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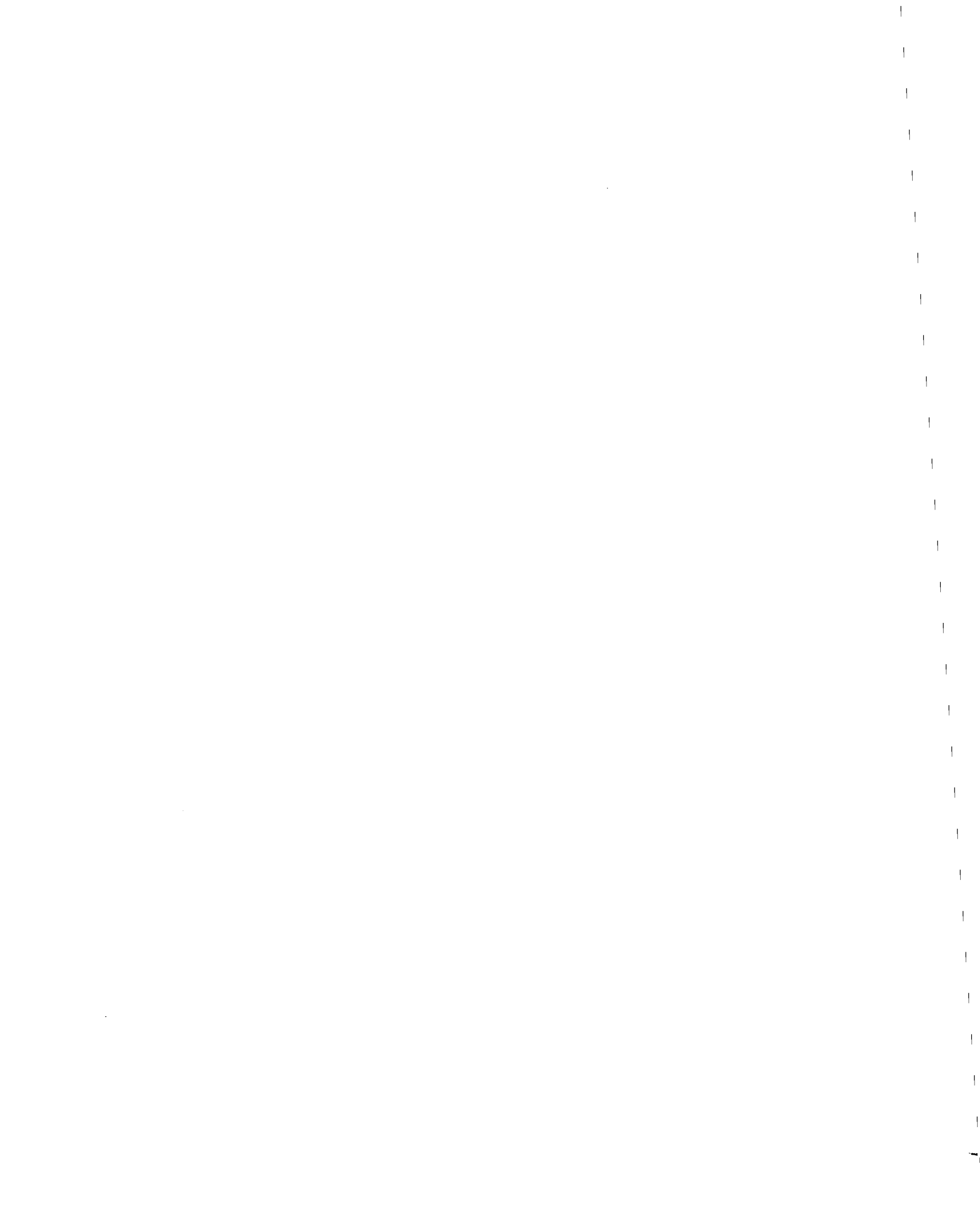
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**Abilities and performance in vocabulary acquisition**

Dunn-Rankin, Patricia Ann, Ph.D.

University of Hawaii, 1987

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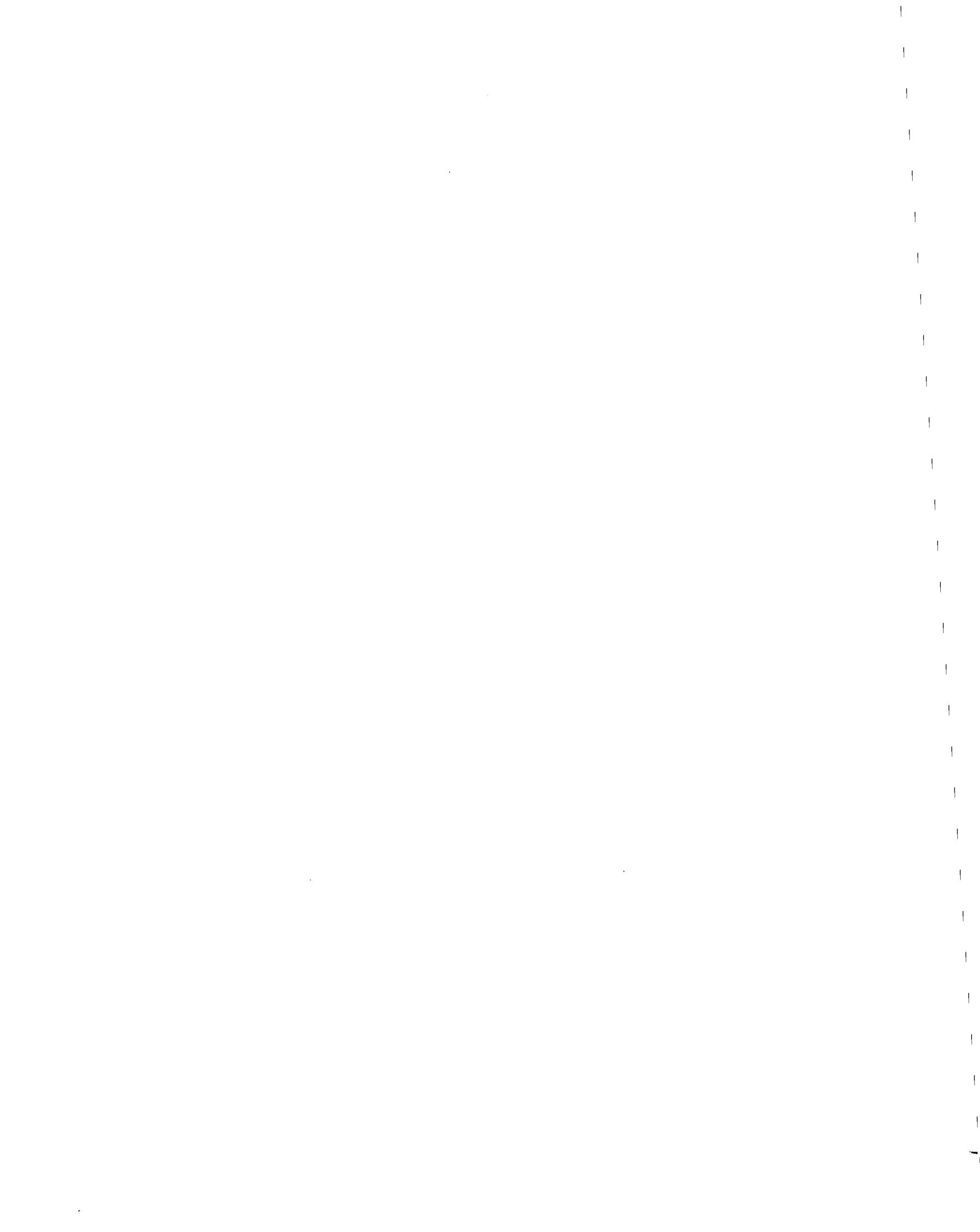


