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ABSTRACT

A collaborative research effort to investigate the relative strengths of selected vocabulary development techniques was conducted by the Wisconsin Center for Education Research and the Taiwan Provincial Institute for Elementary School Teachers' Inservice Education. Parallel studies of children in grades 4 through 6 compared the two prior knowledge strategies, semantic mapping and semantic feature analysis, with the method traditionally used in each country, contextual analysis (for the United States) and the general method (for China). The effect of test format on vocabulary test scores, and retention of vocabulary words were also explored. In the United States, the two prior knowledge approaches were more effective than the traditional contextual analysis method. In Taiwan, the traditional method was more effective, a result which may be attributed to the nature of written Chinese. The effects of test format on performance also differed in the two countries, with U.S. children performing better on the contextual analysis assessment format and Taiwanese children not showing differential performance levels. Finally, teaching strategy appeared to influence the degree of word retention in the United States but not in Taiwan. (Author/RW)

Program Report 83-4

STUDIES OF VOCABULARY DEVELOPMENT TECHNIQUES IN THE UNITED STATES OF AMERICA AND THE REPUBLIC OF CHINA

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Report from the Program on
Student Diversity and Classroom Processes:
Skill Development--Language Arts

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Wisconsin Center for Education Research

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- diversity as a basic fact of human nature, through studies of learning and development
- diversity as a central challenge for educational techniques, through studies of classroom processes
- diversity as a key issue in relations between individuals and institutions, through studies of school processes
- diversity as a fundamental question in American social thought, through studies of social policy related to education

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Table of Contents

List of Tables

List of Figures

Abstract

A collaborative research effort was conducted by the Wisconsin Center for Education Research and the Taiwan Provincial Institute for Elementary School Teachers' Inservice Education to investigate the relative strengths of selected vocabulary instructional strategies in the two countries. Parallel studies were conducted to compare the two prior knowledge strategies of semantic mapping and semantic feature analysis with the method that is traditionally used in each country. The effect of test format on vocabulary test scores was also of primary interest. Retention of the vocabulary words that were taught in the studies was addressed as a secondary research question.

In the United States study the two prior knowledge strategies were more effective than the traditional method (contextual analysis). In the Republic of China study the traditional method (General Method) was the most effective; this effect may be attributed to the nature of the Chinese written language.

The effects of test format also differed in the two countries. In the United States children consistently performed at a higher level on the contextual analysis assessment format. In the Republic of China study subjects did not consistently perform better on any one format. In regard to the retention of vocabulary words, teaching strategy appeared to influence the degree of retention in the United States, while there was no consistent pattern of retention related to vocabulary instruction in the Republic of China.

Introduction to the Studies

Two parallel studies were conducted to provide a cross-cultural comparison of vocabulary instruction in the United States and the Republic of China. Though not identical in every aspect, the two studies compared the effect of three vocabulary instructional strategies: the two prior knowledge strategies of semantic mapping and semantic feature analysis and a conventional method. The sample size, treatment duration, target categories, and lesson plan types for the two prior knowledge treatments were identical. The conventional method used as the third treatment, however, was unique to each of the two studies; in the United States the conventional treatment was contextual analysis while in the Republic of China replication the traditional Chinese method was used. The Chinese method, referred to as the General Method, is essentially a memory drill approach which focuses on the meanings, pronunciation, and writing of the Chinese characters.

Purpose of the Studies

The importance of vocabulary as a critical component of reading comprehension has long been established and repeatedly demonstrated. In the early factor analysis studies of the components of comprehension conducted by Davis (1942, 1944) and others (Hunt, 1957; Spearitt, 1972; Thorndike, 1971; Thurstone, 1946), the importance of vocabulary knowledge in reading comprehension was well documented. It is also well established that the specific teaching of new vocabulary is desirable and improves general word knowledge and reading

comprehension (Ahlfors, 1979; Long, Hein, & Coggiola, 1978; Manzo & Shark, 1971-72; Petty, Herold, Stoll, 1968). What remains unsettled is an identification of the most effective means of vocabulary instruction. Petty, Herold and Stoll (1968) stated that, as of yet, research has not shown one particular instructional method to be significantly better than any other.

Historically, research on word knowledge and vocabulary acquisition focused primarily on two main areas: (1) a demonstration that word knowledge per se is an important component in reading comprehension, and (2) an identification of the discrete skills involved in vocabulary acquisition. A historical overview of the trends in vocabulary research, with an emphasis on the importance of word knowledge as a critical component of reading comprehension, is presented in the paper An Investigation of the Trends in Vocabulary Research and the Effects of Prior Knowledge on Instructional Strategies for Vocabulary Acquisition by Johnson, Toms-Bronowski, and Pittelman (1981).

Although there is agreement among many researchers that word knowledge is an important component of comprehension, there have been few research studies designed to examine the effectiveness of training on vocabulary development, either independently or in relation to the entire comprehension process (Davis, 1972). Recently, however, researchers have begun to examine the efficacy of specific teaching strategies for the development of vocabulary knowledge.

Several traditional vocabulary teaching strategies, including dictionary usage, context, and mnemonic devices have been empirically

validated and found to be effective techniques for general vocabulary acquisition and development. Two more recently developed strategies of vocabulary development, semantic mapping and semantic feature analysis, have not yet been formally investigated. These two strategies are based on prior knowledge with an information-processing orientation and capitalize on categorically arranged conceptual frameworks to increase general vocabulary. From a theoretical standpoint, it would appear that there are advantages to these two methods. Research suggests that this type of conceptual strategy would help retrieval of known words or concepts for words in isolation as well as for words in the context of prose (Johnson, Toms-Bronowski, & Pittelman, 1981). If readers do categorize and map information in memory, educational implications are that the teaching and learning of new vocabulary would be facilitated if strategies which capitalize on these processes were used.

Both semantic mapping and semantic feature analysis are increasingly in use in classrooms in the United States in spite of the fact that their effectiveness has not been empirically validated. Based on the reports from teachers that semantic mapping and semantic feature analysis are effective, several recent reading methods texts already suggest the inclusion of these strategies as techniques for vocabulary building (Johnson & Pearson, 1978; Pearson & Johnson, 1978; Smith & Barrett, 1979; Smith & Johnson, 1980).

The primary purpose of the studies described in this paper was to further investigate the practicality and relative effectiveness of these two new vocabulary teaching strategies. Specifically, the two

alternative prior knowledge methods of semantic mapping and semantic feature analysis were compared with a conventional method for general vocabulary development, contextual analysis in the United States and General Method in the Republic of China.

Research Questions

Two major research questions were addressed in these studies:

1. Are the two instructional strategies which draw on prior knowledge and capitalize on categorically arranged conceptual frameworks at least as effective, if not more effective, for vocabulary building than a traditional approach? And will the same result be found in both countries?
2. Does a specific teaching strategy appear to be more effective when the test format closely resembles the instructional strategy?

While there was no strong empirical basis for hypotheses about the relative effectiveness of teaching strategies within and across cultures, studies have found that the format of an assessment measure does indeed affect student performance (Johnson, Pittelman, Shriberg, Schwenker, & Morgan-Janty, 1978). It was therefore expected that performance would be higher on a dependent measure that was analogous to the instructional strategy than it would be on a test that did not reflect the strategy used in the instructional treatment. In addition to the two major questions being asked, the question of whether all the strategies being investigated facilitate long-term retention was investigated.

United States of America: Method

Subjects

Subjects for the study consisted of 45 fourth-, fifth-, and sixth-grade classrooms from three school districts near Madison, Wisconsin. All three school districts are within an hour's drive from Madison and have populations which are of comparable socio-economic levels. Of the 45 classes, 36 classrooms totaling 1,012 children were assigned to the treatment condition. These 36 classrooms, 12 at each of the three grade levels, comprised all of the intermediate grade level classrooms from two of the school districts. One school district had separate fourth-, fifth-, and sixth-grade classes while the other school district had combined classes of fourth-fifth and fifth-sixth grade. The remaining nine classes, all from the third school district, served as the control condition. Classes, as opposed to individual subjects, were used as the unit of analysis.

Procedure

Classrooms at each grade level were randomly assigned to one of three treatment order presentation groups. One group received the three treatments in an ABC order (Semantic Mapping, Semantic Feature Analysis, Context). The second group received the treatments in a BCA order and the third group was assigned a CAB treatment order. The treatment orders at each of the three grade levels were identical. The experimental design for the instructional treatment, a modified Latin square design, is presented in Table 1.

Table 1

Instructional Treatment Design for United States Study

	Week 1	Week 2	Week 3
4th Grade:			
Classrooms 1-4	A	B	C
Classrooms 5-8	B	C	A
Classrooms 9-12	C	A	B
Classrooms 13-15	D	D	D
5th Grade:			
Classrooms 16-19	A	B	C
Classrooms 20-23	B	C	A
Classrooms 24-27	C	A	B
Classrooms 28-30	D	D	D
6th Grade:			
Classrooms 31-34	A	B	C
Classrooms 35-38	B	C	A
Classrooms 39-42	C	A	B
Classrooms 43-45	D	D	D

Note. A = Semantic Mapping
B = Semantic Feature Analysis
C = Context
D = Control

Each week for three weeks, 15 target vocabulary words were taught by the classroom teacher in three vocabulary lessons. The strategy used to teach the 15 vocabulary words each week reflected the assigned treatment for that week. Five target vocabulary words were presented in each lesson. The lessons were taught on three consecutive days each week. By the end of the three-week period, students had been taught 15 target words through each of the three treatments, a total of 45 words. During the first week, each lesson lasted approximately one hour, while for weeks two and three the lessons were shortened to 35-45 minutes. Periodically during the three weeks of instruction project staff observed some of the vocabulary lessons.

At the end of each week, subjects were tested using three dependent measures, each measure designed to reflect the focus of a particular teaching strategy. The weekly test-order assignments required that the dependent measure reflecting the treatment condition be given last in order of presentation (see Table 2, Assessment Schedule for United States Study). For example, the classes that received the semantic mapping treatment in any particular week received the dependent measures assessment in either a BCA or a CBA for order that week. The orders were randomly assigned to classes within grades. The decision to give the analogous dependent measure last limited the number of test-order presentations to two.

A comprehensive multiple-choice definition test consisting of 45 items, one for each target word, was administered a week after the last lesson and again approximately four months later (following

Table 2

Assessment Schedule for United States Study

Treatment Group	Testing Schedule				
	Week 1	Week 2	Week 3	Week 4	Week 21
ABC	BCA CBA	CAB ACB	ABC BAC	Comprehensive Test	Retention Test
BCA	CAB ACB	ABC BAC	BCA CBA	Comprehensive Test	Retention Test
CAB	ABC BAC	BCA CBA	CAB ACB	Comprehensive Test	Retention Test
Control	D(ABC)	D(BCA)	D(CAB)	Comprehensive Test	--

Note. A = Semantic Mapping
B = Semantic Feature Analysis
C = Context
D = Control

summer vacation) so that both short-term and long-term retention were assessed.

