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Possible Sentences: Predicting word meanings to teach content area vocabulary

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Content area textbooks are an important part of many elementary classrooms. Although textbooks are not and should not be the only materials used to develop understandings in the content areas, textbook material can be interwoven with many other instructional activities to help students understand subject matter concepts and develop independent learning strategies. Prereading vocabulary instruction can improve students' comprehension of their texts and help them retain the concepts that are taught. Several vocabulary instructional methods, including semantic mapping, semantic feature analysis (Johnson, Pittelman, & Heimlich, 1986), and structured overviews (Herber, 1978), have proven useful in preparing students to read a chapter or portion of a textbook chapter. These techniques all teach new words as part of a semantic field. Another approach that teaches new concepts so that they are related to each other, and to the overall topic of a textbook chapter, is Possible Sentences (Moore & Moore, 1986).

Possible Sentences

In the Possible Sentences activity, the teacher first chooses about 6 to 8 words that might cause difficulty for the students. In a

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content area textbook, these are usually key concepts, but also may be more general words that relate to those key concepts. Then, an additional 4 to 6 words are chosen that are likely more familiar to the students. These are used to help generate sentences. In our study, for example, we chose *front*, *barometer*, *humidity*, *air mass*, *air pressure*, and *meteorology* as the target words for a unit on weather, with *high*, *rain*, *clouds*, and *predict* as the more familiar contrast words. We chose the target words based on our intuition about which words might be difficult for fifth graders, and because these words were central to the concepts taught in the passages. The contrast words were words we thought would be known to the students and would lend themselves to logical sentences that would relate to the major concepts in the chapter.

These 10 to 12 words are then put on the board. Teachers can provide a short definition of each word if desired or necessary. Most of the time at least one student in the class will have knowledge of the word to share. Students are directed to think of sentences (*possible sentences* in the chapter or passage they are about to read) containing at least two of these words. Student contributions are then put on the board. Both accurate and inaccurate guesses are included and are not discussed at this time. When the students are finished contributing sentences (and all words are included in at least one sentence), the teacher has them read the passage or chapter.

Following the reading, the teacher then returns to the sentences on the board, and the class as a whole discusses whether each sentence could or could not be true based on their readings. If a sentence could be true, it is left alone. If a sentence could not be true, then the class discusses how it could be modified to make it true.

Possible Sentences is easy to implement, since it requires only a short preparation and most of the work is done on the blackboard. If research also shows it to be effective, it might be a useful addition to a teacher's instructional repertoire.

Why Possible Sentences might work

Possible Sentences seems to share a number of characteristics with both effective vocabulary instructional techniques and effective prereading strategies. Like Semantic Mapping and Semantic Feature Analysis, it draws upon students' prior knowledge of the topic. By making predictions about what sentences might appear, students are required to use what partial knowledge they have about the word and their knowledge about the topic. By involving the use of at least 2 words in each sentence, Possible Sentences requires that students think about relations between word concepts, rather than about each word as a separate entity.

Possible Sentences is easy to implement, since it requires only a short preparation and most of the work is done on the blackboard.

Because Possible Sentences involves interactions among the members of the class, it also encourages children to process information about to-be-learned words more actively, leading to better retention of those concepts. Stahl and Vancil (1986) and Stahl and Clark (1987) found that group discussion was an important ingredient in effective vocabulary instruction. They also found that discussion was effective not only for students with high prior knowledge but also for those with low prior knowledge who seemed to benefit as much or more. Furthermore, class discussion even benefited children who did not contribute as long as they anticipated having to provide an answer. Stahl and Clark (1987) found that even when students were not called upon in class, they learned as well as those who were called upon, as long as they thought they would be called upon. While waiting, students apparently generate possible answers. This process of generation helps them retain the information.

As a prereading activity, the prediction component of Possible Sentences may encourage more active processing of the text. Approaches that rely on prediction, such as the

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Directed Reading-Thinking Activity (DR-TA), have been found to be effective prereading activities for the content areas as well as for literature (see Davidson & Wilkerson, 1988 for review). In addition to activating relevant background knowledge, such activities give students a stake in building an understanding of the passage.

These reasons for the possible effectiveness of Possible Sentences are speculative, since we could not find a study establishing the effectiveness of this technique. In this article, we will describe two such studies in which we not only attempt to establish the effectiveness of Possible Sentences but also suggest why the technique might have been effective.