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ABILITIES AND PERFORMANCE IN VOCABULARY ACQUISITION

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE  
UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY  
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by

Patricia A. Dunn-Rankin

Dissertation Committee:

Daniel D. Blaine, Chairman  
Betsy Brandt  
Morris Lai  
Roland Tharp  
Ann Bayer

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## ABSTRACT

This study was an investigation of the contribution of a selected set of cognitive abilities to students' initial acquisition of word meaning. Four different vocabulary instructional methods were used and their relative effectiveness was also examined. Seventy-one adults enrolled for credit in developmental (remedial) reading courses at Leeward Community College in Pearl City, Oahu served as the subjects. They were administered 17 factor-analytically-derived ability tests from the Kit of Factor Referenced Cognitive Tests (Ekstrom, French & Harmon, 1976). Based upon extensive research these tests were postulated to mark six factors named (a) perceptual speed, (b) induction, (c) integration, (d) memory for associations, (e) visualization and (f) verbal closure. The tests were chosen for this study based on the assumption that they tapped mental processes relevant to vocabulary acquisition under divergent instructional conditions.

A factor analysis of the Leeward Community College students' scores failed to confirm the six factors chosen as predictors of success on the post performance measures. Therefore, individual ability tests were selected for the regression equations. Regression analysis revealed that

scores on some selected ability tests can significantly predict performance following instruction under certain conditions.

The four different treatments were presented to each student in a counterbalanced (Latin Square) design. The conditions were named (a) multisensory, (b) networking, (c) mnemonic, and (d) context. For each condition a different set of ten vocabulary words was used. After each lesson, scores on two performance measures were obtained : (a) a definition recall measure, and (b) a recognition of correct usage measure.

Analysis of variance using the scores on each of two performance measures (recall and recognition) revealed statistically significant differences among the treatments, and multiple comparisons indicated most pairwise differences were statistically significant. With both the recall and recognition performance measures, the order of effectiveness for the conditions was (a) multisensory, (b) networking, (c) keyword, and (d) context.

Repeated measures analysis of variance using the two types of performance (recall and recognition) as a fixed factor revealed statistically significant main effects for the four treatments, the two performance measures, and interaction. Average recognition scores were higher than the average recall scores. A statistically significant

interaction occurred with the keyword and multisensory methods over the recall and recognition measures. The keyword method produced statistically significantly higher recognition scores whereas the multisensory was equally effective on recall and recognition. The overall success of the multisensory method may be due to the social interaction involved (Vgotsky, 1978).

Canonical correlations were calculated using scores from all 17 ability tests as the independent set and the recall and recognition variables as the dependent set. The correlations were not significant, but the standardized coefficients suggested that specific ability tests were differentially related to recall and recognition. Subsequently, two significant canonical Rs were found relating specific abilities to scores on either recognition or recall measures.

Results generally suggest that (a) ability structures may need to be defined differently with a low achievement population, (b) some instructional methods are more successful for initial vocabulary acquisition than others, and (c) main effects and interaction may be altered by the operational definition of the outcome measure.

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## CHAPTER 1

### Introduction

#### Background and Statement of Problem

Differential psychology is predicated on the assumption that learning variables such as rate, extent, style, and quality of learning are a function of underlying ability and personal characteristics of the learner (Tobias, 1976). The relationships between a number of selected ability tests and performance on several learning tasks have been explored and described (Blaine, 1972; Cronbach & Snow, 1977; DeSoto & DeSoto, 1983; Delaney, 1978; Dunham & Bunderson, 1969; Federico, 1982; Ferguson, 1956; Glaser, 1980; Hunt, Davidson, & Lansman, 1981; Jackson, 1980; Kunzendorf, 1981; Hunt, Lunneberg & Lewis, 1975; Perfetti & Lesgold, 1977; Stankov & Horn, 1980). The suggestion is that instruction could be made more efficient by taking individual capabilities into account (Gagne, 1967; Kirby, 1980; Pellegrino & Glaser, 1982). More evidence is needed, however, to establish support for the notion that there is a robust relationship between individual abilities and methods of direct instruction (Carroll & Maxwell, 1979; Cronbach & Snow, 1977).

Evidence of an ability-instructional relationship would be valuable for teachers working with students from nursery school through graduate school. If the correct ability-

instructional relationship could be found, students could be placed, based on their ability strengths, in instructional materials to maximize the probability of a rapid increase in their competence and their subsequent learning success.

One student population that could especially benefit from facilitative placement is that of the community college remedial student. Although advanced reading skills are crucial to success in higher education, there is an increasing number of adults who need remedial reading courses when they enter community colleges (Aaronson, 1972; Bohr & Bray, 1979; Cohen & Brawer, 1982, Cross, 1976). A major component of reading remediation is instruction in vocabulary (Hiatt & Kilty, 1980).