The seven classes which comprised the control condition received the three dependent measure tests weekly as well as the short-term retention test at the end of the fourth week. The control classes did not take the long-term retention test.

The study was conducted over a four-week time period between April and May, 1981. The long-term retention assessment measure was delivered to the schools on September 1, 1981 and was administered at each teacher's convenience between September 1 and September 9.

Prior to the study, a one-hour workshop was conducted by project staff for teachers in each of the two school districts participating in the treatment conditions. During the workshop, teachers were acquainted with the general purposes of the research project. A model lesson for each of the three teaching strategies was then demonstrated, using examples from the actual lessons to be taught during the first week. Time was also allowed for questions and comments. The agenda for the inservice appears in Appendix A.

Treatments

The instructional strategies of semantic mapping, semantic feature analysis, and contextual analysis were the three treatments employed in the study. A brief description of each strategy is presented below. A more detailed discussion of the strategies appears in Johnson, Toms-Bronowski, and Pittelman (1981).

Semantic mapping. Semantic mapping is a categorical structuring of information in graphic form. It is an individualized content approach, in that students are required to relate new words to their own experiences and prior knowledge (Johnson & Pearson, 1978). A completed semantic map provides the teacher with information about what the students know and reveals anchor points upon which new concepts can be introduced. One completed classroom map for the topic Communication with Language is shown in Figure 1.

The general instructional sequence for semantic mapping is:

1. Select a word (topic) of classroom interest or need such as a word central to a story to be read.
2. Write the word on the chalkboard.
3. Ask the class to think of as many words as they can that are in some way related to the target word you have written, and jot them on paper, in categories.
4. Have individuals share the words they have written and, as they do, write them on the board and attempt to put them into categories.
5. Next, have the students name the categories as shown in Figure 1.

Student discussion is crucial to the success of semantic mapping. Through this process, students learn the meanings and uses of new words and new meanings for known words. In addition, they see old words in a new light, and they see the relationships among words.

Semantic feature analysis. Semantic feature analysis capitalizes on the categorical nature of memory structures for individual words

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Name Classroom Composite

Teacher _____ Grade ____

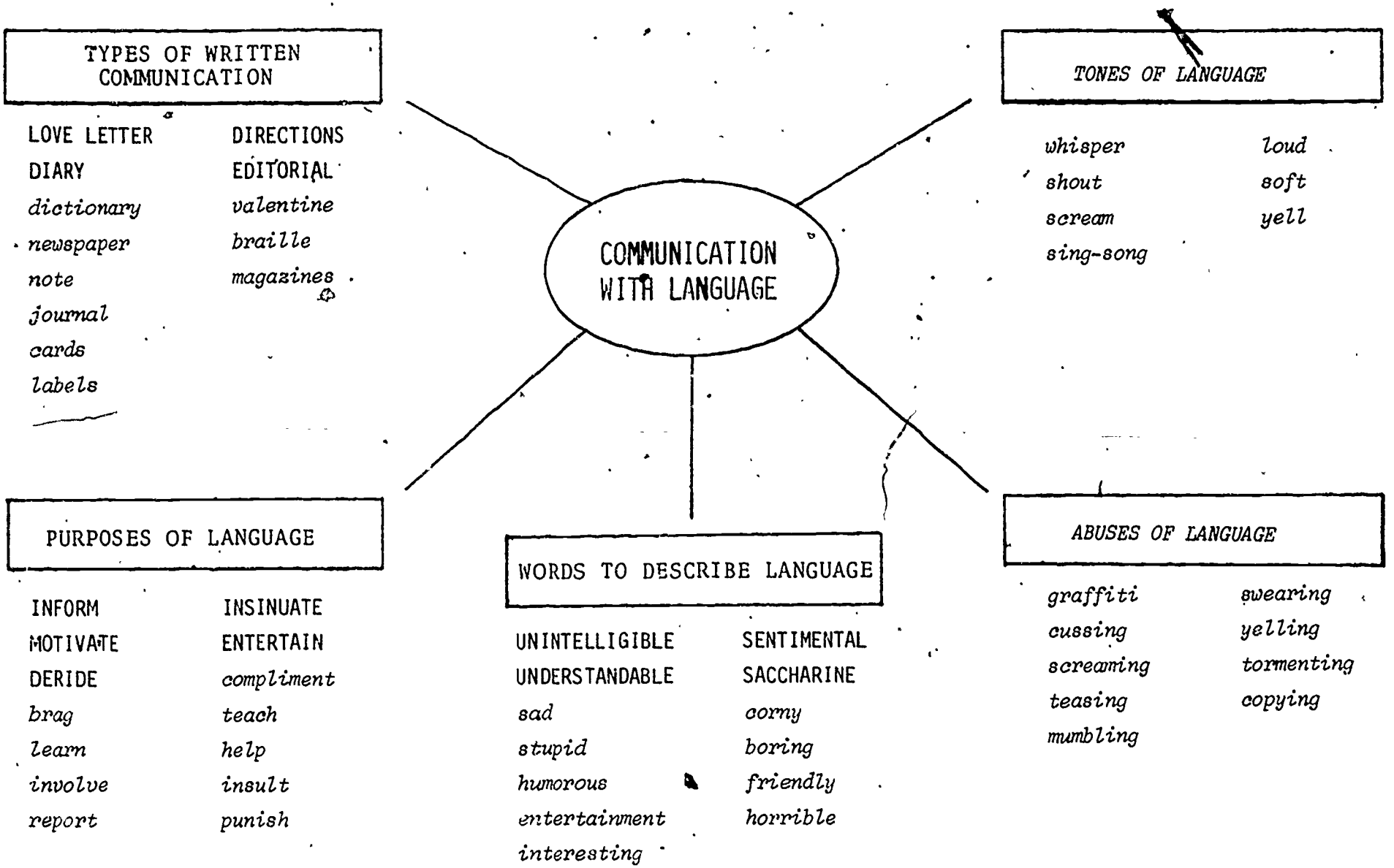

Figure 1. Composite semantic map for Communication with Language from one classroom. (Italized words were suggested by students.)

and words in prose contexts. This strategy focuses on the ways in which words within a category are alike and different and, through discussion, relates their meanings to prior knowledge (Johnson & Pearson, 1978). In semantic feature analysis, vocabulary is presented in a logical, classified way. Grids are used to display the relationships between words as well as the finer nuances within and between concepts. An illustration of a completed semantic feature analysis grid for the topic Communication with Language is shown in Figure 2.

The general instructional sequence for semantic feature analysis is:

1. Select a topic.
2. In a column, at the left, list some words which relate to that topic.
3. In a row along the top, list features shared by some of the words in the column.
4. Have students put pluses or minuses in the grid to indicate whether or not each word that is listed in the column shares each of the features that is listed along the top.
5. Encourage students to add additional words and features.
6. Have students complete the expanded matrix with pluses and minuses to indicate which features each word has. If there is doubt or disagreement, a question mark should be used.
7. Conduct a discussion of the uniqueness of each word as reflected by the pluses and minuses on the grid.

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COMMUNICATION WITH LANGUAGE

(FORMS OF LANGUAGE)

Name Classroom Composite

Teacher

WORDS TO DESCRIBE LANGUAGE	USERS OF LANGUAGE: POLITICIAN	SPORTSCASTER	BABY	PERSON SPEAKING A FOREIGN LANGUAGE	GOODY-GOODY	*teacher*		FORMS OF WRITTEN COMMUNICATION: LOVE LETTER	DIRECTIONS IN A FOREIGN LANGUAGE	EDITORIAL	POOR HANDWRITING	VALENTINE	*braille*	*chain letters*		FORMS OF SPOKEN COMMUNICATION: COLLEGE LECTURE	TV COMMERCIAL	POOR DIRECTIONS	*phony compliments*
UNDERSTANDABLE	+	+	-	-	+	+		?	-	+	-	+	?	+		+	+	-	+
UNINTELLIGIBLE	-	-	+	+	-	-		-	+	-	+	-	+	-		-	-	+	-
SENTIMENTAL	-	?	-	-	+	-		+	-	-	-	+	-	-		-	-	-	-
SACCHARINE	?	-	-	-	+	-		?	-	-	-	?	-	-		-	-	-	+
strange	-	-	+	+	-	-		-	+	-	+	-	?	-		?	-	+	+
boring	+	-	-	?	+	-		-	-	?	-	-	-	-		?	-	?	+
horrid	-	-	-	-	+	-		-	-	-	+	-	-	+		-	-	+	+

Figure 2. Composite semantic feature analysis grid for Communication with Language from one classroom. (Italicized words were suggested by students.)

As with semantic mapping, discussion is an important part of the procedure.

Contextual analysis. Contextual analysis, a word identification skill, is based on the notion that words are given meaning by their context. With contextual analysis the reader is required to search for semantic, syntactic, or graphic cues surrounding an unknown word to reduce the number of possible meanings of the word (Smith & Barrett, 1979, p. 37). Through this technique, a mind set is created whereby students learn to derive meaning for an unknown (or target) word by understanding the words or phrases that surround the unknown word. For example, in the sentence "My uncle, an itinerant preacher, traveled constantly and was always on the road," the words traveled and on the road help a reader to discern the meaning of the word itinerant.

The words or phrases that surround the unknown word in a sentence may be categorized into various types of context clues. In the many taxonomies delineating context clue types (Ames, 1966; Humes, 1978; Ives, 1979; McCullough, 1958; Thomas & Robinson, 1977), three explicit clue types consistently appear: (1) direct explanation, (2) appositive, and (3) contrast.

These three explicit and primarily syntactic context clue types were chosen to form the basis of instruction for the context treatment. In an attempt to control, and therefore minimize, the role that prior knowledge plays when context clues are employed, the exercises emphasized specific context signals rather than actual context for each of the clue strategies. For the direct explanation clue, the

signals were is, and means; for the appositive clue, the signals were commas and or; for the contrast clue, the signals were unlike, rather than, and while.

In each of the three lessons for the context treatment one of the three context clue types was introduced, so that by the end of the week the children had been instructed in all three clue types. The target vocabulary words were introduced through a two-part procedure. The general instructional sequence for the contextual analysis treatment was as follows:

1. The children were given a worksheet which contained sentences in which the target word had been deleted. Children were instructed to fill a word in the blank.
2. Through discussion, the children shared their responses and a list of all the potential words was written on the chalkboard.
3. Children were given a second worksheet that contained the same sentences but the target word was left in the sentence. The children were required to use the context clue in the sentence to write the definition of the target word.
4. The meaning of the target word was discussed in terms of the appropriateness of that definition for each of the "potential" words that had been previously suggested.

