

about words and their relations Method to make judgements about the friendliness of each approaching space ship. Once they decide whether or

Subjects

The target population for this study consisted of thirty fourth graders recruited from two classrooms in an elementary school located in a southeast San Diego suburb. Subjects were selected on the basis of their classroom reading levels. The range of reading achievement for the subjects was first semester, third grade to first semester, fourth grade. Subjects who scored more than an average of 50 percent across four pretests of vocabulary knowledge were eliminated.

The resulting 25 students were divided into three groups (speeded, nonspeeded, control) having 8, 9, and 8 subjects, respectively. The groups had been planned to be equal in size, but differential subject loss due to factors beyond the experimenter's control left the groups unbalanced. Ten subjects were from one classroom and 15 were from the other. The average level of reading achievement for the treatment groups was first semester, third grade and the control group's average was slightly higher at second semester, third grade.

Apparatus and Materials

A microcomputer lexical decision task was designed by the author as a device for teaching vocabulary lists. A detailed description of the task, called "Rescue", is provided in the Appendix. Subjects were told that protecting a space station was their goal which required deciding whether or not approaching space ships were enemies or friends. The instructional aspect of the task required subjects to make decisions

about words and their relations in order to make judgments about the friendliness of each approaching space ship. Once they decide whether or not the ship is friendly, they must press a key either to "Rescue" or destroy the ship, depending on their decision.

There were five possible outcomes for each response in a trial. A correct rejection occurs when the subject shoots the on-coming spaceship and it is a 'true' enemy vessel (i.e., the response is correct). A correct acceptance occurs when the subject rescues a friendly ship. False acceptances occur when subjects attempt to rescue unfriendly ships. Shooting a ship that should have been rescued is considered a false rejection. When subjects could not generate a response before the on-coming vessel collided with the center space station, a no response outcome was recorded. These response categories are used to score each of the subjects' responses. Correct responses result in positive scores that are added to an accumulating overall trial score, while incorrect responses decrease the accumulated scores. See the Appendix for a more detailed discussion of scoring.

Two versions of the microcomputer task were developed: speeded (S) and nonspeeded (NS). The subjects' goal in each version is the same, to shoot or save space ships but the speed requirements for lexical decisions varies. In the S version, the spaceship begins to approach the space station at the start of the trial. In the NS version, the beginning of the ships' "attack" is controlled by the subject. In S condition, the subject must decide on the relation between word pairs and respond within approximately 7 seconds. As soon as a response is given in the S version, the score for that response is recorded, and the

next approaching spaceship with its corresponding lexical relations appears. Subjects assigned to the NS condition control when the approach of the ship will take place by striking a particular keyboard character, but once they set it in motion, it also takes 7 seconds to reach the space station. Their control over the onset of the spaceships flight enables NS group subjects to take as much time as they need to determine which response they will give on the basis of the word relations. That is, the lexical decision precedes the on-coming ship's approach, in contrast to the simultaneous onset of the ship and decision time in the Speeded version.

Instructional words. The entire word corpus was divided into 3 list types: taxonomic, thematic, and a mix of taxonomic and thematic. Taxonomic items were selected from the teacher's edition of the fourth-grade Achievement Goals Program reading curriculum. The Achievement Goals Program is the San Diego school district's version of the Ginn 720 Series curriculum (San Diego City Schools, 1982). The fourth-grade level Ginn 720 Series' primer is used in the regular classroom reading instruction along with the teacher's guide and student manuals (Clymer, Gates, & McCullough, 1976). In addition, a set of word warm-up exercises, required by the district to give students additional vocabulary instruction, was used to select the word corpus (San Diego City Schools, 1982).

The taxonomic word corpus was sorted into 16 categories with at least 7 items in each. Categories that needed 3 or fewer additional items to form a total of 10 words were completed by selecting fourth grade level items from the Dale and Eichholz (1960) word frequency

lists. Twelve of the categories were selected as instructional items (6 for the taxonomic and 6 for the mixed condition). A high frequency single word category label was generated for each of the 6 lists in each list type. All taxonomic word items and category labels were nouns. Table 2 shows the 60 words chosen for the lists. Table 3 shows the 30 taxonomic items used in the mixed list, along with 30 thematic items. Selection of thematic items is discussed below.