The effectiveness of Possible Sentences

To gather evidence to support the use of Possible Sentences, the first question we asked was: Does Possible Sentences help children recall more information from a text than simply having them read it without instruction? This question was addressed in our first study.

In this study, we also compared Possible Sentences with Semantic Mapping. The purpose of the comparison with Semantic Mapping was to show that Possible Sentences produces effects that were at least comparable with another effective prereading vocabulary instructional technique. Both Possible Sentences and Semantic Mapping draw upon students' prior knowledge, ask students to think of relationships between concepts, and involve the use of whole class discussion to explore ideas. The largest difference, however, is in the use of prediction. In Possible Sentences, students are asked to actively predict what information will be in the text. In Semantic Mapping, a great deal of information is brought up in both the initial brainstorming and the development of the map, which does not relate directly to the text. The additional focus of the Possible Sentences activity on prediction may encourage students to more actively engage with the text to verify their predictions, and this engagement may lead to better learning.

Subjects. Sixty-two fifth-grade students participated in the study. These students were in a district serving middle to upper-middle class students in suburban Washington, D.C. On the Gates-MacGinitie vocabulary test (Level 4-5, Form K, Third Edition), their average score was equivalent to the 59th percentile, putting their ability somewhat above the national norms.

Procedures. The second author saw the students in their classes over a period of 5 days. On the 1st day, we gave the Gates-MacGinitie as a measure of students' general vocabulary knowledge, and a vocabulary checklist to assess their previous knowledge of the target words. This checklist, based on that of Anderson and Freebody (1983), consists of a list of 95 words and nonwords, including the 18 target words used in the study. Students were to check the items they thought were real words. Such a checklist has proven to be a reliable and valid measure of students' word knowledge (Anderson & Freebody, 1983).

On the 2nd through 4th days, students were asked to read a passage about a science topic, "Weather," "The Moon," or "Objects in the Universe." These passages, taken from a book of short science readings intended for junior high students, were about 500 words long, written slightly above their grade placement. This challenging text was chosen so that the effects of vocabulary instruction could more clearly be shown; moreover, material taken from the same book of readings worked satisfactorily in an earlier study (Stahl & Vancil, 1986).

Prior to reading, students received either a Possible Sentences treatment, a Semantic Mapping treatment, or no introduction at all. All classes received all treatments, counterbalanced over the different days. The Possible Sentences treatment was carried out as described earlier, except that the words were presented on an overhead projector slide. Students' responses were also written on that slide. After the reading, students discussed each sentence, making corrections as needed.

The Semantic Mapping treatment was carried out as described by Johnson, Pittelman, and Heimlich (1986). Students were asked to tell what they knew about the day's topic. These responses were put on the board. During this brainstorming, the teacher discussed the target words and how they related to the other terms. The brainstormed terms were used to create a semantic map

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showing the relations between the target terms and the other terms provided by the students. Following their reading, the whole class discussed the map and added additional terms from the reading.

In the no-treatment condition, students were asked to read the passage and were told they would be questioned on its content.

Posttests. Students were given 3 posttests. The first two were given immediately after the final discussion. The first was a written free recall in which students were told to recall all the facts they could about what they read. They were given credit for each fact in their recall that also appeared in the passage. This measure was used to assess the effects of Possible Sentences on literal recall of the passage content. We did not measure any other levels of comprehension because of time constraints. The second measure was a sentence anomaly test consisting of a series of sentences using the target words. Some of these sentences were true, given the information in the passage; others were clearly false. The false statements were created by negating a true statement. Students were to check the true statements. Credit was given for each statement, true or false, correctly identified. The anomalous sentences made up with these target words were mostly factual, and this measure served as another measure of students' recall of specific information about the concepts taught.

Three days after the last treatment, students were given a multiple choice test on the target words. This test consisted of the target word and four distractors, two of which were true. Students were asked to tell which two items were correct. Such a format cuts down on guessing and has been found to be highly reliable (Stahl & Clark, 1987). This measure was intended to be a measure of students' knowledge of the definitions of the target words, or their logical relations with other words. Examples of anomalous sentence and multiple choice items are shown in Table 1.

