gildea, 1988). It was hypothesized that exposure to syntactic information about the new word in the example sentence might help students evaluate the target sentences. The example sentences used in this format were taken from the definition of the real word in children's dictionaries (Thorndike-Barnhart, 1988; Webster's II, 1984) whenever an example sentence was given. If no example sentence was given, one was created.

The third format for the definition is an unconventional format that gives the word to be defined in a short phrase, and then paraphrases that phrase. This type of definition appears to give information about the syntactic properties of a new verb in more accessible form. It eliminates the necessity of knowing the conventions of definitions and is currently used in the *Sesame Street Dictionary* (Hayward, 1980) and the Cobuild dictionary (1987). This condition was included to see if students would still make fragment selection errors when the definition was rewritten so that syntactic information about the

subject and object of the action became more accessible. In this condition, information is presented about the way a verb would be used in a sentence. Because this information is often obscured in conventional definitions, it was thought that this type of definition might help students understand what the word actually means and how it would be used.

The questions addressed by this experiment are: (a) Does adding examples to conventional definitions reduced fragment selection errors? (b) Does an unconventional format such as the one used by the Sesame Street Dictionary reduce fragment selection errors? and (c) Are any benefits of format conditioned by grade or ability?

As in Experiment 1, the definitions are paired with three types of sentences: a sentence that uses the nonce word correctly, a fragment selection sentence based on selecting an inappropriate fragment from the definition for the meaning of the new word, and a sentence that was created so that there is no semantic overlap between the definition and the target sentence. The students' task was to determine whether the given sentence makes sense for the given definition (i.e., whether the word is used in the sentence in a way compatible with the meaning given).

Design

The items were counterbalanced across nine versions of the test so that all subjects received an equal number of items in all conditions but saw a given item in only one condition. There were 72 total test items, with 8 fragment selection items, 8 correct items, and 8 no semantic overlap items in each of the three definitional conditions. Thus 24 items were tested in each definitional condition and 24 items were tested in each sentence type. The items were also divided into two blocks, which were counterbalanced in order of presentation.

Subjects

The subjects were 55 fourth-grade students and 45 sixth-grade students from the same school district as Experiment 1. The subjects were tested in intact classes during their normal reading periods.

Analysis

The data were analyzed using hierarchical multiple regressions, following the logic of mixed analysis of variance. The dependent measure was the proportion of correct answers, normalized using an arcsine transformation.

Two analyses were performed. The first analysis looked at the effect of the different definitional formats on the three sentence types, and the interaction of grade and language ability, as measured by the total language score on the Stanford Achievement Test, with sentence type and definition format. The second analysis looked at mean proportion correct for fragment selection sentences alone and the interaction of definition format with grade and language ability for those sentences.

Full analysis. The main question addressed by this analysis is whether the format of the definition given to the students made a difference in the proportion of right answers given for the three types of sentences. The reduced model of the regression is given in Table 6.

[Insert Table 6 about here.]

This analysis indicates that there was a significant main effect of sentence type. That is, there is a highly significant difference between the mean proportion correct for the three sentence types. The values for the mean proportion correct for the three sentence types within each definition type are given in Table 7. It is apparent from the means and post hoc analyses that the error rate for fragment selection

sentences is significantly greater than error rate for the other two types of sentences. This replicates the findings of Experiment 1.

[Insert Table 7 about here.]

However, there was no main effect of definition format on the mean proportion of correct answers. There was also no significant interaction of definition format with any of the other variables.

There was a highly significant main effect of grade that can be best interpreted by looking at the significant grade by sentence type interaction. Table 8 gives the nontransformed mean proportion correct for each sentence type by grade. Apparently, the sixth graders are better than fourth graders at distinguishing when the sentences either use the word correctly or have no semantic overlap with the definition. However, they are appropriately equal in the number of times they are fooled by the fragment selection sentences.

[Insert Table 8 about here.]