Figure 3 contains the items from the Worksheets A and B for the five target words in the Communication with Language category.

WORKSHEET A

DIRECT DEFINITION

4. A friend who is _____ is one who is overly agreeable.

APPOSITIVE

4. The rumor that the girl told _____, or made fun of, the famous actor.

9. Kathy was _____, or given a reason, to clean up her room.

CONTRAST

6. Rather than come right out and say it, he _____ that we were late.

10. Yesterday the directions over the loudspeaker were _____, while today the directions were understandable.

WORKSHEET B

DIRECT DEFINITION

4. A friend who is saccharine is one who is overly agreeable.
Saccharine means _____.

APPOSITIVE

4. The rumor that the girl told derided, or made fun of, the famous actor.
Derided means _____.

9. Kathy was motivated, or given a reason, to clean up her room.
Motivated means _____.

CONTRAST

6. Rather than come right out and say it, he insinuated that we were late.
Insinuated means _____.

10. Yesterday the directions over the loudspeaker were unintelligible, while today the directions were understandable.
Unintelligible means _____.

Figure 3. Excerpts from the two worksheets for each of the three types of context clues.

Lesson Plans

For each lesson, detailed lesson plans were provided, as well as multiple copies of the student materials. An abbreviated lesson plan for each of the treatments is presented in Appendix B. A copy of a detailed lesson plan for each treatment is available in a report by Toms-Bronowski (1982a).

Each week the classroom teacher taught three lessons of five target vocabulary words each using one of the strategies. By the end of three weeks, each subject had been taught 15 vocabulary words through each of the three instructional strategies for a total of 45 words. For both semantic mapping and semantic feature analysis the 15 weekly targeted words were subsumed under three category topics; one topic per lesson to be presented on each of three consecutive days. For the context treatment, the 15 target words were randomly presented within one of three lesson formats: direct explanation, appositive, and contrast.

Selection and Validation of Target Words and Categories

The careful selection of the target words to be taught during the vocabulary lessons was an important part of the planning of the study. Since semantic mapping and semantic feature analysis are both based on categorical relationships among words, it was necessary that the target words be presented in semantic categories. The first task in selecting the target words, then, was the identification of the nine topics or categories of words. Using current seventh- and eighth-grade developmental reading texts and a children's thesaurus, Words to

Use (Drysdale, 1974), 12 potential topics were identified. One of the criteria that was employed in selecting the topics was that they not be specifically related to content area materials for grades 4-6. After topics had been identified, prototypic semantic maps were developed for each topic as well as semantic feature analysis grids for selected topics. A minimum of 12 potential target words were generated for each category. Words for each topic were selected using current sixth-, seventh-, and eighth- grade basals. The selection was based on two criteria listed below.

1. The words should be unknown to intermediate grade level children. A word was considered if it was above an eighth grade level. The Word Frequency Book (Carroll, Davies, & Richman, 1971), The Living Word Vocabulary (Dale & O'Rourke, 1976), and the Ginn Lexicon of Multi-Meaning Words (Johnson & Moe, in press) were used to determine word difficulty.
2. The words should be representative of several of the subcategory headings on each map.

After the categories had been determined and potential target words under each category identified, the preliminary semantic maps and lists of potential target words were critiqued by outside consultants. The list of categories was then reduced to ten, and ten words were chosen as target words within each category.

To assure that the target words would be unknown to the subjects in the study, the target words were pilot tested the week of March 16, 1981, in twelve sixth-grade classrooms in two midwest suburbs. Each item on the 100-item multiple-choice test consisted of the potential

target word and four definitional choices. Based on the results of the testing, nine categories and 5 target words for each category were identified. The selection of target words and categories was based on the following criteria:

1. Within a category, the five words with the lowest percentage correct were chosen.
2. The reduction from ten categories to nine categories was done by deleting the category whose five target words had the highest average percent correct.

Following the identification of the 45 target words, a specific definition for each word was written. A variety of adult as well as children's dictionaries were consulted to ensure that the definition employed would be appropriate for intermediate grade children. After the definitions had been written, materials for the three treatments were developed. The prototypic maps and grids were then revised to reflect the final selection of words and categories, and exercises for the context treatment were developed. Step-by-step plans were written for each lesson. A more detailed description of the selection of the target words and categories, as well as of the development of the treatment materials is presented in Toms-Bronowski (1982a, 1982b). A list of the 45 target words, arranged by conceptual category, is presented in Figure 4.

Description of Assessment Materials

At the end of each week of instruction, three tests were administered to assess students on the fifteen vocabulary words that had been introduced

Stores	Water	Communication with Language
exorbitant	placid	saccharine
dear	turbulent	unintelligible
moderate	serene	motivate
proprietor	saline	insinuate
clientele	brackish	deride

Schools	Shelters	Animals
apathetic	rustic	muskie
provocative	dilapidated	wolverine
agog	exquisite	molt
ambivalent	hovel	hoard
lackadaisical	villa	forage

Environment	Fiction	Size
deplete	fanciful	corpulent
squander	enthralling	obese
expend	plausible	immense
reclaim	conjuror	rotund
restrain	sage	diminutive

Figure 4. Categories and target words for United States Study.

that week. Each test was designed to reflect the focus of one of the three treatment strategies. The test items for the target word saccharine, from each of the three test formats and from the Comprehensive/Retention test are presented in Figure 5.

The semantic mapping test format, a clustering task, attempted to emphasize the categorical nature inherent in the teaching strategy. As in the example for saccharine, the target word was not always the correct response choice. Care was taken to ensure that the word that was "not close in meaning to the other two" came from a different subcategory on the map than did the two words that were categorically similar.

The semantic feature analysis test format was very similar to the teaching procedure. With only very few exceptions the descriptions that were used on the test for each of the target words were drawn specifically from the grids.

The context test format was a sentence completion task. The sentences were constructed so that the contextual situation in the sentence was not related to the categories that had been presented in the semantic mapping or semantic feature analysis lessons. In addition, for each word the sentence on the test contained a context clue type different from the one used during instruction. For example, since saccharine had been presented through direct definition in the instructional setting, it was assessed through contrast.

The comprehensive/retention vocabulary test given during the fourth week of the study and again three months later was very similar

Semantic Mapping

For each item below, read all three words. Two of the words are very close in meaning. Find the word which is not close in meaning to the other two. Then circle that word.

1. saccharine phony honest

Semantic Feature Analysis

Read each word and the descriptions under the word carefully. Decide which answer best describes the word. Then put a check on the line in front of that answer.

1. saccharine

_____ describes a friend who tells you a joke

_____ describes a friend who gives phony compliments

_____ describes a friend who calls you a name

Context

Read each sentence carefully. Notice that there is a word missing. Below each sentence there are three word choices. Read each of the word choices and find the one that best completes the sentence. Then circle that word.

1. Unlike Carl who is saccharine, Thomas is not overly _____.

fat agreeable talkative

Comprehensive/Retention Test

Read the vocabulary word. Underneath that word are four word choices. Read each of the word choices and find the one that is closest in meaning to the vocabulary word. Then put a check mark (√) in front of your answer.

1. saccharine

_____ a. unsweetened

_____ b. mean

_____ c. too friendly

_____ d. too sour

Figure 5. Test items for target word saccharine.

to the pretest used for the selection of the target words. The multiple-choice definition format was chosen since it would not be biased in favor of any one of the three treatment conditions.

Republic of China: Method

Subjects

Subjects for the study consisted of 48 fourth-, fifth- and sixth-grade classrooms from two public schools in the Republic of China. These schools were located in a low-to-moderate income suburban area. Of the 48 classes, 36 classrooms totaling 1,523 children were assigned to the treatment condition. These 36 classrooms, 12 at each of the three grade levels, were equally divided between the two schools, as were the 12 classrooms serving as the control condition. In this study, individual subjects rather than classes were used as the unit of analysis.

Procedure

Twelve classrooms at each grade level were randomly assigned to one of three treatment conditions: Semantic Mapping, Semantic Feature Analysis, and the conventional approach (General Method). In this study, a classroom received the same treatment for all three weeks of instruction. The design for the instructional treatment, a 4 x 3 x 3 x 3 block design, is presented in Table 3. The four instructional strategies (the three treatments plus the control condition) and the three grade levels were the between-subject factors. The three assessment formats and retention over time were the within-subject factors.

As in the study conducted in the United States, each week for three weeks 15 target words were taught in three vocabulary lessons.

Table 3

Instructional Treament Design for Republic of China Study

	Week 1	Week 2	Week 3
4th Grade:			
Classrooms 1-4	A	A	A
Classrooms 5-8	B	B	B
Classrooms 9-12	C	C	C
Classrooms 13-16	D	D	D
5th Grade:			
Classrooms 17-20	A	A	A
Classrooms 21-24	B	B	B
Classrooms 25-28	C	C	C
Classrooms 29-32	D	D	D
6th Grade:			
Classrooms 33-36	A	A	A
Classrooms 37-40	B	B	B
Classrooms 41-44	C	C	C
Classrooms 45-48	D	D	D

Note. A = Semantic Mapping
B = Semantic Feature Analysis
C = Conventional Method
D = Control

The lessons were taught by the classroom teacher on three consecutive days each week. By the end of the three-week period, students had been taught 45 vocabulary words. The strategy used to teach the vocabulary words reflected the treatment group to which the class had been assigned at the beginning of the study. Experimenters observed each class session to ensure that the treatments were administered uniformly in all classes.

At the end of each week, subjects were tested using three dependent measures. As in the United States study, each measure was designed to reflect the focus of a particular teaching strategy. The weekly test-order assignments were based on the condition that the dependent measure which resembled the treatment condition was given first in the order of presentation (see Table 4, Assessment Schedule for Republic of China study). For example, the classes that received the semantic mapping treatment were given the dependent measures in an ABC order for all three weeks.

At the beginning of the fourth week of instruction a comprehensive multiple-choice definition test was administered. This test was again administered a month later to assess longer term retention. Unlike the United States study, in the Republic of China the comprehensive test was also administered as a pretest on the first day of the study.

The 12 classes which comprised the control condition received the comprehensive test as a pretest, at the end of the third week and a month later. At the beginning of the study, the teachers of the classrooms assigned to the control condition were given a list of the

Table 4

Assessment Schedule for Republic of China Study

Treatment Group	Testing Schedule					
	Day 1	Week 1	Week 2	Week 3	Week 4	Week 7
Semantic Mapping	Comprehensive Test	ABC	ABC	ABC	Comprehensive Test	Retention Test
Semantic Feature Analysis	Comprehensive Test	BCA	BCA	BCA	Comprehensive Test	Retention Test
General Method	Comprehensive Test	CAB	CAB	CAB	Comprehensive Test	Retention Test
Control	Comprehensive Test	--	--	--	Comprehensive Test	Retention Test

Note. A = Semantic Mapping

B = Semantic Feature Analysis

C = Conventional Method

45 target words that were going to be taught in the study. (This was not done in the United States study.) The teachers, however, were not given any directions about teaching the words to their students.