Results. Students' performance on all measures was analyzed with a class-by-condition (Possible Sentences, Semantic Mapping, no treatment) analysis of variance, with the condition effect treated as a repeated measure. Although the Possible Sentences condition consistently produced the highest scores (see Table 2), overall statistically significant main effects were only found on the multiple choice measure ($F\,(2,112) = 5.25, p < .01$). Since the measure was given 3 days after treatment, this suggests that the effects of the Possible Sentences treatment were on more lasting recall of the information. On the multiple choice measure, the Possible Sentences condition produced significantly greater recall than the Semantic Mapping condition which, in turn, produced significantly greater recall than the no-treatment condition.

Although the overall differences on the written free recall were not statistically significant, there was a significant interaction between class and condition ($F\,(4,116) = 3.80$, $p < .05$). This interaction is shown in the Figure. Such an interaction means that the treatments had different effects in different classes. In two classes, the Possible Sentences condition produced significantly greater recall than

Table 1
Examples of sentence anomaly and multiple choice posttest measures for target word *satellite*

	Sentence anomaly	Multiple choice
(Anomalous)	4. The earth has more than one natural *satellite*.	8. Satellite a. like a star (b.) orbits a planet (c.) like the moon d. small planet
	(7.) A *satellite* is something which rotates around a planet or a moon.	
	(15.) An astronaut's capsule is a type of *satellite*.	

Note: Circled items are true, given information in the passage.

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Table 2
Summary of results on sentence anomaly and multiple choice measures to reflect order in table

	Sentence anomaly	Multiple choice
Possible Sentences	.130	.261
	(1.09)	(.980)
Semantic Mapping	-.088	.005
	(.932)	(.874)
No treatment	-.071	-.266
	(.996)	(1.06)

Notes: The results were converted to z-scores, which are standardized scores having a mean of 0 and a standard deviation of 1. Actual standard deviations are in parentheses.

the other two conditions in which effects were not significantly different from each other. In the third class, there were no differences between treatments. We have examined video tapes of the three classes. In the third class, there was a clear difference in motivation. In the other two classes, the teacher helped establish rapport. In this class, the teacher was not supportive, exerting no effort to help the researcher establish rapport. Although she did not do any of the teaching, her attitude toward the research may have affected the students' motivation, and thus their performance.

Thus, Possible Sentences seems to be an effective approach to teaching content area vocabulary. And, in at least two of the three classes where Possible Sentences was used, it appeared to produce better fact retention from expository text materials. For all measures the Possible Sentences condition produced the highest posttest scores of all conditions, significantly so for all classes on one measure and for two of the three classes on a second measure.

Possible Sentences not only outperformed a no-preparation control condition, it also outperformed the Semantic Mapping condition, a highly effective vocabulary instructional approach. Johnson, Pittelman, and Heimlich (1986) suggest that Semantic Mapping is effective because it mobilizes students' prior knowledge and allows them to tie that knowledge together with the to-be-learned words. Possible Sentences appears to do the same, but the prediction component may serve to give students greater involvement in their learning than Semantic Mapping provides. A second study was intended to look at some of these issues.

The role of discussion and prior knowledge

The second study was similar to the first, but with somewhat different aims. In order to evaluate the relative importance of discussion and prediction, in this study we compared Possible Sentences instruction done with a whole class discussion to one done using worksheets, without any discussion of the different sentences.

Instead of comparing Possible Sentences to no instruction, as in the first study, here we compared it to a control condition in which the teacher asked students to brainstorm what they knew about the topic. This approach was used for two reasons: First, it represents a common type of prereading instruction in which the teacher conducts a general discussion of students' knowledge about a topic prior to reading; second, since activation of prior knowledge is a component of Possible Sentences, it allowed us to evaluate how important this component is by itself.

Subjects. For this study, subjects were 80 students in 4 fifth-grade classes in 2 rural districts in western Illinois. Students in one district were from a wide range of backgrounds, including children of farm workers and university professors. In the other district, children were from more homogeneous, rural backgrounds. On the Gates-MacGinitie vocabulary test, students scored near the national test norms with an average score equivalent to the 52nd percentile.

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Table 3
Summary of results on free recall, sentence anomaly, and multiple choice measures from second study

	Free recall	Sentence anomaly	Multiple choice
Possible Sentences (Group)	4.36 (2.24)	13.12 (1.96)	2.45 (1.45)
Possible Sentences (Individual)	3.19 (1.86)	11.74 (2.11)	3.09 (1.18)
Control (Prior knowledge)	3.08 (2.10)	11.76 (2.19)	1.90 (1.16)

Notes: Sentence anomaly test score is out of a possible 18. Multiple choice score is out of a possible 6. Standard deviations are in parentheses.