According to Bowker (1980) in his comprehensive review, vocabulary acquisition at the college level is usually taught by giving students workbook or study module assignments. He further states that achievement is most often measured by multiple choice tests (Bowker, 1980). The vocabulary instructional model reported by Bowker (1980) appears to emulate those methods used with typical high school students or students in traditional university English courses and may not be appropriate for remedial students in community colleges.

Community college students form a unique population in part because of the open door admissions policy (Cohen &

Brawer, 1982; Rouche, 1977). These colleges offer the first two years of university courses, career education and continuing education for all who come to enroll and as a result, there is great diversity in the student population. This diversity is evident in the numbers of minorities, handicapped, and older students attending.

Because of the expanded access to community colleges, there is a large population of academically underprepared students. These students have further been assessed and classified as little concerned with learning for its own sake, low in motivation, and high in need of direct instruction (Cohen & Brawer, 1982). Attempts are made to assist these students through remedial or developmental programs. However, as Bender (1980) pointed out, there has been little scientific inquiry into selection and development of teaching strategies and learning materials for this group. He further stated that too much time is spent comparing one method against another when environment, task, and individual differences may be more important variables.

Research in vocabulary instruction with adults as well as children has focused on comparisons of teaching methods and attempted to identify the most beneficial instructional models. Although there is strong support for the direct teaching of vocabulary (Becker, 1977; Bohr & Bray, 1979;

Griffin, 1981; Herber, 1970; Johnson & Pearson, 1978; Petty, Herold, & Stoll, 1968), the relative effectiveness of vocabulary instructional programs with adult populations is largely unexplored (Bliesner & Staiger, 1962; Bowker, 1980; Greene, 1971; Kameenui, 1982). Petty, et al. (1968) suggested that the skills needed for application of different methods of teaching vocabulary may be so diverse that comparison of methods could be inappropriate. Nevertheless, over a decade later, little exploration of individual differences and their relationship to outcomes in vocabulary acquisition is in evidence (Tobias, 1981).

Consequently, the conceptual framework for this study lies in aptitude-by-treatment interaction (ATI) theory. ATI theory is based on the assumption that when more than one method of instruction is available, individual difference variables, such as specific information processing ability, predict the best method for optimal performance by a particular student.

#### Aptitude-Treatment-Interaction

There is ample evidence that there are individual differences in processing and retaining information (Berliner & Cahen, 1973; Cattell, 1971; Donaldson, Hunt, & Yantis, 1982; Fredericksen, 1980; Gagne, 1967; Guilford, 1967; Hunt & Kunzedorf, 1981; Kintsch, 1974; Kirby, 1980; Lansman, 1974; Newell & Simon, 1972; O'Neil & Spielberger,

1979; Schmeck & Ribich, 1978; Sternberg, 1977). Conversely, most research dealing with instructional improvement is concentrated on finding a "best" general instructional method, rather than searching for "best" methods for specific individuals as characterized by their individual ability profiles.

Singer and Gerson (cited in O'Neil & Spielberger, 1979) stated:

The potential interaction between instructional methods and learner capabilities should receive primary emphasis in the design of any instruction system. If the method for providing the strategies associated with learning a task are not compatible with a learner's capabilities and personal learning style, the acquisition of skill will probably be impeded. Since the desire of an instruction systems designer is to develop the most efficient way for a person to learn skills, individual differences among learners must be taken into account when establishing an instructional program.

(p. 241)

More research is needed either to help us find ways to adapt instructional treatments to students based on each individual's cognitive profile or to determine if such adaptations are even feasible.

A well-known formal call for this type of research was made to psychologists by Lee J. Cronbach (1957). He described a separation at that time between the disciplines of experimental and correlational psychology. Experimentalists, he said, were interested in manipulating treatments to study variance, and individual differences were treated as error. Correlationalists were not interested in treatment variation, but in individual and group variance. Neither camp at that time was interested in interactions.

Further, Cronbach described applied psychology as suffering from the same schism. Applied experimentalists attempted to treat all persons alike, but to modify treatments in order to obtain the highest average from the group. They searched for one "best" way. Applied correlationalists, however, attempted to raise averages by modifying individual jobs, individual instructions, or individual expected outcomes.

Cronbach's appeal, then, was for a united effort between the experimentalists and the correlationists in order to make progress toward a theoretical network containing both treatment and organism dimensions. He stated that:

We are not on the right track when we conceive of adjustment or adjustive capacity in the abstract. It

is always a capacity to respond to a particular treatment. The organism which adapts well under one condition would not survive under another. If for each environment there is a best organism, for every organism there is a best environment. The job of applied psychology is to improve decisions about people. The greatest social benefit will come from applied psychology if we can find for each individual the treatment to which he can most easily adapt. This calls for the joint application of experimental and correlational methods. (p. 679)

Cronbach argued for investigating person dimensions and treatment dimensions simultaneously. The two sets of dimensions then could provide a base for allocating persons to treatments. The expectation in this case was for a strong interaction of person attributes with treatment conditions. Only then, he postulated, could prediction and explanation of human behavior be practically useful.

Cronbach's proposal was followed by a proliferation of scientific investigation coined aptitude-treatment-interaction (ATI) research. ATI research pertains to the adaptation of instruction to individuals based on personality traits and/or aptitudes. Aptitudes are psychological constructs that are operationalized by scores on some kind of task or test. An implicit assumption for

ATI research is that there are distinct, fundamental differences in aptitudes across individuals (Tobias, 1976). These differences affect the individual's ability to learn in a particular situation. Treatments, in a broad sense, are instructional variables which are manipulated by varying the pace, style, sequence, or content of the lesson. Interaction occurs when a particular situation has an effect on one individual and a different effect on another as characterized by aptitude.

In 1975, Cronbach spoke about the state of ATI research. He pointed out that, although ATIs were proving to be important, interactions were more complex than he had earlier theorized. He said:

Though enduring systematic theories about man and society are not likely to be achieved, systematic inquiry can realistically hope to make two contributions. One reasonable aspiration is to assess local events accurately, to improve short-run control (Glass, 1972). The other reasonable aspiration is to develop explanatory concepts, concepts that will help people use their heads. (p. 126)

The problem for the social scientist, according to Cronbach, is to create a reasonable sketch of man, rather than an unchanging blueprint.

Before Cronbach made his second speech, the search to isolate good aptitude and treatment matches was attempted in many curriculum spheres. At least twenty years of this research was extensively re-analyzed and reviewed by Cronbach & Snow (1977). They concluded that, although there are interesting findings that point to a need for further careful exploration, there was no solid evidence of any practical usefulness for classroom use. They postulated a need for more definitive treatments and more carefully designed studies.