There was also a highly significant main effect of language ability, even when it was entered after grade, and a significant interaction of sentence type with language ability, which is pictured in Figure 2. The interaction of sentence type with the language ability is similar to the interaction of sentence type with grade--total language ability helps students distinguish when sentences use the word correctly, or when there is no semantic overlap. It helps some, but not nearly as much, for the fragment selection error sentences.

[Insert Figure 2 about here.]

Second analysis. Another analysis examined only the data for the fragment selection sentences. In particular, the effect of the three definition formats on fragment selection errors was analyzed. The dependent measure was the number of correct rejections of the fragment selection sentences.

[Insert Table 9 about here.]

There was no effect of grade on the propensity to make fragment selection errors. There was, however, a significant main effect of language ability. This was not conditioned by definition format. The higher ability students were better at rejecting inappropriate fragments for the meanings of new words regardless of the format of the definition. A comparison of Figures 1 and 2 shows the same relatively weak relationship between ability and fragment errors in both experiments. Although high-ability students made fewer fragment errors, the differences associated with ability are relatively small, and most students respond to the fragment items at a level not different from chance.

There seemed to be a slight advantage in providing an example sentence to students but it was not statistically significant at the .025 level ($F_{2,198} = 3.08$, $p > .025$), which is the alpha set for the two analyses, using Dunn's multiple comparison procedures (Dunn, 1961). Comparisons of the means also show that the difference is not very large (see Table 7).

Discussion

In Experiment 2, the results of Experiment 1 were replicated and extended. Both fourth- and sixth-grade students were found to accept an alarming number of inappropriate fragments of definitions as the entire meaning for new words.

The relatively high scores for correct usage and no semantic overlap sentences indicates that the subjects did understand the task and were able to use some information about definitions. However, they were

willing to accept fragments of definitions as representing the meaning of new words with regularity. This occurred at all ability levels.

The most interesting finding is the lack of significance for definition type. Before this experiment, we expected that changing the format of definitions would significantly reduce fragment selection errors. It was thought that one of the problems with conventional definitions was the way they displayed information about the meaning of the word.

The results, however, indicate that students at both grade levels and all ability levels make fragment selection errors even when the use of the word is illustrated in an example sentence or when the definition is expressed in a non-conventional and presumably more helpful format.

It seems that the propensity to ignore the structure of a definition and to select a fragment of that definition as the complete meaning of a new word is pervasive. Furthermore, this propensity is not just due to the bizarre conventions of regular definitions. Students still make these types of errors when they are explicitly given the object and agent of a verb in an nonconventional definitional format.

Conclusion

Miller and Gildea (1987) examined data from the commonly used classroom task of having students write sentences from definitions of new words, and concluded that errors were so serious and frequent as to make the task pedagogically useless. We have used a different task, one not typically used in classrooms, but, we believe, a good indicator of students' ability to make meaningful use of the information provided by the definitions in school dictionaries, and especially, of their ability to integrate information from definitions with sentence contexts. Given our results, we can only conclude that upper elementary students have a pervasive and fundamental inability to cope with the structure of dictionary definitions.

It is clear that our subjects were able to extract *some* information from the definitions, as is evidenced by their performance on the correct usage and no semantic overlap sentences. This ability may give the illusion that students are able to successfully use definitions, especially in the case of highly constrained tasks, such as vocabulary worksheets, or in the case of vocabulary instruction or glossaries in which definitions are limited to synonyms or very short phrases. However, it also seems clear that the subjects in this study can hardly be expected to use dictionaries independently. The tasks used in this study involve the integration of information from definitions with the context in which a new word occurs. This type of integration is essential in using definitions to understand new words one encounters in text.

The quality of definitions in dictionaries and glossaries can certainly be improved, and careful rewriting of definitions can lead to gains in student comprehension (McKeown, in press). However, our results make it clear that simple, mechanical changes in the format of definitions will not be adequate. And even the highest quality definitions must assume some knowledge on the students' part of the nature and function of definitions.