Procedures. We administered the same passages and same pre- and posttest measures. Other than the two treatments compared to Possible Sentences, the procedures were identical to the first study.

In the first comparison condition, the students were given sheets of paper containing the same 10 words as those in the group condition described above. They were told the topic they were going to read about and that they were to "make up sentences using 2 of the words on the page that might appear in their reading." After the students had written their sentences (and nearly all students wrote at least 4 sentences) and read the passage, they were asked to "change any sentence they wrote that could not be true and leave alone any sentence that could be true." Our review of the papers indicated that, by and large, students followed these directions.

In the second comparison condition, the teacher asked the students what they knew about the topic of the day. This elicited information was written on the blackboard. She made no attempt to steer the discussion to the target words. If a target word came up in the discussion, she included it but did not give it any special emphasis.

As in the first study, all students participated in all conditions. In this case, the lessons were taught by one of our graduate students, a teacher with 14 years' teaching experience at a variety of grade levels. Also, instruction in all 3 groups varied between 15 and 20 minutes per day.

Results. Again, the group version of Possible Sentences instruction produced the highest scores on all of the posttests.The results are shown in Table 3. In this study, these differences were statistically significant on the written free recall measures (F (2,152) = 15.65, p < .001) and the sentence anomaly measures (F (2,154) = 27.22, p < .001), but not on the delayed multiple choice test. Analyses of these differences indicated that for the recall and sentence measures, the Possible Sentences (group) condition produced significantly higher posttest performance than the other conditions that were similar to each other.

The effectiveness of Possible Sentences

Possible Sentences seems to be a simple yet effective approach to preparing children to read content area texts. In both studies, the use of Possible Sentences improved students' recall of vocabulary. In 5 of the 6 classes studied, it improved students' recall of facts from the text. For its effectiveness and its ease of implementation, Possible Sentences should be a part of the repertoire of prereading and vocabulary instructional approaches used by teachers who teach with expository texts.

One of its virtues is simplicity. To do a Possible Sentences lesson effectively requires little more than familiarity with the content of the chapter, taking some time to choose key words and contrast words, putting these words on the blackboard, and leading the discussion. There is no preparation of worksheets, bulletin boards, or other materials. Possible Sentences involves only class time to discuss and

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tie together the new vocabulary. The second study indicated that such a discussion, structured around predicting how key vocabulary words will be used in a passage, seems to improve recall of that passage better than a more general discussion of the topic. Such an active discussion also produced better recall of the text information than when students worked individually on worksheets, even though the content of the worksheet and the discussion were similar.

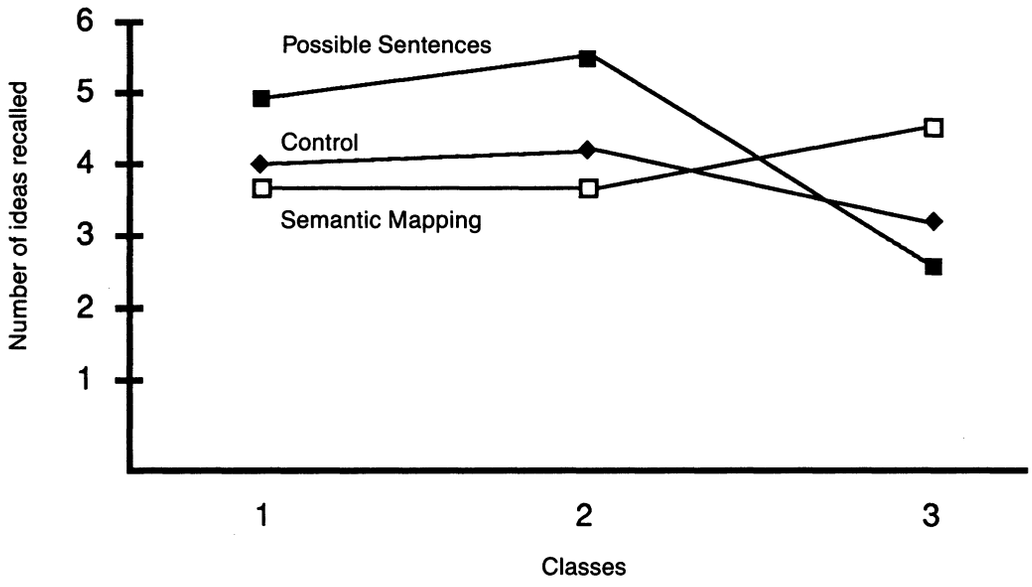
We used Possible Sentences with words associated with a single discipline. Our experience, however, is that it would work equally well with words not necessarily from the same knowledge domain. In order to draw relationships between two words, one must think about the words and about possible intersections of meaning. Even if the words were not as closely related to each other as the words we used, the process of relating words to each other should produce similar effects. If the words were taken from a narrative instead of an expository text, relating key words to each other might encourage predictions about the text.