A domain of considerable importance that has been relatively unexplored using an ATI methodology is that of verbal learning. There have been a few ATI studies in reading (Cronbach & Snow, 1977), focusing mainly on beginning reading instruction with young children. Reading comprehension is highly correlated with and perhaps even dependent upon vocabulary knowledge (Yap, 1979), yet little ATI exploration of vocabulary acquisition has been reported.

#### Vocabulary Instruction

Vocabulary instruction is typically an endeavor to have students learn new word and meaning associations through the use of varying types of formal exercises. Petty et al.'s (1968) review of research in vocabulary instruction included methods known as (a) context, (b) analytical, and (c) direct teaching through word lists. More recent research reports

include additional methods based on cognitive theories of memory structure such as those of Rumelhart, Lindsey and Norman (1972), Collins and Quillian (1970) and Kintsch (1974). These methods have the names (a) networking and (b) semantic mapping .

Most of the research in vocabulary acquisition centers on comparing instructional methods as in the following examples.

### Context

Several studies report the contextual analysis paradigm as being the most effective teaching method. Contextual analysis refers to a reader's use of the surrounding context in order to infer the meaning of an unknown vocabulary word.

Gipe (1979) used four methods to teach word meanings to third and fifth graders and hypothesized that the context method would produce the greatest increase in vocabulary. The methods were (a) association, (b) categorization, (c) context, and (d) dictionary. The association method paired the new word with a synonym or brief definition and the task involved memorizing the pairings in order to write them without referral to a study sheet. The categorization method utilized the placing of a new word in a list of three familiar words. For example, the words mean, cruel, barbarian, and robber were categorized under the heading Bad People. Barbarian was the new word. Students then added

words from their own background to the list. Four new words were utilized in this manner. The second part of the method was to correctly categorize a random list of all previously provided words.

The context method consisted of reading new words in meaningful sentences, supplying, in writing, the new words in meaningful sentences, and responding, in writing, to a question connecting a student's past experience to the meaning of the new word. The dictionary method involved looking up the meaning of the new word and writing the definition and an original sentence using the target word. The criterion was a cloze test. A cloze test is a test of the ability to correctly complete a thought based on the available context. For the cloze test, students were asked to place the target words correctly in sentences. For both third and fifth graders, the context method was significantly better ( $p < .01$ ) than all other methods. This superiority, however, could be explained by the fact that the criterion had the same format as the context learning task. In other words, in the context method, students had specific practice placing the target words correctly in meaningful sentences.

Using 70 undergraduate introductory psychology students, Crist and Petrone (1977) compared "context" learning with "definition" learning of unfamiliar words.

Fifteen words and their definitions were chosen from vocabulary workbooks designed to improve college student's vocabularies. One subject group was then given five separate presentations of fifteen unfamiliar words. Each presentation consisted of a different contextual use of the words. Another group saw the words five times with the same definition. Two posttests were given. The first consisted of context sentences similar to those studied by the context group with instructions to supply the word. The second test was comprised of the definitions with instructions to supply the word. A 2 x 2 analysis of variance revealed a statistically significant interaction ( $p < .05$ ) between study conditions and posttest scores, but no significant main effect. The context group outscored the definition group on the context test as expected. Surprisingly, the context group scored equally as well as the definition group on the definition test. The finding suggests that word definition can be effectively acquired from several varied contexts. In the case of this particular study, the contextual sentences were created by the experimenters. Therefore, the contexts may have been particularly "rich", or saturated with meaning. An interesting extension would be to repeat the study using a variety of contexts from textbooks that already exist.

In some studies, the comparison of vocabulary instructional methods is intertwined with some aspect of reading comprehension. Pany and Jenkins (1977), for example, used three instructional conditions with learning disabled students to test whether or not direct teaching of vocabulary had any effect on reading comprehension. These conditions were (a) getting meaning from context, (b) being given meanings while reading, and (c) practice in reciting meanings before reading. Meanings from context called for inferring word meaning from the passage content. Students were told the meanings of target words as they read in the meanings- given condition. For the practice condition, students practiced reciting target word meanings before they read a story. Nine stories from the students' regular reader were chosen and randomly divided among the three treatments. Six students were used in a randomized block design and treatment sequences were randomly assigned.

Three dependent measures were used. The first, a measure of unaided oral recall of the target word definition was given at story completion and again three to eight weeks later. No mention was made of how delay time was randomized. The second dependent measure involved using the target words in context. Six sentences, each containing one of the target words, were constructed. For three of the sentences, students were asked to replace the target word

with a correct synonym or phrase. For the other three sentences they were asked to choose a correct meaning from four choices. The third dependent measure was a factual comprehension test about the story. Ten questions were given, four of which contained one target vocabulary word. Significant ( $p < .01$ ) treatment effects were found for all three vocabulary measures. Further, a multiple comparison test revealed that in each case, the practice in reciting meanings condition was significantly different from the other two treatments. The meanings-in-context condition had the poorest results. There were no effects due to treatment on the reading comprehension measure.

In further exploration using the same design with 12 fourth graders reading at or above grade level, Pany and Jenkins (1978) found again that the meanings-practiced condition was significantly effective compared to all other conditions ( $p < .01$ ). The poorest results came from the meanings-in-context condition. It is, of course, difficult to generalize from the Pany and Jenkins studies because of the small number of subjects.

On the other hand, Sternberg, Powell and Kaye (1983) have recommended the context method as the most effective instructional method. This recommendation is based on what they call "armchair criteria" of (a) internal and external connectedness and (b) ease of use. The concept of

internal and external connectedness originated with Mayer and Greeno (1972), and is defined by two instructional forms. According to Sternberg et al. (1983), in the case of learning new vocabulary, "internal connectedness" is created through learning derivations of words and subtleties of their meanings. "External connectedness" is created by relating new vocabulary definitions to previously learned concepts through synonyms, antonyms, rhymes and examples of usage. Because research has suggested that internal and external connected knowledge successfully retained in memory, Sternberg et al. (1983) deem this connectedness extremely important. The components of the connectedness criterion, however, are more complex than the components of what most authors refer to as the "context method".

"Ease of use" refers to the practicality of a method for determining word meaning in everyday life; i.e., when a dictionary is not handy. Therefore, the context method appears to be an "easy" way to ascertain the meaning of a word since no outside source of information is required.