Although students are given some instruction in dictionary use, current instruction appears to deal largely with the mechanics of dictionaries--alphabetization, keywords, and pronunciation keys. It is certainly premature to suggest what form it should take, but it is clear that some type of instruction is needed that focuses on the central problem of dictionary use--translating the cryptic and conventionalized content of definitions into usable word knowledge.

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Table 1

Example Definition with Three Sentence Types

stermate: to become aware of by using the nose.

"Correct usage" sentence:

Dana *stermated* smoke when she walked in the door.

"Fragment selection" sentence: Incorrect usage of the word due to a fragment selection error:

His *stermate* looked like a ski jump.

"No semantic overlap" sentence: Incorrect usage of the word due to lack of semantic overlap between definition and sentence:

The *stermate* in the closet was neatly folded.

Table 2

Task Conditions

Illustrated with the correct usage of the word in the sentence

Definition First:

datch: to cut with a long stroke of a knife or other object.

The sword *datched* through the curtains.

Does this sentence make sense for this definition? Yes No

Sentence First:

The sword *datched* through the curtains.

datch: to cut with a long stroke of a knife or other object.

Does this definition make sense for this word? Yes No

Table 3

Results of Multiple Regression Analysis

Variable	% of Variance	*F*
Between Subjects		
Language ability	49.72	55.39**
Residual	50.38	
Within Subjects		
Sentence type	47.73	214.05**
Task Condition	.06	< 1
Block	1.18	10.58**
Order	0.00	< 1
Sentence type x Task	.35	1.62
Sentence type x Block	.62	2.78
Sentence type x Order	.04	< 1
Sentence type x Language ability	2.20	9.87**
Residual	48.21	

**$p < .01$

Table 4

Mean Proportion Correct for Two Task Conditions

	Definition First	*Sentence First*
Sentence type	Mean (S.D.)	Mean (S.D.)
Correct usage	.84 (.14)	.82 (.15)
Fragment selection error	.49 (.17)	.45 (.18)
No semantic overlap	.84 (.13)	.83 (.20)

Table 5

Definition Formats

1. Conventional definition:

wuffle: to put in the hospital for treatment.

2. Conventional definition plus example sentence:

wuffle: to put in the hospital for treatment.
"The doctor thinks we may have to *wuffle* you".

3. Unconventional definition

wuffle: when you are *wuffled*, you are put in a hospital for treatment.

Table 6

Reduced Regression with Three Definition Formats

Variable	% of Variance	*F*
Between Subjects		
Grade	11.68	12.57**
Language ability	40.59	82.74**
Residual	45.63	
Within Subjects		
Sentence type	32.86	289.83**
Definition format	.19	1.68
Sentence type x Grade	2.37	14.55**
Sentence type x Language ability	.94	8.29**
Residual	63.25	

** $p < .025$

Table 7

Mean Proportion Correct for Definition Format by Sentence Type

	Definition Format		
	Conventional Definition	Conventional + Sentence	Unconventional Definition
Correct usage	.84	.87	.87
Fragment selection error	.51	.59	.54
No semantic overlap	.85	.82	.81

Table 8

Sentence Type by Grade
Mean Proportion Correct for All Definition Formats

	Grade 4	Grade 6
Correct usage	.81 (.19)	.93 (.10)
Fragment selection	.55 (.25)	.54 (.24)
No semantic overlap	.79 (.20)	.87 (.16)

Table 9

Reduced Regression with Fragment Selection Sentences Only

Variable	% of Variance	*F*
Between Subjects		
Grade	.10	< 1
Language ability	11.26	11.84 **
Residual	88.48	
Within Subjects		
Definition format	1.78	3.08
Definition format x grade	.11	< 1
Definition format x Language ability	.04	< 1
Residual	97.91	

** $p < .025$

Figure 1
Effect of Ability on 3 Sentence Types
(Experiment 1)