The study was conducted over a three-week period during December 1981 and January 1982. Prior to the study, the teachers of the three treatment groups received two days of training at the Taiwan Provincial Institute for Teachers' Inservice Education. During the training, the experimenter gave separate demonstration lessons to the three groups of teachers. To ensure uniformity of treatment, a videotape was shown that demonstrated the methods used in the United States study. The demonstration lessons were followed by a question and answer period and preparation time for teachers to study the lesson plans. Each teacher was asked to select one of the nine lesson plans and to practice teaching it in front of other teachers in the group.

Treatments

As in the United States study, the purpose of this study was to investigate the relative effectiveness of two new instructional strategies that were based on prior knowledge with a more conventional strategy. The two prior knowledge strategies of semantic mapping and semantic feature analysis that had been used in the United States study were also employed in the Republic of China study. The third instructional treatment used in the Republic of China study, however, was not the contextual analysis treatment that had been used in the United States study. Rather, the conventional technique for

vocabulary development in the Republic of China, the General Method, was used.

Semantic mapping and semantic feature analysis. The instructional procedures that were used for these two strategies in the Republic of China study are generally the same as those described on pages 10-14, except that new words for each category were chosen. A semantic map and semantic feature analysis grid for the topic Communication with Language, translated into Chinese, are presented in Figures 6 and 7.

General teaching method. The conventional Chinese method, or General Method, is essentially a combination of the whole word and definition approaches to vocabulary learning. The method focuses on the meanings, pronunciations and writing of the Chinese target words. As part of this method, the children had the opportunity to learn to write, pronounce, and hear the meanings of the characters that make up a target word. In the Chinese language, each separate character has its own meaning, which can stand for one or more English words. When several characters are put together, the result is a new meaning which may build on, but yet be different from, the meaning of any one character. For example, library (圖書館) in Chinese consists of three characters: picture (圖), book (書), and hall (館). Compared to English, Chinese written language is semantically rather than phonologically based; beginning readers cannot "sound out" a Chinese word without the use of an artificial phonetic symbol system developed specifically to teach Chinese characters to beginning readers.

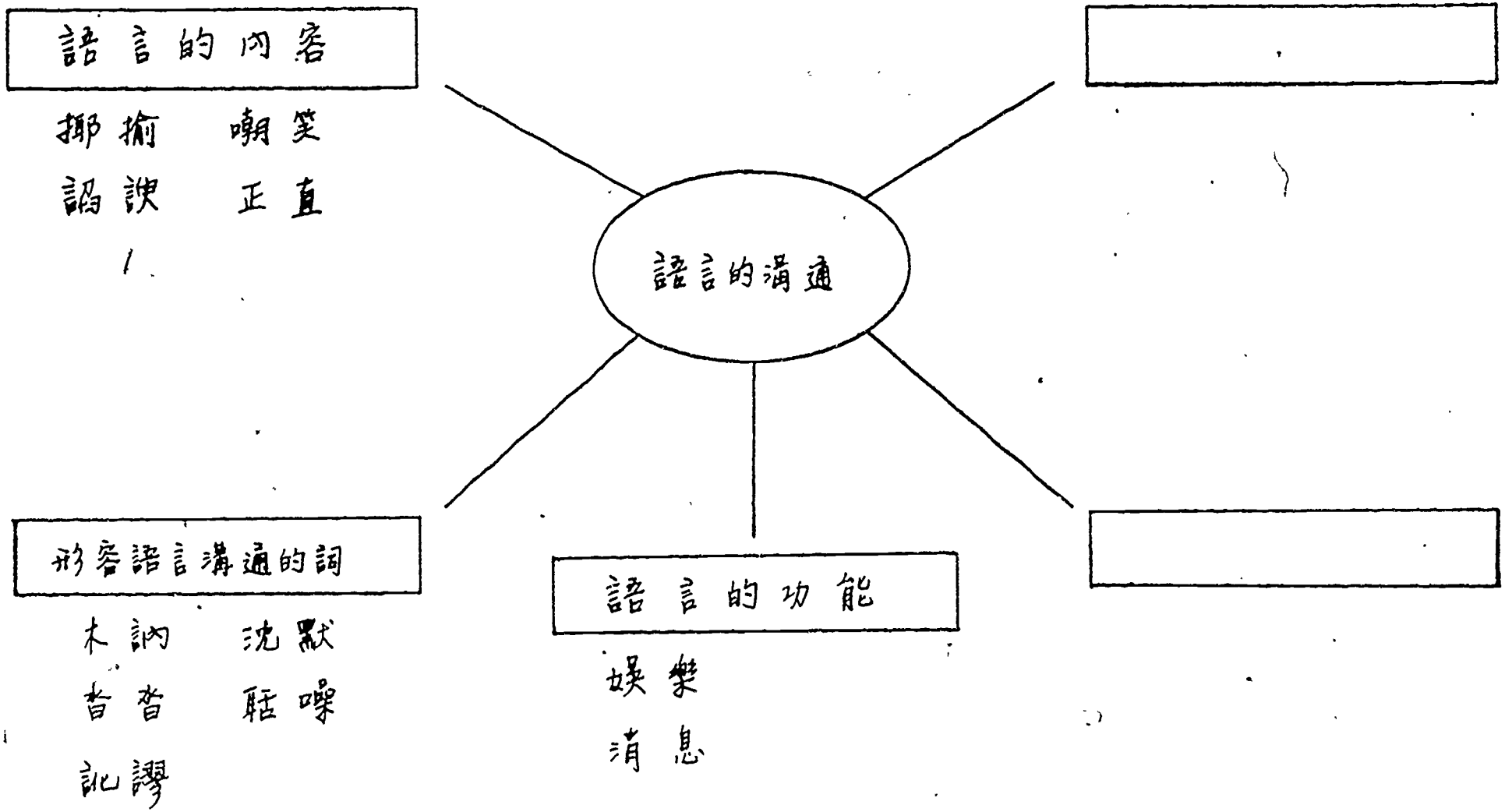

Figure 6. Semantic Map for the topic: Communication With Language.

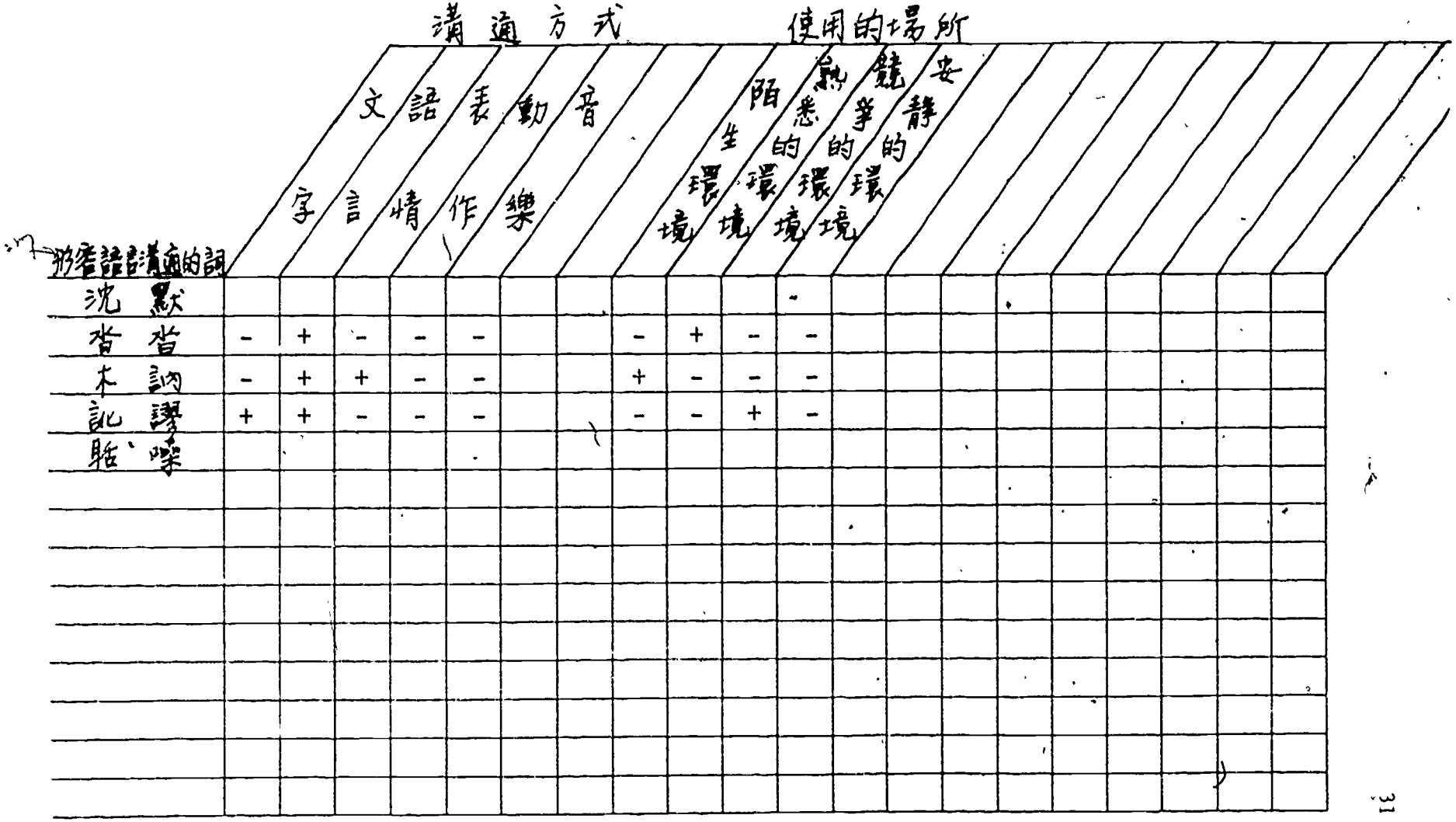

Figure 7. Semantic Feature Analysis Grid for the topic: Communication With Language.

The overall procedure for the General Method is as follows:

1. The teacher displays a flash card with the target vocabulary word (written in Chinese characters).
2. The word is read by the teacher, and the children repeat it three or four times. Students are then asked to sound out the word with the aid of phonetic symbols written next to the characters.
3. With the aid of objects, pictures, action, description, examples, or paraphrase, the teacher provides the definition of the word.
4. The students are asked to explain the meaning of the vocabulary word and use it in a sentence.
5. Students report what they had written and again explain the word meaning.

As in the United States Study, detailed lesson plans were written for each of the three treatments. The lesson plans for the Semantic Mapping and Semantic Feature Analysis treatments were very similar to those used in the United States study. An abbreviated lesson plan for the General Method treatment is presented in Appendix B.