Thematic word lists and the other half of the items in each mixed list were derived from the previous work of Vaughn (1982) discussed above. Each 10 word list was selected so that each item instantiated some 'prop' or role in a common event or activity, such as 'dining out'. In addition, these words were considered unfamiliar to fourth graders. Some of the items in the lists had to be replaced by a low frequency synonym word in order to achieve a low level of familiarity for these words. For example, the word 'instruct' has a frequency of 91% on the Dale and Eichholz word frequency list for fourth grade vocabulary knowledge, whereas its synonym 'lecture' has a 37% sixth grade frequency score. Therefore, 'lecture' would be a suitable replacement for 'instruct' under these conditions. Dale and Eichholz word frequency lists were used to select synonyms. The 60 nouns chosen for thematic lists are shown in Table 4 and mixed list thematic items are shown in Table 3. Each noun is paired with a verb.

Verbs were chosen to form verb-noun pairs that would emphasize the actions each thematic item is to emphasize. Category labels were familiar nouns paired with a verb. An exemplar of the category label 'dining out' might be 'use utensils', where 'utensils' is the unfamiliar

Table 2

Taxonomic List Stimuli

Category Label	Category Word Items	
Clothing	Shawl Galoshes Fez Turban Blouse	Cape Breeches Burnoose Bloomers Sweater
Trees	Elm Birch Sequoia Banyan Eucalyptus	Mulberry Cottonwood Tupelo Hickory Ponderosa
Flowers	Marigold Daffodil Chrysanthemum Thistle Fuchsia	Hepatica Carnation Hollyhock Snapdragon Primrose
Animals	Condor Mongoose Killdeer Dingo Sloth	Drake Mammoth Barnacle Bandicoot Gerbil
Jobs	Paleontologist Archaeologist Lawyer Pianist Peddler	Geologist Investigator Jeweler Psychologist Commander
Places to Live	Dormitory Studio Mansion Hostel Berth	Lair Domicile Chamber Suite Refuge

Table 3

Mixed List Stimuli

Category Label	Category Word Items	
Make Clothes	Tailor Homemaker Designer Seamstress Couturier	Pick Pattern Lay Fabric Cut Material Sew Garment Set Hem
Mail Gift	Messenger Postmaster Clerk Mailman Courier	Use Adhesive Write Address Send Package Pay Postage Find Container
Paint Room	Handyman Painter Carpenter Custodian Decorator	Cover Woodwork Move Furniture Get Scaffold Dip Bristles Use Turpentine
Make News	Journalist Monger Correspondent Reporter Publisher	Write Article Use Typewriter Set Composition Write Headline To Publication
Drive Car	Valet Cabdriver Chauffeur Coachperson Transporter	Get Passengers Check Mirrors Turn Ignition Start Engine Shift Gears
Visit Doctor	Nurse Physician Practitioner Radiologist Therapist	Greet Patient To Examination Give Medicine Push Wheelchair Give Injection

Instructional item and the verb Table 4 presented to emphasize the thematic structure of the list.

Thematic List Stimuli

Each mixed list was made up of 5 taxonomic and 5 thematic items as described. Category Label, Dry Labels for Category List are developed at the same time as

Washing Dishes
 Find Apron
 Get Detergent
 Soak Cookware
 Rinse Utensils
 Dry Salver
 Remove Scraps
 Fill Basin
 Stack Saucers
 Run Disposal
 Get Sponge

Go to Movies
 Read Newspaper
 Find Theatre
 Pass Usher
 Buy Concession
 See Characters
 Find Schedule
 Buy Ticket
 Enter Foyer
 See Previews
 Read Credits

Waking Up
 Push Alarm
 Remove Pajamas
 Use Shampoo
 Use Comb
 Use Razor
 Enter Bathroom
 Take Shower
 Use Toothbrush
 Get Robe
 Find Attire

Dining Out
 See Hostess
 See Menu
 Order Meal
 Pay Check
 Tip Waiter
 Find Booth
 Order Beverage
 Order Desert
 Pay Receipt
 Get Entree

Making Pictures
 Get Camera
 Load Film
 Find Image
 Set Exposure
 Get Photograph
 Get Tripod
 Remove Lenscap
 Set Focus
 Make Negative
 Use Flashbulb

At School
 Hear Lecture
 Write Cursive
 Find Desk
 Read Primer
 Do Alphabet
 Get Notebook
 Use Pencil
 See Blackboard
 Say Pledge
 Do Mathematics

instructional item and the verb 'use' is presented to emphasize the thematic structure of the list.