Johnson and Pearson (1978) devote a chapter in their book to ways of teaching contextual analysis. They caution, however, that this form of determining meanings of words is not a finite set of generalizable rules, but that it is a whole approach to reading. They also state that for adults it is the most common approach to learning word

meanings. Further, Werner and Kaplan (1950) studied acquisition of word meaning through verbal contexts and found that the ability to correctly assign meaning to new vocabulary words increased with age. These points suggest that the ability to use context to gain meaning develops over time, and that herein may lie the reason for its lack of effectiveness when used as a single method, especially with younger children.

Strong criticism of the context method comes from Deighton (1959). He culled passages from 500,000 words of reading material which appeared in technical texts and reading anthologies. He then used these examples to illustrate context revealing meaning through definition, example, modifiers, restatement, inference, and inference through established connections. His conclusion was that meaning is not easily revealed through context as often as we might think. Four of his major arguments are:

(1) Inferring from context depends a great deal on the reader's experience. Most students who desperately need vocabulary development have meager experiential and literary backgrounds.

(2) It is rare to find complete meaning revealed through context outside of instructional materials written strictly for the purpose of teaching the context method.

(3) A meaning revealed through context is specific rather than elaborative. It is questionable, he claims, whether or not even that specific meaning is learned.

(4) Learning new words as they naturally occur in discourse is a slow way to increase vocabulary.

Deighton's analysis of the problems of the use of context to acquire meaning pointed to the problems inherent in promoting it as an exclusive method.

#### Keyword

A mnemonic technique called the keyword method has empirical support in current literature on vocabulary instruction. This technique, originated for teaching foreign language vocabulary by Raugh and Atkinson (1975), is now being adapted to successful teaching of native vocabulary to students from kindergarten through college (Levin, 1981; Pressley & Levin, 1981; Pressley, Levin & Miller, 1982).

The keyword method uses the mnemonic device of imagery linking, both acoustic and visual. Here is Pressley and Levin's (1981) standard example of how the method is used. For the new word "carlin" which means old woman, CAR is given as a key. The image of an old woman driving a car is used to encode the connection between word and definition. Thus the definition of "carlin" is elaborated by a visual image called an "interactive image." If, when learning the

definition of "carlin", one were asked merely to visualize an old woman, the image would be "noninteractive."

According to Levin (cited in Sternberg, et al., 1983) theoretical learning principles that are in use in the keyword method are: (a) Meaningful stimuli are more reliably encoded than are nonmeaningful stimuli; (b) interactive images (refer to example above) are more reliably associated than noninteractive images; (c) the greater the similarity between two stimuli, the more reliably one will evoke the other; and (d) thematic interactions (such as creating a story to help in remembering isolated facts) are reliably retrieved from appropriate cues.

Using fifth graders, divided high and low achieving groups, Levin et al. (1984) compared three vocabulary instructional strategies. One instructional strategy was an adaptation of Atkinson's (1972) keyword method. Students were taught a "keyword" for each target vocabulary word and were then shown a picture relating the keyword to the target vocabulary word's meaning. In the adaptation for this study, the keyword was phonetically related to the target word. For example, when the target word was "angler," the keyword was "angel." The picture, in cartoon fashion, showed an angel catching fish from a pond. Two observing angels discussed the fact that the angel knew a lot about

fishing because he was an expert angler. All target words and their accompanying keyword were initially presented on cards and read aloud by the experimenter.

Semantic mapping was the second method used. Semantic mapping is a form of categorization. For example, the word angler could be broadly connected with sports and hobbies and then connected with names for people with hobbies, such as gardener, stamp collector, and equestrian. Another segment of the "map" could list equipment used for sports and hobbies, such as trowel, magnifying glass, saddle, and rod and reel. For the semantic mapping method, target words and definitions were first presented on cards and read by the experimenter. Students then generated their own personal "maps" to connect relevant information about the target word.

The third method was contextual analysis. First, the target words and definitions were presented on cards and read aloud by the experimenter. Then a paragraph containing the target vocabulary word was read to students as they followed their own written copy. They were instructed to underline anything in the paragraph that would help them remember the meaning of the target word. At the end of all three treatment sessions, the experimenter read each target word aloud and the students read the accompanying definition.

Four kinds of tests were given following the treatment. These tests were: (a) definition recall (the principle outcome measure), (b) judgment of correct usage, (c) sentence completion, and (d) definition matching. With both high and low achieving groups, the keyword method produced statistically significant higher means on definition recall compared to the other two methods. With the higher achieving group, the keyword method also produced significantly higher means on sentence usage.

Pressley, Levin, and Miller (1982) used 120 introductory psychology undergraduates in a study comparing two versions of the keyword method and three verbal-contextual methods with a control group. Thirty-two low frequency words with an imageable key in the first syllable were chosen from The Official Scrabble Player's Dictionary (1978). The dependent measure was recall of the definition when given the word. A scoring system was devised to allow full or partial credit depending on the level of response. The keyword imagery method was superior to all other conditions and to the control. A surprising finding was that the sentence context condition was not better than the control condition.

In a review of educational research on the keyword method, Pressley, Levin and Delaney (1982) found general support for this method both in native and foreign language

learning. They reported, however, that only a few individual differences variables had been examined with the keyword method.

Imagery methods appear to work most effectively with nouns, herein lies the focus of criticism of the method (Bowker, 1981). Although in one study, with students learning a foreign language, Delaney (1978) found facilitating results with the keyword method whether or not the definition referent was abstract or concrete, there appears to be no other reported research on using the keyword method with words other than concrete nouns.

### Structural Analysis

There are many proponents of vocabulary instruction through structural analysis (Lehr, 1979; Reedy, 1981; Scanlan, 1980; Sebesta, 1979). In this type of instruction a student learns the meaning of roots, prefixes, and suffixes and then practices deriving whole word meanings from the sum of the parts. An advantage of this form of learning word meanings seems to be transferability (Brown, J., 1980)

In his vocabulary text, Brown (1980) includes the information that there are 14 magic words that contain the 20 most important prefixes and the 14 most important roots. He further states that these roots and prefixes then "unlock" between 14,000 and 100,000 words. For example, the

word "nonextended" contains "non" (not), "ex" (out, beyond), and "tendere" (stretch). "Monograph" contains the prefix "mono" (alone, one) and the root "graphein" (write). Theoretically, if one learns the 14 words, one also learns the meanings of the prefixes and roots.