Selection of Target Words and Categories

Since direct translations of English words are not necessarily of the same difficulty level, nor even appropriate for the language, forty-five different Chinese target vocabulary words were chosen. Five words were identified for each of the nine conceptual categories used in the United States.

Initially, a pool of 180 words, 20 for each category, was selected from Chinese reading materials for grades 6-9. All of the words were judged by elementary school teachers to be unknown to Chinese students in grades 4-6. A multiple-choice vocabulary test was then constructed and administered to 210 sixth-grade students in a low-to-moderate income suburban school. Based on the results of the testing, forty-five target words were identified. For each of the words identified, less than 17 percent of the subjects had selected the correct answer on the test. The 45 target words, arranged by category, are presented in Figure 8.

Description of Assessment Instruments

A comprehensive vocabulary test which required students to select the correct meaning for the target vocabulary words was developed. This test was given as a pretest, a posttest, and a retention test.

Three assessment formats, each favoring a particular treatment, were developed for administration at the end of each week.

Store	Shelter	Animals
rice cake	clothes that have no lining	hibernation
sinew of ox	heavy comforter	to stand on the lookout
sickle	curtain	furry
vanity box	door and wall	jade
sluggish	floodgate	the smell of sheep or goats

School	Water	Communication
to discipline and punish	ship	lacking eloquence; inflexible
school	sound of water	to mimic; to ridicule
admonish	sewers	flattery
to investigate and punish	the strength of current	erroneous
book	embankment	chattering and talkative

Fiction	Size	Environment
metaphor	vast	high and steep
to joke	vast and boundless	perilous
crafty; cunning; treacherous	tiny; small	winding
proverb	small land	the chaotic world in prehistoric
anecdote (not included in history)	vast expanse of water	isolated and lonely

Figure 8. Categories and target words for the Republic of China Study.

United States of America Study: Results

Two main research questions were addressed in this study. The first was whether the two instructional strategies which draw on prior knowledge and capitalize on categorically arranged conceptual frameworks are as effective as the traditional approach of contextual analysis for vocabulary building. To answer this question, a repeated measures analysis of variance at the classroom level was performed. The second research question was whether a specific teaching strategy would appear to be more effective when the test format closely resembled the instructional strategy. A descriptive analysis of the data which addresses the latter question is presented later in this chapter under Research Question #2. (A statistical analysis of this data may be found in Toms-Bronowski, 1982a, 1982b.)

The design for this study, a modified 3 x 3 Latin square (refer to Table 1, p. 6), allowed for analysis of three main effects: Order Group, Method (treatment) and Week (words), as well as one residual effect that represented 2- and 3-factor interactions (Winer, 1971, p. 686). A repeated measures analysis of variance was utilized to analyze all dependent measure data (Winer, 1971, p. 696).

Analysis of the Data

In order to respond to Research Question One, the repeated measures ANOVA for the within-classroom analysis, the data were blocked on Order Group and Treatment (method). The 45-item

comprehensive test was divided into three word sets, each with a possible score of 0-15, and then rearranged to represent the 15 target words taught each week. By arranging the data in this manner, it was possible to look at treatment effects. The factors for the within-classroom analysis were: Treatment, Words (W1, W2, W3), and Residual. The Residual, analyzed as a main effect, was a mixture of two-factor and three-factor interactions that could not be analyzed separately. The Residual indicates interactions of Order Group, Treatment, and Words. For the between-classroom analysis, the data were blocked on Order Group and Grades. Each school was treated separately as one school had combined fourth-fifth and fifth-sixth grade classes and the other school had separate fourth, fifth, and sixth-grade classes. The between class factors were: School, Grade within School, and Order Group.

The final analyses were performed with the Bmdp4v program (Dixon, 1981), which allows for the nesting of grades and computes standard adjustments for univariate analyses. Since the sphericity tests were met (cell variances were reasonably homogeneous for logits and the classes were assigned to orders in a nearly balanced way), classical univariate analysis with post ANOVA T tests was used (Winer, 1971) Comparable analyses were performed on the weekly dependent measures data in order to respond to Research Question Two (see Toms-Bronowski, 1981a, 1982b).

Results: Research Question #1

Results of the analyses performed indicate that there were large. Method or treatment effects. The two instructional strategies based on prior knowledge, Semantic Feature Analysis and Semantic Mapping, were indeed more effective than Context for general vocabulary acquisition. Semantic Feature Analysis produced significantly higher results than Semantic Mapping and Semantic Mapping produced significantly higher results than Context.

The descriptive presentation of data for performance on the Comprehensive Test had indicated that the three treatments differed (see Tables 5, 6, 7, and 8). Semantic Feature Analysis had a mean score of 10.45 correct, Semantic Mapping, 9.91, and Context, 9.60. Each mean differs from the other at the 5 percent level (LDS = .26, on 43df).

Mean scores on the retention test indicated that treatment effects were maintained over time. The Semantic Feature Analysis classes had a mean score of 9.05, Semantic Mapping, 8.56 and Context, 8.42. Each mean differed from the others at the 5 percent level (LDS = .26, on 42df).

The analysis of variance resulted in three extracted factors for within-classroom comparisons: for Method (treatment effects), for Words, and for Residual. The Words factor refers to the set of words taught for each week. The Residual is a mixture of two-factor interactions that are not estimable separately. The results of the ANOVA for within-classroom analysis for the comprehensive test data are presented in Table 9. The results show large differences among

Table 5

Mean Scores for Method by Treatment Group

on Comprehensive Test

Order Group	Semantic Mapping		Semantic Feature Analysis		Context	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
ABC	10.34	1.59	9.87	1.33	10.99	1.47
BCA	10.61	1.26	10.44	1.26	8.70	1.69
CAB	8.79	1.15	11.04	.90	9.13	1.37
Total	9.91	1.54	10.45	1.24	9.61	1.79

Note. Maximum score is 15.

N = 12 classes for each Treatment Group

Table 6

Mean Scores for Method by School

on Comprehensive Test

Order Group	Semantic Mapping		Semantic Feature Analysis		Context	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
School X						
ABC	10.36	1.18	9.26	1.24	10.93	.59
BCA	10.84	.98	10.59	.67	8.74	1.45
CAB	8.76	.93	10.94	.96	9.35	1.13
Total	10.01	1.33	10.40	1.08	9.74	1.41
School Y						
ABC	10.32	2.21	10.02	1.58	11.09	2.32
BCA	10.37	1.55	10.29	1.73	8.65	2.05
CAB	8.83	1.42	11.13	.92	8.90	1.64
Total	9.81	1.78	10.51	1.43	9.46	2.16

Note. N = 12 classes for each Treatment Group.

Table 7

Mean Scores for Method by Grade (School X)

on Comprehensive Test

Order Group	Semantic Mapping		Semantic Feature Analysis		Context	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
Grades 4 & 5						
ABC	9.83	1.37	9.95	1.61	10.92	.75
BCA	10.72	.80	10.40	.81	8.24	1.32
CAB	8.35	.92	10.35	.60	8.35	.19
Total	9.65	1.39	10.21	1.06	9.35	1.56
Grades 5 & 6						
ABC	11.07	.23	9.50	.76	10.93	.46
BCA	10.96	1.31	10.78	.60	9.24	1.66
CAB	9.17	.90	11.54	.94	10.34	.46
Total	10.40	1.22	10.61	1.12	10.17	1.16

Note. N = 6 classes for each Treatment Group.

Table 8

Mean Scores for Method by Grade (School Y)

on Comprehensive Test

Order Group	Semantic Mapping		Semantic Feature Analysis		Context	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
Grade 4						
ABC	10.06	-	10.56	-	12.94	-
BCA	10.22	1.18	10.05	1.72	7.85	.81
CAB	9.14	1.02	10.78	.45	8.07	.78
Total	9.76	.96	10.44	.96	8.96	2.30
Grade 5						
ABC	9.61	1.66	9.44	.80	10.44	.35
BCA	9.80	.73	9.97	.26	8.18	.86
CAB	7.24	.10	10.62	.61	7.90	.22
Total	8.89	1.51	10.01	.71	8.84	1.31
Grade 6						
ABC	11.15	3.78	10.33	2.85	10.82	4.13
BCA	11.09	2.89	10.84	3.31	9.93	3.82
CAB	10.11	.73	11.98	1.20	10.73	1.68
Total	10.78	2.22	11.05	2.16	10.49	2.66

Note. N = 6 classes for each Treatment Group.

Table 9

Within-Classroom ANOVA for Comprehensive Test

Source	df	MS	F	p
1. Method	2	5.68	18.94	.000**
2. Method X School	2	.17	.58	.56
3. Method X Grade/ School	6	.35	1.17	.33
4. Words	2	26.25	87.48	.000**
5. Words X School	2	.47	1.57	.22
6. Words X Grade/ School	6	.85	2.84	.020*
7. Residual	2	.62	2.06	.14
8. Residual X School	2	.14	.48	.62
9. Residual X Grade/ School	6	.96	2.99	.016*
10. Error	42	.3000		

Note. N = 36 classrooms

*p < .05

**p < .001

Methods and Words and two interactions with Classes. Statistically, there was a large Method effect ($F = 18.94$, $p < .001$). Interestingly, Method did not interact with School ($F = .58$, $p = .56$) or with Grade ($F = 1.17$, $p = .33$).

The results of the retention test data for the within-classroom analysis are presented in the ANOVA Table 10. Again, results show large differences among Methods and Words with a smaller significant interaction between Words within Schools. A large Method effect remains ($F = 11.58$, $p < .001$) as well as the Words effect ($F = 86.36$, $p < .001$). For a more thorough discussion of the Words effect, refer to Toms-Bronowski, (1982a, 1982b).

The analysis of variance yielded three between-classroom factors: School, Grade within School, and Order Group. The Comprehensive Test means for Schools (School X = 10.05; School Y = 9.92) and for Grade within Schools (School X: 4th and 5th = 9.73 and 5th and 6th = 10.39; School Y: 4th = 9.71, 5th = 9.24, 6th = 10.73) showed no significant differences. The Retention test means for the two Schools (School X = 8.60, School Y = 8.76) were also not significantly different; however, there was a significant difference between the fourth and sixth grades ($t = 1.95$ at the 5 percent level of significance) for School Y (4th = 8.25, 5th = 8.34, 6th = 9.60). There were no significant differences between grades in School X (4th and 5th = 8.27, 5th and 6th = 8.98). All the between classroom effects on the comprehensive test data and retention test data were nonsignificant as shown in the ANOVA Tables (see Tables 11 and 12). Therefore, there were no significant differences between Schools ($F = .01$, $p = .95$), between Grades within

Table 10

Within-Classroom ANOVA for Retention Test

Source	df	MS	F	p
1. Method	2	3.39	11.58	.000**
2. Method X School	2	.62	2.12	.13
3. Method X Grade/ School	6	.47	1.60	.17
4. Words	2	25.29	86.36	.000**
5. Words X School	2	1.03	3.52	.038*
6. Words X Grade/ School	6	.33	1.13	.36
7. Residual	2	.30	1.04	.36
8. Residual X School	2	.04	.13	.88
9. Residual X Grade/ School	6	.30	1.02	.42
10. Error	42	.2929		

Note. N = 36 classrooms

*p < .05

**p < .001

Table 11

Between-Classroom ANOVA for Comprehensive Test

Source	df	MS	F	p
1. Order Group	2	6.06	1.09	.35
2. School	1	.04	.01	.95
3. Order Group X School	2	.57	.10	.90
4. Grade/School	3	9.44	1.70	.20
5. Order Group X Grade/School	6	1.64	.30	.93
6. Error	21	5.5536		

NSD

Note. N = 36 classrooms.