Each mixed list was made up of 5 taxonomic and 5 thematic items as described above. Category labels for each list were developed at the same time as taxonomic and thematic lists. Taxonomic items for mixed lists were single word, low frequency nouns. All thematic items for the mixed lists and their category labels were made up of verb and noun phrases. The nouns for the mixed items were also low frequency.

Criterion measures. A standard free recall test was employed, along with four pretest-posttest vocabulary knowledge transfer tests. Examples of each of the four pretest-posttest measures can be found in Figure 2. Two of the tests, spelling and vocabulary discrimination, consisted of 20 multiple choices, presented in a cloze sentence format, each with 4 alternatives. The three distractors for each test item in the spelling test were phonetically related to the correct choice. Distractors in the vocabulary discrimination test were taken from three categories different from that of the correct choice, but of the same semantic list type. The third test was an open-ended test; it also used a cloze sentence format, but did not include multiple choices. Subjects were required to fill in the sentence blanks with any word that they thought was appropriate to complete each sentence. The three cloze sentence tests were considered to be tests of sentence level comprehension (Stahl, 1983; Weaver, 1979) and understanding of vocabulary use in context (Stahl, 1983; Gipe, 1979; Johnson & Stratton, 1966). A fourth test, vocabulary definition, used a multiple choice

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Spelling Test Items

1. The _____ moved slowly under water to another rock.
a. barnacle b. barnacle c. barnakler d. barnackel
2. The airplane's arrival was more than two hours off _____.
a. schedual b. skedual c. schedule d. skedule

Vocabulary Discrimination Test Items

1. The girl drank her _____ before eating dinner.
a. camera b. beverage c. lecture d. character
2. The _____ tried to keep the man out of jail.
a. lawyer b. dingo c. birch d. galoshes

Definition Test Items

1. chrysanthemum
a. flower with many colors
b. a large place to live
c. plays music
d. an ancient shaggy animal
2. theatre
a. cover for box used to make pictures
b. a pad used for scrubbing dishes
c. room you take bath in
d. a place you go to see movies

Open-ended Test Items

1. The hood on the _____ kept my head warm. (burnoose)
2. The _____ of the little boy was used to find him.
(photograph)

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Figure 2. Examples of Spelling, Vocabulary Discrimination, Definition, and Open-ended Vocabulary Knowledge Test Items.

format. Each test item consisted of an instructional word as the stem, followed by 4 definitional choices. The distractors were definitions of words from three other categories of the same semantic list type.

Procedures

There were 3 alternative forms of each of the four tests. One sentence was constructed for each of the 10 word items in each 6 list category, totaling 60 sentences for each semantic list type. Twenty sentences were selected for each alternative form. Test items were balanced with respect to category and list item representation. Each alternative form was presented once either as a pretest or posttest. The tests were used in conjunction with the definition measure to assess the different effects of the treatments on lexical organization and semantic memory. The different forms were used to present subjects with a different, yet highly similar test, from pretest to posttest.

Response Recording. The spelling, vocabulary discrimination, and definition tests were presented on an Apple microcomputer. A microcomputer multiple choice test was developed to present the questions and record response accuracy. The open-ended cloze sentence test was a paper and pencil test, requiring subjects to fill in the blank in each sentence. Free recall data were written down by the experimenter on a recording sheet.

Design

The experiment consisted of a 2X3X2 repeated measures factorial design: Instructional groups (speeded, nonspeeded, control), Semantic List Type (taxonomic, thematic, a mix of taxonomic and thematic) and Test Interval (pretest, posttest). The instructional group factor was

manipulated between-subjects. Semantic List Type and Test Interval were with-in subjects factors.

Procedures

Subjects were randomly assigned to one of two experimental groups (speeded or nonspeeded) or the control. The experimental groups received all three semantic list types (taxonomic, thematic, & mixed) in different, counterbalanced orders. The 6 categories, making up each semantic list type, were presented together and subjects were required to reach criterion before the next semantic list was introduced. Subjects in the control condition were not presented the semantic lists. The pattern of the instruction over the three instructional cycles is shown in Figure 3.