Despite its apparent value as an instructional method, the structural analysis approach, according to published research seems to fare well only with average and superior students (Clark, 1981; Culyer, 1978; Weintraub, 1968). Furthermore, there is the problem of variation in the meaning of word parts in different words (Brown, 1981). This inconsistency is difficult for students. For example, the prefix "meta" may mean "change" as in the word "metamorphosis" or it may mean "going beyond" as in the word "metaphysics." The prefix "in" may mean "not" as in "inconclusive" or it may mean "into" as in the word "inhale." Finally, there is often little motivation on the part of students (especially remedial students) to learn lists of roots, suffixes, and prefixes.

The small amount of empirical scrutiny of structural analysis compared to other methods is surprising because many widely used vocabulary instructional texts have a strong focus on this method. [See, for example, 101 Ways to Improve Your Vocabulary (White, 1983)].

### Other Methods

Descriptive reports, rather than empirical studies, constitute a major proportion of the literature on vocabulary acquisition. These reports cover a variety of approaches to instruction. Carpenter (1979) reported on vocabulary expansion modules for community college adults in which half the class period was spent in the formal instruction of word analysis, context use and etymology, and half was spent playing word games. These games were modeled after Bingo (called "Wordo"), Charades, and popular television games such as Jeopardy, Concentration, and Password. For example, in Wordo, the player cards contained 30 definitions of words previously studied. The instructor chose at random from the study words, used them in sentences, and students matched them. She found improvement in vocabulary on standardized tests significant at the .001 level when compared to pretests. Content tests at the end of the semester covered over 1000 words and were consistently passed at the 80% level. In her report, Carpenter (1979) gave credit for the results to the games rather than to the structural analysis. Games were also reported to be successful for Crist and Anderson (1979), Jernee (1982), and McHale (1982).

On the other hand, Plaister (1980) who teaches English as a second language, and Ignoffo (1980) who teaches native

speakers prefer using analogies for vocabulary instruction because of the cognitive problem solving that must take place to solve the analogy. An analogy consists of four terms for which some kind of relationship is to be determined. If myriad and sparce are the first terms, the student must reason that the first two terms are adjective antonyms and therefore the next two terms must also be adjective antonyms. As an activity, the student may be given the third term with a group of possible answers for the fourth term. For example:

myriad : sparce :: many : \_\_\_\_\_.

(a) large (b) few (c) dainty (d) heavy.

Word bank instruction is recommended by Reifman (1981). A word bank is made from a student's collections of unfamiliar vocabulary words discovered through reading and listening. The basic premise behind a word bank is that the student will learn more easily when she or he has a personal need to know.

Kurth (1980) prefers teaching vocabulary through concept development. Concept learning instruction includes practice in naming (a) critical attributes (necessary characteristics of the concept), (b) noncritical attributes, (c) positive examples, and (d) non-examples. For example, after initial instruction about the concept desert, students may be given practice exercises such as the following:

Directions: Circle any answer that is correct.

1. A desert is (a) dry (b) wet (c) cold
2. Girls and boys play hide and seek in the tall grass and behind the many trees.  
(a) This is a desert.  
(b) This is not a desert.

3. They saw few plants and no animals in the large dry area of land.  
(a) This is a forest  
(b) This is a prairie  
(c) This is a desert

4. Write all the important features of a desert.

A collocation grid, illustrated in Figure 1, is an instructional device recommended by Channel (1981). To create a collocation grid the following steps are necessary: (a) select a category, (b) list words within the category, (c) list some features shared by words in the category, and (d) put plusses and minuses in the proper spaces.

Figure 1

Collocation Grid

words:	2 wheel	4 wheel	motor	passen- ger	enclosed	handle- bars	rubber tires
bi- cycle	+	-	-	+	-	+	+
motor- cycle	+	-	+	+	-	+	+
car	-	+	+	+	+	-	+
skate- board	-	+	-	-	-	-	-

Both the concept development method and the collocation grid appear to be more salient for use with nouns than with other parts of speech.

Channel (1981) uses yet another approach through semantic emphasis in which words that share an aspect of meaning are studied together in what is called a "network" or "field." For example, the words walk, run, amble, stroll, trot, and jog are all movement verbs and this links their meaning. The "movement" verb field can then be expanded by taking one word, such as run, and putting it in a group of words such as gallop, dash, and sprint. Now there is a "fast movement" verb field.

Others recommend teaching vocabulary by a combination of methods rather than by a single technique (Angelotti, 1978; Bowker, 1981; Crist & Anderson, 1979; Dale & O'Rourke, 1979; Herber, 1970; Johnson & Pearson, 1978; Swinton, 1977). These recommendations are supported in cognitive psychology by the encoding variability theory. The encoding variability model stresses the importance of giving different types of examples as elaboration on the presentation of a vocabulary word. For example, one could present descriptive, contextual, and semantic information about the word. This would create an expanded representation in a single memory trace resulting in more efficient recall. Sternberg and Powell (1983) caution,

though, that variability may create an overload for individuals who have difficulty with integration. This overload in turn may hinder rather than enhance memory.

Rote-learning, another vocabulary instructional method, is basically the straightforward memorizing of definitions. The standard procedure in rote-learning of vocabulary is for students to make a collection of words and definitions using three by five cards on which they write the word, definition and a sentence using the word. Instruction for learning words this way is found in many vocabulary building and reading instructional books. See, for example, College Vocabulary Skills by J. F. Shepherd (1987).

Two 1000 word boxes of vocabulary cards are commercially published by Visual Education Association, 1981. The cards are printed with the word, pronunciation, and a sentence on one side; the meaning on the other side. Students are exhorted to study and learn a few at a time and to watch for them in their reading.

A rote-learning format appears in the popular press in trade books such as 30 Days to a More Powerful Vocabulary (Lewis & Funk, 1981)). In these books there is heavy use of multiple-choice and matching tests. The implication is that reading and self-testing will enhance recall.

Despite the apparent popularity, rote learning is not a

recommended method because the resultant learning tends to be semantically impoverished, and the associations restricted (Sternberg & Powell, 1983). With rote-learning, long-term retention suffers and students' ability to use the words in new situations is not developed.