Table 12

Between-Classroom ANOVA for Retention Test

Source	df	MS	F	p
1. Order Group	2	4.55	1.16	.33
2. School	1	.61	.16	.70
3. Order Group X School	2	.13	.03	.96
4. Grade/School	3	8.64	2.21	.12
5. Order Group X Grade/School	6	.33	.08	.96
6. Error	21	3.9150		

NSD

Note. N = 36 classrooms

Schools ($F = 1.70$, $p = .20$), or between Order Groups ($F = 1.09$, $p = .35$). It was surprising that there were no grade level differences, for at the classroom descriptive level of analyses, there was an indication of grade differences (in School X the 5-6 grades > the 4-5 grades; in School Y the 6 grades > 4 grades > 5 grades). The differences were not supported statistically.

Results: Research Question #2

Each week, three assessment instruments were administered for the 15 target vocabulary words, with each instrument reflecting one of the three treatments. This resulted in nine assessment scores for each subject over the three week period. The test orders had been determined first by treatment group (ABC, BCA, CAB) and second by the particular teaching strategy assigned to each group. The dependent measure that reflected the treatment taught to a group was always administered last. For example, in Week I the ABC treatment group (Semantic Mapping, Semantic Feature Analysis, Context) received the dependent measures either in a BCA or a CBA order. Identical test orders were randomly assigned across grades and school districts.

A descriptive analysis of the data showed that there was a general trend for subjects in the Context condition to perform at a higher level on the subtest that matched their treatment condition than did subjects in the other two groups. This was not as evident for subjects in the Semantic Mapping treatment and was not at all true for subjects in the Semantic Feature Analysis treatment; subjects in Semantic Feature Analysis performed least well on the dependent

measure that reflected their treatment. The descriptive analysis also indicated that subjects in all treatment conditions performed at a higher percentage level on the weekly tests (on all three subtests) than they did on the comprehensive or retention tests. (Note: A statistical analysis of this data may be found in Toms-Bronowski, 1982a, 1982b).

Control Group

Due to complications in scheduling, two classrooms from the original nine classes that formed the Control Group were lost. There were, therefore, only seven classes in the no-treatment control condition (four fourth, one fifth, and two sixth-grade classes), so that high power was not expected. Due to the above consideration and the fact that the Control Group was comprised of classes from a school district not involved in any treatment condition, only descriptive analyses were performed at the class level on the comprehensive test data for the Control Group. The descriptive analyses indicated that the Control Group performed well below all treatment groups on all dependent measures as would be expected for a no treatment Control Group. A descriptive level of class analysis indicated that the sixth grade scored higher than the fifth grade in number correct on the comprehensive dependent measure, and the fifth grade tended to be above the fourth grade (see Table 13). A median polish indicated percent correct on the comprehensive test scores also increased as grade level increased.

Table 13

Control Group Class Means on Comprehensive Test for the Three Weekly Groups of Words

Grade	Week 1 Words	Week 2 Words	Week 3 Words
4	4.00	4.91	4.81
	3.73	3.73	4.91
	3.71	4.86	3.00
	5.62	5.00	6.46
5	6.06	3.94	6.00
6	7.85	6.80	11.20
	6.53	5.06	8.00

Note. Maximum score is 15.

N = 7 classes

Summary

Treatments differed significantly, with Semantic Feature Analysis more effective than Semantic Mapping and Semantic Mapping more effective than Context. Thus, both of the vocabulary teaching methods which draw on prior knowledge and capitalize on categorically arranged conceptual frameworks were more effective than the traditional approach of contextual analysis for vocabulary building in the United States study.

The three between-class factor effects--School, Grade within School, and Order Group--were nonsignificant. Therefore, there were no significant differences between the two school districts involved in the experimental treatments and none between grade levels within the schools. Thus, the differences between grades in the descriptive analyses were not large enough to be statistically significant. That the order in which the three treatment conditions were presented (i.e.: ABC, BCA, CAB) had no effect on performance on the comprehensive test or the retention test indicates that there is no carry-over effect of one treatment condition to another treatment condition.

The three main within-classroom factor effects were: Method (Treatment), Words, and Residual. Both Method (Treatment) and Words were highly significant at the $p < .001$ level. The very large Words effect was attributed to the Week II words. For whatever reasons, the Week II words were more difficult than the Week 1 words, which in turn were more difficult than the Week III words in all treatment conditions.

Republic of China Study: Results

The design was a 4 x 3 x 3 x 3 design with three instructional treatments and a control group. A problem resulted from the control group teachers having been given the target words each week. Many of the control teachers chose to teach the words to their classes. Thus the control group was not really a control but rather was an "unspecified" treatment group about which no observations can be made. For this reason, even though control group data are included in the analyses, they are not discussed further in this report.

Analysis of Data

For each subject, the posttest score minus the pretest score was used as an indicator of the amount of gain due to instructional treatment. A two-way analysis of variance was performed to examine which instructional strategies were the most effective for what grade levels.

The retest score minus the posttest score was used as the retention score for each subject. A two-way analysis of variance was performed to examine which instructional strategy had the most lasting effect for what grade levels.

Every week, three assessments of target vocabulary words using different formats were administered. Thus there were nine assessment scores for each subject over the three week period. A four-way analysis of variance was performed to detect instructional strategies x grade x assessment format x time interaction, since effects of instruction might be influenced by the performance measures

taken. Furthermore, the rate of progress under the different instructional strategies might differ.

Results: Research Question #1

Table 14 presents the mean scores on the pretest, posttest and retention test for each of the three treatment groups (semantic mapping, semantic feature analysis and general method) in grades four, five, and six. From the results of the pretest it can be concluded that the 45 words selected for the study were appropriately difficult. In grade four pretest scores for the semantic feature analysis and general method group were nearly twice those of the semantic mapping group. In grade five pretest scores of the general method group were nearly twice those of the other two groups. Semantic feature analysis students performed slightly better on the pretest than the other two groups did in grade six. In no group were more than a quarter of the words known at the outset of the study.

Of greater interest are the posttest results. Subjects showed significant gains in all three treatment groups at all three grade levels. Thus, all three vocabulary methods can be described as highly successful with the Chinese students. In all three grade levels the General Method mean scores surpassed those of the Semantic Mapping and Semantic Feature Analysis subjects. In fact, in grades five and six, General Method subjects had a mean score of more than 40 out of a possible 45. The highest mean scores for the prior knowledge approaches were 32+ in grade six. This pattern

Table 14

Mean Scores for Pretest, Posttest, and Retention Test by Grade and Treatment

Treatment Group	Pretest	Posttest	Retention Test
Grade 4			
Semantic Mapping (N=164)	4.695	28.323	26.408
Semantic Feature Analysis (N=167)	8.467	22.880	21.586
General Method (N=174)	8.471	37.034	35.379
Grade 5			
Semantic Mapping (N=179)	5.709	30.094	29.296
Semantic Feature Analysis (N=162)	5.160	27.154	24.358
General Method (N=171)	10.888	40.988	39.707
Grade 6			
Semantic Mapping (N=167)	9.005	32.137	30.592
Semantic Feature Analysis (N=170)	11.435	32.188	30.600
General Method (N=169)	9.461	41.863	40.674

Note. Only the scores for the Treatment Group are presented in this table.

Maximum possible score was 45.

prevailed on the retention test, as shown in Table 14. The results of the Analysis of Variance used to compare these means is shown in Table 15. All main effects and interactions were significant ($p < .001$).

For each subject, the posttest score minus the pretest score was used as an indicator of the amount of gain due to instructional treatment. A two-way analysis of variance was performed to examine which instructional strategies were the most effective for what grade levels. Tables 16 and 17 present mean difference scores and ANOVA results for the pretest/posttest analysis, the comparison of greatest interest in this study.

Table 17 reveals that significant F values were obtained for treatment, grade and their interaction. An inspection of the mean difference scores presented in Table 16 shows highly significant vocabulary growth for all three instructional methods. However, greater gains occurred for the General Method group than for either Semantic Mapping or Semantic Feature Analysis at all three grade levels. Semantic Mapping subjects outperformed Semantic Feature Analysis subjects in all three grades. The General Method was clearly the most successful of the three approaches and, in contrast to the United States study, Semantic Mapping outperformed Semantic Feature Analysis. Explanations for the success of the General Method are presented in the Discussion section of this report.

Tables 18 and 19 reveal the posttest/retention test mean difference scores and the ANOVA results. The retention score for each subject was calculated by taking the retest score minus the

Table 15

Analysis of Variance for Main Effects and

Interactions by Treatment, Grade, and Test Period

Source	df	MS	F Value	p<
Test	2	380457.2950	12997.2198	.0000
Method	3	24680.6339	234.6154	.0000
Test/Method	6	3794.3230	129.6220	.0000
Grade	2	11996.4513	114.0389	.0000
Test/Grade	4	437.4418	14.9439	.0000
Method/Grade	6	759.5776	7.2205	.0000
Test/Method/ Grade	12	393.4991	13.4427	.0000
Method/Grade/ Subject	2004	105.1960		
Test/Method/ Grade/Subject	4008	29.2722		
Total	6047			

Note. Analysis is based on Treatment and Control groups.