Subjects are given pretests for the first semantic list (taxonomic, thematic or mixed) prior to the instruction. Following pretesting, subjects were given a number version of the Rescue task. The number task provided subjects with practice in coordinating the keys and the cognitive demands of the task. Six lists of numbers were selected for this task. For example, there was a 1's list made up of 10 identical six digit string items (i.e., 111111). The other number lists, consisting of 2's up to 6's were constructed in the same way, totaling 6 categories. This number task was a recognition task in which subjects were rescue identical string pairs (e.g., 111111 and 111111) and shoot the spaceship when different string pairs were presented (e.g., 111111 and 222222). Subjects were required to practice this task until they reached a score of 17500 or higher for a single trial. This

score was derived on the basis of pilot work. Subjects who attained this score or higher were assumed to be highly Instructional Group in the task.

		Exercise	Level	Speeded	NonSpeeded	Control
Cycle1	Pretest	No Rescue		Yes	Yes	Yes
		Level 0		Yes	Yes	Yes
	Rescue	Level 1		Yes	Yes	No
		Level 2		Yes	Yes	No
		Level 3		Yes	Yes	No
		Level 4		Yes	Yes	No
		Level 5		Yes	Yes	No
		Level 6		Yes	Yes	No
Posttest	No Rescue		Yes	Yes	Yes	
Cycle2	Pretest	No Rescue		Yes	Yes	Yes
		Level 0		Yes	Yes	Yes
	Rescue	Level 1		Yes	Yes	No
		Level 2		Yes	Yes	No
		Level 3		Yes	Yes	No
		Level 4		Yes	Yes	No
		Level 5		Yes	Yes	No
		Level 6		Yes	Yes	No
Posttest	No Rescue		Yes	Yes	Yes	
Cycle3	Pretest	No Rescue		Yes	Yes	Yes
		Level 0		Yes	Yes	Yes
	Rescue	Level 1		Yes	Yes	No
		Level 2		Yes	Yes	No
		Level 3		Yes	Yes	No
		Level 4		Yes	Yes	No
		Level 5		Yes	Yes	No
		Level 6		Yes	Yes	No
Posttest	No Rescue		Yes	Yes	Yes	

Figure 3. Pattern of Instruction Across Cycles. In instructional cycle was complete.

score was derived on the basis of pilot work. Subjects who attained this score or higher were assumed to be highly accurate and fluent in the task. were introduced to a different semantic list after pretesting,

The instructional cycles began after subjects met criterion on the numbers task. Each cycle is best described by 6 levels within the basic structure of the task, thus obviating the need for the numbers Rescue task. For the sake of clarification, the taxonomic semantic list type will be used to show how the 6 categories in that list type were introduced into the task. Taxonomic list categories included Jobs, Clothing, Trees, Places to Live, Animals, and Flowers (see Table 2). There are 10 words that fell under each of these 6 category labels (see Table 2). In Level 1, one of the 6 lists in the number task was randomly selected and replaced by one of the six taxonomic categories, also chosen at random (e.g., Trees). This new category in the Rescue changed it from a digit recognition task to word classification. When subjects reached the criterion score on this version at this level, they moved to Level 2 where another taxonomic list was added to the task (e.g., Animals). Replacement of number lists by the remaining taxonomic word lists continued in this way until Level 6, at which point all 6 taxonomic lists had replaced the number categories. Once the free classification task replaced the number task entirely, subjects were required to continue until they reached criterion (i.e., 17500) on three trials, without changing levels. The three trials did not have to be consecutive. Once this new criterion was met, the instructional cycle was complete.

Before the next instructional cycle, subjects were given their pretests for one of the two remaining semantic lists (e.g., thematic). They were introduced to a different semantic list after pretesting, which began the next instructional cycle. The numbers task was slightly different in this and the subsequent cycle. Subjects had learned the basic structure of the task, thus obviating the need for the numbers task in its entirety. In order to introduce each semantic list type in a systematic way, some aspects of the numbers task were retained. The first semantic category list was immediately introduced in place of one of the numbers category. Once subjects learned the words in this new semantic list, the third and final instructional cycle (i.e., the introduction of the third semantic list type) was presented in the same way.

The first Treatment consisted of daily lessons that lasted from 30 to 40 minutes on the average. All lessons were taught by the investigator to control for teacher effects. Pretesting occurred before an instructional cycle. Before subjects were introduced to the words in a semantic list, they were given the pretests. Posttests were given after subjects completed each instructional cycle. All subjects were given the free recall task first and on the same day they completed the cycle. The other four posttests followed one at a time and in a balanced order. Testing was administered by the experimenter.

four posttests.