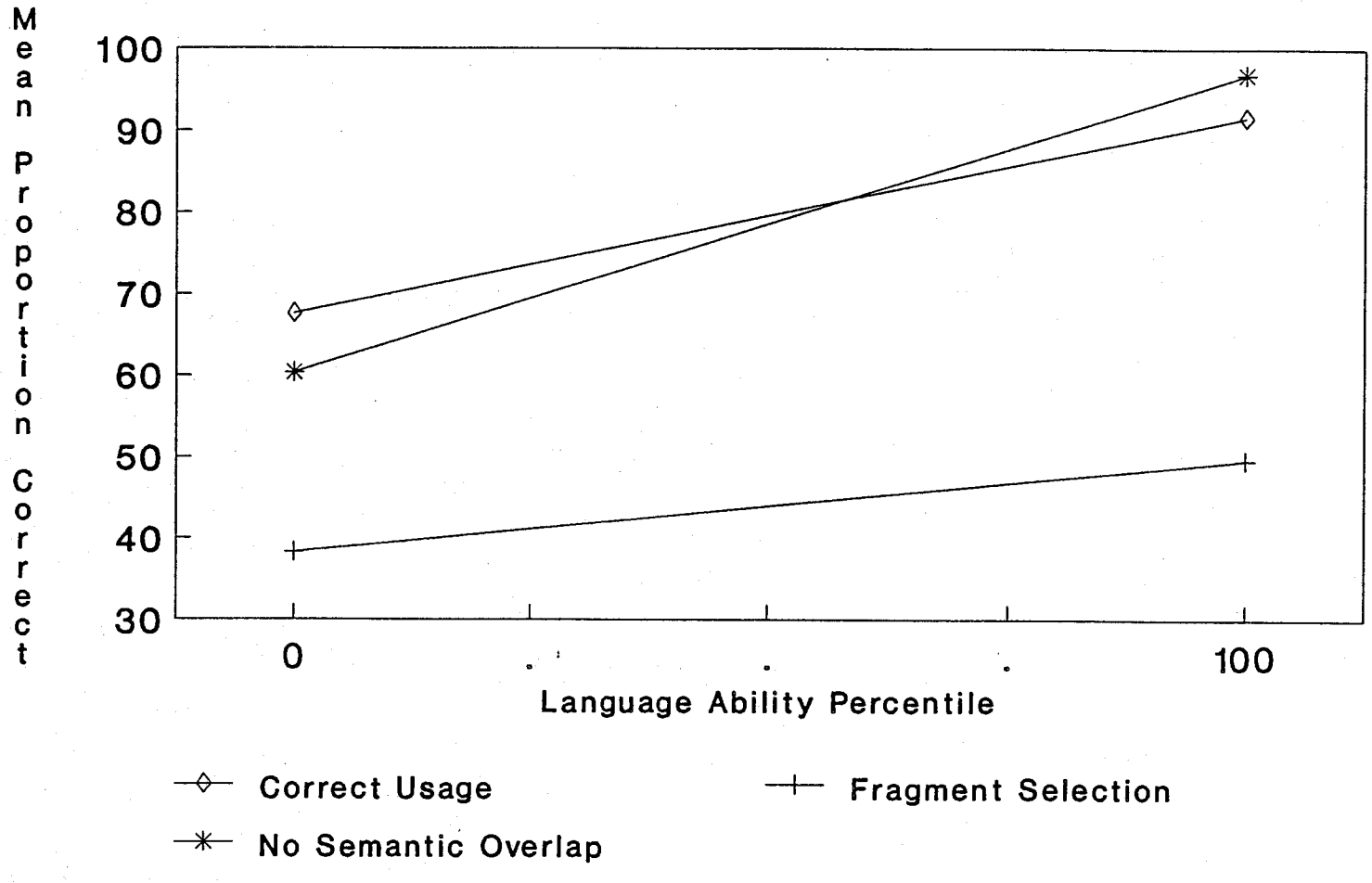

Figure 2
Effect of Ability on 3 Sentence Types
(Experiment 2)