Table 16

Mean Difference Scores Between Pretest and Posttest

by Grade and Treatment Group

Treatment Group	Difference Score
Grade 4	
Semantic Mapping (N=164)	23.628
Semantic Feature Analysis (N=167)	14.413
General Method (N=174)	28.563
Grade 5	
Semantic Mapping (N=179)	24.385
Semantic Feature Analysis (N=162)	21.993
General Method (N=171)	30.099
Grade 6	
Semantic Mapping (N=167)	23.131
Semantic Feature Analysis (N=170)	20.752
General Method (N=169)	32.402

Table 17

Analysis of Variance for Pre- and Posttest Differences by Treatment and Grade

Source	df	MS	F Value	p<
Method	3	10896.6461	141.5822	.0000
Grade	2	1079.3032	14.0235	.0000
Method/ Grade	6	1363.1677	17.7119	.0000
Method/ Grade/ Subject	2004	76.9633		
Total	2015			

Table 18

Mean Difference Scores Between Posttest and Retention Test by Grade and Treatment Group

Treatment Group	Difference Score
Grade 4	
Semantic Mapping (N=164)	-1.914
Semantic Feature Analysis (N=167)	-1.293
General Method (N=174)	-1.655
Grade 5	
Semantic Mapping (N=179)	- .798
Semantic Feature Analysis (N=162)	-2.796
General Method (N=171)	-1.280
Grade 6	
Semantic Mapping (N=167)	-1.544
Semantic Feature Analysis (N=170)	-1.588
General Method (N=169)	-1.189

Table 19

Analysis of Variance for Posttest and

Retention Test Differences by Treatment and Grade

Source	df	MS	F Value	p<
Method	3	28.8859	1.6444	.1755
Grade	2	45.5342	2.5922	.0731
Method/ Grade	6	89.8369	5.1144	.0001
Method/ Grade/ Subject	2004	17.5653		
Total	2015			

posttest score. Mean difference scores for all treatments at all three grade levels were negative. A two-way analysis of variance was performed to examine which instructional strategy had the most lasting effect for what grade levels. While there was a significant treatment by grade interaction, difference scores by method were not significant ($p = .1755$) nor were difference scores by grade ($p = .0731$). Thus, regardless of the treatment through which the target words were learned, there was a slight loss in retention; and these minimal losses did not significantly differ from one treatment to another or one grade to another.

Post hoc comparisons of pre- and posttest differences and posttest/retention test differences were done using the Scheffe test. In grade four all pair-wise comparisons on pre- to posttest differences were significant. That is, the General Method subjects significantly surpassed Semantic Mapping and Semantic Feature Analysis subjects ($p < .001$) and the Semantic Mapping subjects significantly surpassed Semantic Feature Analysis subjects ($p < .001$). In both fifth and sixth grades the General Method subjects scored significantly higher than either Semantic Mapping or Semantic Feature Analysis subjects ($p < .001$) Thus, it can b concluded that while all three instructional strategies were highly effective and showed significant pre- to posttest gains, the General Method was the most effective of the three, followed by Semantic Mapping and then Semantic Feature Analysis.

Results: Research Question #2

A second research question addressed in the study was whether or not there would be a match between method of treatment and assessment format. Every week, subjects were tested on the target vocabulary words using three dependent measures, each measure designed to reflect the focus of one of the three teaching strategies. Thus there were nine assessment scores for each subject over the three week period. It was expected that subjects would perform better on the test format that resembled the method of treatment by which they were being instructed than they would on the other two test formats. An analysis of variance was performed on the mean scores by test format by week within treatment groups.

Tables 20, 21, and 22 present the mean scores on each test for each treatment group. An examination of Table 20, which presents scores for the Semantic Mapping treatment group, shows that only in weeks two and three in grade six did Semantic Mapping subjects score highest on the test format that matched treatment. In week one in grade six, and in all three weeks for grades four and five, Semantic Mapping subjects scored higher on the General Method test format than on any other; therefore, the prediction was not supported.

Table 21 shows a different pattern. Subjects in all three grades participating in the Semantic Feature Analysis treatment group consistently did better on the Semantic Mapping test formats and on the General Method format than they did on the Semantic

Table 20

Semantic Mapping Group: Mean Scores by Test Format and Week

Test Format	Week 1	Week 2	Week 3
	Grade 4		
Semantic Mapping	12.6	12.7	12.0
Semantic Feature Analysis	11.9	10.6	9.5
General Method	14.0*	13.2*	12.2*
	Grade 5		
Semantic Mapping	13.5	12.9	12.4
Semantic Feature Analysis	12.1	11.0	10.7
General Method	14.1*	13.5*	12.7*
	Grade 6		
Semantic Mapping	13.9	13.9*	13.3*
Semantic Feature Analysis	11.7	11.7	11.1
General Method	14.0*	13.7	12.9

*Highest score for each grade each week.

Table 21

Semantic Feature Analysis Group: Mean Scores

by Test Format and Week

Test Format	Week 1	Week 2	Week 3
	Grade 4		
Semantic Mapping	12.6	11.8*	11.4*
Semantic Feature Analysis	10.5	8.6	9.0
General Method	12.7*	11.2	10.5
	Grade 5		
Semantic Mapping	13.4	13.0*	13.0*
Semantic Feature Analysis	11.1	9.6	9.1
General Method	13.6*	11.1	11.8
	Grade 6		
Semantic Mapping	14.2*	14.3*	14.1*
Semantic Feature Analysis	12.4	11.5	11.0
General Method	14.2*	14.0	13.7

*Highest score for each grade each week.

Table 22

General Method Group: Mean Scores

by Test Format and Week

Test Format	Week 1	Week 2	Week 3
	Grade 4		
Semantic Mapping	13.5	13.9*	13.6*
Semantic Feature Analysis	13.7	12.7	12.5
General Method	14.4*	13.8	13.0
	Grade 5		
Semantic Mapping	13.9	14.2	14.2*
Semantic Feature Analysis	14.2	13.9	13.6
General Method	14.6*	14.6*	14.1
	Grade 6		
Semantic Mapping	14.6	14.4	14.3*
Semantic Feature Analysis	14.5	14.5*	14.3*
General Method	14.7*	14.2	14.1

*Highest score for each grade each week.

Feature Analysis test format. Thus, again, with the Semantic Feature Analysis group, the prediction was not confirmed.

Table 22 shows that with the General Method group, the look-alike test format showed superior results on only four of the nine comparisons. Once again the prediction failed to be consistent.

Examination of the results presented in Tables 20, 21, and 22 leads to the conclusion that there was not a consistent match between test type and treatment type. Though common sense would suggest that subjects would perform better on tests which resembled their treatment methodology, such was not consistently the case in the Chinese study. This is in contrast with the United States findings which showed that the Context treatment scored higher on the subtests that reflected their treatment.

Summary

All three instructional methods worked in the Chinese study. Subjects in all three treatments at all three grade levels made significant gains between the pre- and posttests ($p < .001$). Subjects in the General Method treatment did, however, significantly outperform the subjects in the Semantic Mapping and Semantic Feature Analysis treatments respectively at all three grade levels. As would be expected, the Retention testing showed small losses in percentage scores across groups, though there were no significant differences between treatments or across grades. Post hoc comparisons of pre- and posttest differences and posttest/retention test

differences, indicated that the General Method was significantly more effective than Semantic Mapping and Semantic Feature Analysis.

Analysis of the weekly tests did not show one test format to be superior to the others for any treatment condition or grade level. The hypothesis that test format would influence performance was therefore, not supported statistically.

Discussion

Treatments

All three instructional treatments employed in both the United States Study and the Republic of China Study appeared to be effective techniques for vocabulary instruction. Subjects in all three treatments at all three grade levels in both countries had considerable success in learning the target words. The treatment(s) that proved to be the most effective, however, was not consistent across cultures.

In the United States, children in the Semantic Feature Analysis and Semantic Mapping treatments outperformed students in the Context treatment, with the subjects in Semantic Feature Analysis doing significantly better than the students in the Semantic Mapping treatment. The strategies of Semantic Mapping and Semantic Feature Analysis, both of which draw on the prior knowledge bases of children, resulted in significantly increased vocabulary acquisition. One might hypothesize that the strategies that linked what the children were already familiar with to the new concepts and definitions for the target words had a highly facilitating effect on the acquisition of those vocabulary words. The Semantic Feature Analysis teaching method may have been more effective than Semantic Mapping because the strategy does indeed highlight the similarities and differences among words, thus emphasizing finer nuances among word meanings. (Many of the target words within categories were very close in meaning to each other.)

In the Republic of China, while all three strategies were significantly effective, the General Method treatment was the most effective. Subjects assigned to this treatment showed significantly greater gain scores than the Semantic Mapping and Semantic Feature Analysis groups at all three grade levels. It is clear that for vocabulary instruction in the Chinese language with Chinese students, the General Method was more successful than the two approaches based on prior knowledge.

There are several interpretations for this finding. Chinese writing is semantically rather than phonetically based. Each written symbol is a wholistic representation of a concept, rather than a symbol for an element of sound in Chinese. Therefore, beginning readers are unable to utilize graphemic information to gain access to phonological representation that they already possess in the oral language. Every Chinese character has its own meaning and each stands for a morpheme or one or more English words. When all the characters which form a word are put together, the result is a word which most often reflects a combined meaning of the characters, yet is different from the meaning of any one character. For example, tricycle in Chinese consists of three-wheel-vehicle (see Figure 9). Learning the meaning of each character probably helped the students to remember the meaning of the whole word by association, thus serving as a mnemonic device.

Beginning Chinese readers cannot "sound out" words as English readers can when they are confronted with unfamiliar symbols.

三 three

輪 wheel

車 vehicle

Figure 9. Chinese characters making up tricycle.

However, the structure of many Chinese characters allows for learning sound by analogy. For example, many characters that look similar (媽, 罵, 馬) also sound similar. All those characters contain the phonetic 馬 and are pronounced /ma/. It is not clear how useful the analogies are, since some of these characters are pronounced using different tones that are phonemically distinct. Moreover, the analogies do not always hold: 紅 and 虹 are pronounced /hong/ but 扛 also contains the phonetic 工 and is pronounced /kang/. Although written Chinese does not have phoneme-grapheme correspondences, research evidence has shown that for fluent Chinese readers phonological recoding is necessary for character and sentence recognition (Chu-Chang & Loritz, 1977; Tzeng, Hung, & Wang, 1977) as well for reading comprehension of words and prose passages (Chu-Chang, 1979).

To help children gain access to the phonetic representation of the Chinese characters, an artificial phonetic symbol system is taught to all children in the first grade in the Republic of China. The symbols are written alongside the Chinese characters in elementary school texts, children's dictionaries, and children's newspapers. In the General Method, the teacher pronounced each target character with the aid of the phonetic symbol which was written next to each character on the flashcard. This pronunciation of the target vocabulary words was reinforced by students reciting each character as well as the word. In the Semantic Mapping and Semantic Feature Analysis Methods, the phonetic symbols were not used, and the teacher did not reinforce the pronunciation of the target vocabulary word. It seems that since the written Chinese language is less accessible phonologically, it becomes much more important to emphasize the phonological aspects in teaching Chinese than in teaching a language like English which does not require further reinforcement once the decoding skills have been mastered by students in the early grades.

Another possible reason for the success of the General Method was that students had the opportunity to write all the target words in sentences. The kinesthetic and visual feedback as well as putting words in context probably aided learning. In Semantic Mapping and Semantic Feature Analysis, students neither wrote the target words nor put them in sentences.