The research reported in this review generally fail to address the major recommendations of Petty, Herold & Stoll (1968). In a research project report for the National Council of Teachers of English, they exhorted researchers to design better studies through (a) more carefully stated hypotheses and definition of terms, (b) better isolation of variables being studied, (c) more adequate population samples, (d) more valid and reliable measuring instruments, and (e) more attention to other variables, such as time limits, word types, and experimenter bias. (These criticisms are, in fact, applicable to most research; not just vocabulary research.)

Comparisons of instructional methods is, at this time, the predominant thrust of the research on vocabulary acquisition. The major portion of this research is descriptive rather than experimental, and interaction is often ignored. The bulk of the research has been done with elementary school children because vocabulary is most often taught there. Nevertheless, there is a growing need for

more informative research with adults, and this research should consider interaction as well as method main effects.

## CHAPTER 2

### Method

A counterbalanced design in which students served as their own controls and participated in all experimental conditions was used in this study. Forty unfamiliar target words were randomly divided into four groups of ten words each. The word groups were then randomly assigned to four different treatment conditions. Presentation of treatments was ordered according to a Latin square arrangement (see Table 1).

Table 1

Treatment Condition Assignments: A=Network, B=Multisensory, C=Mnemonic, D=Context

---

	Week			
	1	2	3	4
Class				
1	A	B	C	D
2	B	D	A	C
3	D	C	B	A
4	C	A	D	B

---

On the class day following a treatment, participants were given two performance measures. The first measure tested recall of the definition of the word and the second tested recognition of correct usage in a sentence. Prior to the treatments, scores from 17 ability measures were obtained from each student. Following all treatments, a multiple-choice test of definition recognition containing all 40 target words was administered.

### Participants and Setting

The participants were 70 adults enrolled in four sections of a one semester developmental reading course (English 21) at Leeward Community College. The sample included 27 males and 43 females ranging in age from 18 to 30 with a mean age of 19. Twelve ethnic groups were represented.

The developmental reading course is designed for students who are native speakers, but score below the 25th percentile on the Nelson-Denny Reading Test (1980). The components of the course content are comprehension, vocabulary and study skills. Participants were informed that they were receiving special formulated instruction for the purpose of research and that this instruction was not a digression from the normal objectives of the course. They received points toward course completion for their participation.

Classes met twice a week, either on Tuesdays and Thursdays or Mondays and Wednesdays. Ability testing was conducted during the first four weeks of the study. Treatments and task performance measures were given over the next five weeks. Because students registered into the classes at a time of their own choosing, they were not distributed equally across classes.

### Materials

In this dissertation, Cronbach and Snow's (1977) recommendations for exploring individual differences were followed. First, divergent treatments were designed in order to increase the likelihood of significant main effects. Second, ability measures most likely to correlate with specific experimental treatments were chosen in order to increase the likelihood of significant interaction.

### Instructional Treatments

Four instructional treatments were developed using models and recommendations from the literature on previous research in vocabulary instruction. These treatments were labeled (a) multisensory, (b) networking, (c) context, and (d) mnemonic.

Multisensory. The multisensory method was primarily based on recommendations from Herber (1970) and Perfetti and Lesgold (1982). These authors indicated that remedial

students need vocalization, repetition, and speeded practice in verbal processing. Herber (1970) also suggests that visual memory for words can be enhanced by exercises that call for close attention to the configuration of the word. Therefore the multisensory treatment included (a) oral and written repetitive practice with word and meaning associations and (b) speeded exercises in visually discriminating target words from other words. Samples of the exercise types in the multisensory method are presented below:

1. This practice is for quick visual recognition of the study words. Mark the word on the right that is the same as the target word. For example:

ennui erratic erudite ennuï evoke exploit

Go as fast as you can and record your time when you are finished.

enigma enervate engross exploit evoke enigma  
colloquy conclusion confidence colloquy complacent

2. Here is the same type of exercise, but in this case the words are close together and may appear more than once. The target word is listed first.

deleterious dissonance disparage diversity deleterious dubious

3. Here are definitions of the study words. Read the word and the definition out loud.



1. Circle the three words in each line that are related in meaning. Use the list of meanings to help you.

enervate                  weaken                  energize                  exhaust

2. Match the words in the two columns that are most nearly opposite by drawing lines between them.

belligerent	not skillful
adroit	peaceful

3. Match the correct study word to a phrase by drawing a line between them.

A person who shows extreme anger.	adroit
A fine surgeon.	belligerent

4. Underline the best word or phrase to complete the sentence. Sometimes both words or phrases will be correct.

His shrewd strategy on the tennis court made him an easy winner. He (is, is not) adroit.

Context. The context treatment, chosen because it appears to have strong support in the literature, followed the standard format used in several vocabulary instructional texts. That is, the student was given three sentences containing the same "unknown" word. The student was instructed to determine the meaning of "gregarious" from "clues" in the sentence. For example:

Gregarious people are usually fun to know.

---

A gregarious person, not an introvert, is most likely to become class president.

---

Someone who is gregarious will never turn down a chance to be with other people.

---

The correct answer was provided immediately on the following page.

Keyword. Based on the highly touted keyword method, the mnemonic treatment was modeled, in part, after Pressley and Levin (1981). "Keys" from the target words, and interactive images were given orally to the students. The interactive images were developed by the experimenter, and two samples of these are presented below:

Word	Key	Visualization
Sanguine	sanguine	A person singing because he/she is cheerful and confident. (Visualize someone singing cheerfully.)
Voluble	voluble	Lubricating gears to make them turn easily; a voluble person talks easily. (Visualize someone lubricating their vocal cords and then talking very fast with lots of words.)

See Appendix A for the complete worksheets and all keyword imagery.

### Ability Measures

In defining "ability," Ferguson (1956) stated: "The abilities of man, including the reasoning, number,

perceptual and spatial abilities, and whatever is subsumed under intelligence, are attributes of behaviour, which through learning have attained a crude stability or invariance in the adult..." (p. 121)

Scientists, in an attempt to quantify the state of this "crude stability," have analytically formulated performance measures or tests. An inference may then be made, from the results of one's performance, about the comparative level of one's ability in the particular domain tested.

Ability measures for this study were chosen on the assumption that they would tap the abilities utilized in the vocabulary acquisition task. The source of the measures used was the Kit of Factor-Referenced Cognitive Tests (Ekstrom, French & Harmon, 1976), hereafter called the KECT.