In these studies, 2 of the measures (the written free recall and the sentence anomaly measures) tested largely factual recall and the third tested mainly definitional information about taught words. Therefore, we cannot make any claims about the effectiveness of Possible Sentences instruction in encouraging higher levels of comprehension or in encouraging knowledge integration. Our experience in teaching these classes in the studies and in hearing the discussions is that students are learning more than just facts, but our measures were limited to factual recall.

Possible Sentences also produced greater vocabulary understanding and recall of text information than Semantic Mapping in the first study. Nevertheless, we are not recommending that Possible Sentences be used in place of Semantic Mapping. Instead, they and other similar techniques (such as Semantic Feature Analysis, Quadrant Charts, and the like) should be alternated as prereading content area instruction. Since vocabulary instruction is an on-going process, a teacher needs to be able to vary the delivery of that instruction. Rather than recommending one particular approach, we would like to stress general principles that are common to effective approaches. Such general principles (adapted from Stahl, 1986) would include the following:

Include both definitional and contextual information. Possible Sentences not only provides students with examples of the word in context, but by having students use two words

Written free recall results across classes from Study 1



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in each of their sentences, forces them to look for logical relations among words. This definitional information includes relations such as synonyms, antonyms, superordinates, subordinates, and examples that might be customarily included in a dictionary (see McKeown, in press). To create sentences containing two of the words, the students had to relate features of meaning shared between the two words. The sentences, however, rarely took the form of a dictionary definition.

By comparing the sentence contexts they create to those in the text, students also make a clearer analysis of how each new word functions in context. These nuances are often lost in dictionary or glossary-based instruction, but are important for learning word meanings.

Involve the students in active word learning. For Possible Sentences, the group discussion appears to improve learning by having students more actively process the information about the to-be-learned words. Both by forming possible answers in the discussion and by actual participation, students think more deeply about the relations between the new words and words they already know. These links lead to learning.

Discussion adds an important dimension to vocabulary instruction. In order to participate in a discussion, children must practice or prepare a response to themselves while waiting to be called upon. This practiced response can lead to learning (Stahl & Clark, 1987). Because each student should expect to be called upon, teachers should allow all students in the class some think time before calling on one individual. Also, a teacher should be sensitive to his or her patterns of calling on children, avoiding calling on only the "fast" kids. If a child does not think that s/he will be called upon, the child will not practice a response. Without the practiced response, discussion is not as valuable a learning experience. (See Alvermann, Dillon, and O'Brien, 1987, for a thorough discussion of discussions.)

Discussion seems to improve vocabulary learning in general. Children not only seem to benefit from active processing involved in participating in discussions, but also seem to benefit from the contributions of other children. It is our experience that children who enter a Possible Sentences lesson without any knowledge of a target word seem to learn a great deal from their peers who may have partial or even considerable knowledge of the word. We have found that in open discussions, children are often able to construct a good idea of a word's meaning from the partial knowledge of the class as a whole. For some of the words, though, we had to interject some information about the word, such as a quick definition.

Provide multiple exposures. In Possible Sentences instruction, children see each word many times through generating sentences, reading the passage, and in the follow-up activities. At each time, they get slightly different meaningful information about the to-be-learned word. Such multiple exposures are also a component of effective vocabulary instruction.

There are a number of approaches to vocabulary learning that fit these general principles and are effective in improving comprehension and learning from content area texts. We wish to add Possible Sentences to this group as another effective approach to teaching word meanings.

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