Furthermore, the two prior knowledge strategies of Semantic Mapping and Semantic Feature Analysis are based on categorical relationships. For both the Chinese students and the teachers, however, a

language teaching strategy that emphasizes categorization is a new concept. Furthermore, some of the target words did not easily fit within the nine categories that had been used in the United States study. As shown in Figure 8, many words had to be "forced" under particular categories where they were unnatural. In fact, teachers were frequently confused as to why a target word had been placed under a specific topic and consequently had difficulty assigning words that were generated by the students to an appropriate category. This would have detracted from the effectiveness of the Semantic Mapping and Semantic Feature Analysis treatments which rely heavily on categorization. Finally, Semantic Mapping and Semantic Feature Analysis were unfamiliar methodologies. Students, therefore, did not adjust to them as readily as they did to the highly familiar General Method.

Retention

Another cross-cultural difference was the relative effectiveness of the treatments on the retention scores. In the Republic of China, no one treatment facilitated retention better than any other treatment. As expected, there were slight losses on the retention test scores for all three treatment groups; these losses were all insignificant. In the United States study, however, students in the Semantic Feature Analysis treatment scored highest on the retention test. In fact, the treatment effect profile on the retention test data remained the same as for the comprehensive test data. Therefore, treatment effects were maintained over time. As in the Republic of China, there were also small, but insignificant losses on the retention score for

all three treatment groups. It must be noted, however, that the retention test was given three months later in the United States rather than one month later as in the Republic of China.

Treatment and Test Format

There was no consistent trend in the Republic of China weekly dependent measure data to indicate any facilitating effect in matching test format with teaching strategy. There were no significant consistencies between grade levels or treatment conditions when test scores were compared to test format.

In the United States study, however, a trend was noted for one of the treatments; Context treatment subjects always performed at a relatively higher level on the context subtest than did the Semantic Mapping and Semantic Feature Analysis treatment subjects on their respective analogous subtests. This finding may indeed indicate that the context test format more closely resembled its analogous treatment than did the other two assessment formats.

The descriptive trend in the data highlights the concern that practitioners and researchers have raised in regard to the types of knowledge that are assessed in tests and in the choice of test format which determines to some extent not only what type of knowledge is being assessed, but also the performance levels that will be attained.

Conclusions and Implications for Future Research

The twin studies were designed to advance knowledge in the area of vocabulary instruction both within and between two cultures: the United States and the Republic of China. A primary focus of the study was to evaluate in the Republic of China the effectiveness of two strategies, both based on prior knowledge, which had been proven to be effective in the United States.

It was hypothesized that vocabulary teaching strategies which capitalized on the individual prior knowledge bases of children, regardless of whether the bases are the same or different, would provide culturally sensitive approaches to increase vocabulary acquisition. It was hoped that using the same word categories in both studies would provide invaluable insights as to specific prior knowledge bases of culturally different children and thereby also provide additional empirical evidence as to the effectiveness of the Semantic Mapping and Semantic Feature Analysis strategies. In each study the choice of the third vocabulary teaching method was based on what was already known to be effective. Therefore, the conventional Chinese General Method approach and the contextual analysis approach were chosen for comparison purposes.

Test scores indicate that all three vocabulary strategies employed in both studies had a positive impact on vocabulary acquisition. In the Republic of China the conventional Chinese approach was the most effective, while in the United States the two prior knowledge

approaches were most effective. The study did, however, validate the effectiveness of the two prior knowledge strategies. The Chinese language with its pictographic writing is unique, yet semantic mapping and semantic feature analysis produced mean score gains very close to the conventional memorization method with which the students were familiar. Continued research in the area of instructional methods for vocabulary acquisition would be most beneficial.

Several modifications of the study conducted in the United States might prove insightful. Composition writing could be incorporated as a natural extension of the Semantic Mapping and Semantic Feature Analysis procedures. Furthermore, different types of criteria for choice of sample populations could provide additional information concerning the utility of the treatment strategies for general vocabulary development. The grade levels used in the United States study could be altered to encompass primary or secondary student populations. Either student population would provide for a differentiated developmental component that could shed light on the age level utility of the vocabulary teaching strategies. Another criteria for sample population choice could be varied ability levels represented within any chosen student sample. The identification of and resultant control for ability levels of subjects might provide invaluable information regarding the utility of the teaching strategies when considering specific learner characteristics.

It would be advantageous if the Republic of China study were repeated using categories and words that were more consistent with the Chinese language and culture. Furthermore, modifications should be

made in the Semantic Mapping and Semantic Feature Analysis procedures to include: teaching and reinforcing the phonological representation of the target word with the aid of the phonetic symbols, teaching the meaning of each character as well as the target word, providing writing practice with the target words, and putting the target words in sentences. With these modifications, the two prior knowledge strategies should again be compared with the General Method to see if the power of a modified approach which combines the best features of the General Method with the best features of the two prior knowledge approaches would show greater strength than the conventional method.

Additional research is needed in the area of teaching strategies that facilitate general vocabulary acquisition and development. Both the study in the United States and the study in the Republic of China have demonstrated, however, that the two vocabulary teaching strategies that capitalize on student prior knowledge do substantially and positively effect general vocabulary acquisition. The power of prior knowledge on vocabulary development should continue to be incorporated in vocabulary research instruction both in the United States and in the Republic of China.

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Appendix A

Vocabulary Study Workshop Agenda

Vocabulary Study Workshop Agenda

Brief Description of the Study

- Schedule of Lessons
- Evaluation Form

Brief Overview of the Three Treatments

- Context
- Semantic Mapping
- Semantic Feature Analysis

Demonstration of Activities from Week One

- Semantic Mapping
  - a) Outline of Lesson Plans
  - b) Sample Lesson
- Semantic Feature Analysis
  - a) Outline of Lesson Plans
  - b) Sample Lesson
- Context
  - a) Outline of Lesson Plans
  - b) Sample Lesson

Questions and Answers

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Appendix B

Abbreviated Lesson Plans for Semantic Mapping

Abbreviated Lesson Plans for Semantic Feature Analysis

Abbreviated Lesson Plans for Context

Abbreviated Lesson Plans for General Method

Abbreviated Lesson Plans for Semantic Mapping

OBJECTIVE: To introduce new vocabulary words (Definition of the five target words are provided.)

MATERIALS: The Semantic Map copied onto the chalkboard
A copy of the Semantic Map for each child

PROCEDURE:

1. Introduction. Tell the children the topic of the Semantic Map and review the categories that appear on the map.

2. Definition of Target Words and Other Unfamiliar Words; Addition of a Word to Each Category.

3. Independent Work (5 minutes). Have the children work independently adding words and categories to their copies of the map.

4. Class Discussion. Add children's suggestions for additional words and categories to the chalkboard map and discuss them. (Take only a few suggestions at this time.)

5. Review of Target Words and Other Unfamiliar Words. Discuss each of the words using some of the following techniques: synonym, antonym; sentences, cross-category comparisons.

6. Further Additions to the Semantic Map. If time permits, have the children suggest additional words and categories and add these to the chalkboard map.

7. Collect Children's Work.

Abbreviated Lesson Plans for Semantic Feature Analysis

OBJECTIVE: To introduce new vocabulary words (Definitions of the five target words are provided.)

MATERIALS: The Semantic Feature Analysis Grid(s) copied onto the chalkboard
A copy of the Semantic Feature Analysis Grid(s) for each child

PROCEDURE:

1. Introduction. Tell the children the topic of the Semantic Feature Analysis Grid and the type (category) of the words going down the side of the grid and across the top of the grid.

2. Definition of Target Words and Other Unfamiliar Words.

3. Addition of a Word and a Feature to the Grid.

4. Independent Work (5 minutes). Have the children work independently filling in the pluses (+) and minuses (-) on their copies of the grid, and adding new words and features to the grid.

5. Class Discussion. Add children's suggestions to the chalkboard grid. Discuss the pluses (+) and minuses (-) and question marks (?) as they are being filled in. (Take only a few suggestions at this time.)

6. Review of Target Words and Other Unfamiliar Words. Discuss the pluses and minuses that were filled in for each target word. Have the children help you to define each target word in terms of the semantic features that have been marked.

7. Further Additions to the Grid. If time permits, add more of the children's suggestions to the chalkboard grid and fill in all remaining pluses (+) and minuses (-). Discuss each entry as it is made.

8. Collect Children's Work.

Abbreviated Lesson Plans for Context

OBJECTIVE: To introduce new vocabulary words (Definitions of the words are provided.)

MATERIALS: Chalkboard and chalk
A copy of the two Context Worksheets for each child

PROCEDURE:

1. Introduction. Tell the children that they will be learning some new words by using context clues.

2. Explanation of Context Clue Type and Description of Signals.

3. Independent Work (5 minutes). Have the children work independently filling in a word or words in the blank for each of the ten sentences on the worksheet. As the children do each sentence, they should circle the signal.

4. Class Discussion. List the children's suggestions for each blank in a column on the chalkboard. Have the children discuss their reasons for selecting the words. Collect the children's worksheets.

5. Independent Work (5 minutes). Give the children the second worksheet, consisting of ten sentences each having an underlined word. The children should work independently writing a meaning for each underlined word.

6. Class Discussion. For each of the sentences, list the children's meanings for the word in a second column on the chalkboard. Then add the underlined word to the first column on the chalkboard. Discuss that the underlined word has the same meaning as the meaning written on the chalkboard. Compare and contrast some of the other words in the first column with the meaning written on the chalkboard.

7. Review of Target Words and Other Unfamiliar Words. Go over each of the vocabulary words and restate the definition of each of these words.

8. Collect Children's Work.

Abbreviated Lesson Plans for General Method

OBJECTIVE: To introduce new vocabulary words (definitions of the words are provided).

MATERIALS: Five flash cards, each containing one of the five target vocabulary words
Five flash cards, each containing the target vocabulary word and the appropriate definition
Worksheet for each student
Pictures or examples related to each word (as appropriate)

PROCEDURE:

1. Introduction. Tell the children that they will be learning some new vocabulary words.

2. Definition of Target Words. Display each of the flash cards one-by-one. As each card is shown to the class, ask the students to sound out the words. Then show the cards that contain the definitions and explain the meaning of each word. Using pictures, actions, examples, or paraphrases explain the meaning of each word in a deep and vivid sense.

3. Independent Work(5 minutes). Have the children write the meaning of each word and write a sentence using the word.

4. Class Discussion. Have the children share the definitions and sentences they generated.

5. Review of Target Words. Review the definition of each of the target words by having students define the words, suggest synonyms and antonyms for the vocabulary words as well as sentences constructed with the vocabulary words, and, when appropriate, to suggest examples of the words.

6. Make-Up Time. Have students who had not finished writing a definition and sentence for each target word complete their work.

7. Collect Children's Work.