The tests in the KECT are markers for ability factors that have been identified by extensive research with adolescents and adults. One criterion for the inclusion of an aptitude factor in the kit was that the construct underlying the factor be found in a minimum of three factor analyses at two separate laboratories, or by two different researchers (Ekstrom, et al., 1976).

Seventeen tests, each with separately timed halves, from the KECT collection were chosen for this study. See Appendix B for sample test items with instruction pages (included by permission of the Educational Testing Service,

Princeton, NJ). These tests, representing six ability factors, are described below. The rationale for the inclusion of each test is also explained.

Perceptual Speed (P). This factor is described as possibly being "related to or a part of an 'automatic process' factor" (Ekstrom et al., 1976, p. 123). Samuels (1979) stated that more attention can be given to comprehension when less attention is required for decoding. In other words, "automaticity" in decoding a word may leave more processing capacity available for learning new information. Perfetti and Lesgold (1977) concluded from their research that verbal coding speed is a general factor in comprehension. Therefore, there may be some relationship between the perceptual speed factor and the multisensory practice learning task which has a perceptual speed component.

There are three tests used to define the P factor. Finding As presents five columns of words in which the student must cross out any word containing an "a". Number Comparisons presents the task of inspecting pairs of multi-digit numbers and determining any pair that is different. Identical Pictures presents a target picture with a comparison row of pictures. The student is to choose a match for the target.

Associative Memory (MA). This factor is described as "the ability to recall one part of a previously learned but otherwise unrelated pair of items when the other part of the pair is presented (Ekstrom et al., 1976, p.93)." The tasks used to measure this factor are similar to tasks used in research on paired-associate learning. Therefore, there was hypothesized to be a relationship between this factor and the multisensory practice which contains a simple rote paired-associative learning component.

There are three tests used to define the MA factor. The Picture-Number Test presents the student with pictures of common objects, each paired with a two digit number. After a short study period, the pictures are presented to the student in a different order. The task requirement is to remember the appropriate number for each picture. The Object-Number Test pairs object words with numbers, such as car-17 and horse-12. The task is to remember the numbers when presented the object name. The task in the First-Last Names Test is to remember the first name when the last name is presented.

Verbal Closure (CV). Ekstrom et al. (1976, p. 33) describe this factor as "the ability to solve problems requiring the identification of visually presented words when some of the letters are missing, scrambled, or embedded among other letters". Ohnmacht, Weaver, and Kohler (1970)

and Weaver and Kingston (1963) found the cloze technique to be possibly related to this factor. Because context must be used for success with the cloze technique, there may be a relationship between the verbal closure factor and the context practice learning task.

Three tests are used to define the verbal closure factor. Scrambled Words is a series of items, each consisting of scrambled letters that can make a common English word. In the Hidden Words Test, the student is given the task of finding common four-letter words in a 10 x 10 square of letters. For the Incomplete Words Test the student is asked to provide missing letters for partial words.

Induction (I). Ekstrom et al. (1976, p. 79) describe this factor as identifying "the kinds of reasoning abilities involved in forming and trying out hypotheses that will fit a set of data. Induction has been identified as a process used in determining the meaning of words from context (Cook, Heim & Watts, 1963; Sternberg & Powell, 1983) and therefore it was hypothesized that there may be a relationship between Induction and the context practice learning task. Three tests define the Induction factor. For the Letter Sets Test the student must determine the rule that governs four out of five sets of letters. Each group contains five sets of four letters. The Locations Test presents students

with items containing places and gaps. Rules govern both the places and the gaps. Students must determine the rule in four rows and mark a fifth row place accordingly. Figure Classification is made up of items presented in groups of geometric figures that are alike according to some rule. The student's task is to discover the rule and assign test figures to the proper group.

Integrative Processes (IP). This factor has been defined as "the ability to keep in mind simultaneously or to combine several conditions, premises, or rules in order to produce a correct response (Ekstrom et al., 1976, p. 87)." The network practice learning condition requires the student to encode with a variety of examples. Therefore it seems reasonable to expect a relationship between the integrative processes factor and the network practice condition. Two tests are used to identify the integrative processes factor. The Calendar Test requires the student to find a date after being given some directions that are fairly complex. Following Directions is a test of the students success in finding a point in a matrix of letters. The set of directions is fairly complex.

Visualization (VZ). Ekstrom et al. (1976, p. 173) define this factor as "the ability to manipulate or transform the image of spatial patterns into other arrangements." The keyword method is predominantly "image

linking" rather than image manipulating, but a relationship is postulated because both the visualization tests and the keyword method call for "seeing with the mind's eye."

Three tests define this factor. In the Form Board test each item consists of five shaded drawings of pieces. Some or all of these pieces can be put together to form a target figure. Students are asked to determine correct pieces. For the Paper Folding test, successive drawings illustrate two or three folds made on a square of paper. The last drawing shows a hole punched in the paper. The student selects the drawing that illustrates where the hole would be if the paper were completely open. Surface Development presents items that are representations of solid forms. Each item is a drawing showing how a piece of paper or metal might be folded and cut in order to make the solid form. The diagram shows by a mark a corresponding surface in the drawing. The student is to show which flat sides correspond to the surfaces on the folded form.

### Selection of Vocabulary

The 40 vocabulary words taught were chosen from college reading course books and instructional kits. The words were tested for unfamiliarity in two ways: (1) by a frequency study (Dunn-Rankin, 1973) and (2) by testing a sample of remedial reading students who did not participate in the experiment. From an alphabetized list and using a random

numbers table, an assignment was made to each treatment condition. In order to minimize effects of confounding methods and words, the word lists were subsequently balanced on the basis of word frequency (Thorndike, 1944), word length, and parts of speech. The words, with the frequency code for each, and treatment assignment are shown in Table 2.

Table 2

Listing of Instructional Words with Thorndike Frequency Code<sup>a</sup>

Context		Mnemonic		Network		Multisensory	
astute	1	tacit	1	adroit	1	ennui	1
blatant	1	voluble	2	enervate	0	evoke	2
specious	1	sanguine	4	intrepid	2	enigma	1
empirical	0	ephemeral	1	assiduous	1	erudite	1
ingenuous	1	diffident	2	innocuous	1	colloquy	1
parsimony	0	vicarious	0	garrulous	1	vociferous	2
credulous	3	ubiquitous	1	fortuitous	1	dissonance	0
introspect	0	connotation	0	scurrilous	0	deleterious	1
pernicious	4	perspicacious	0	implacable	2	ostentatious	2
concomitant	1	surreptitious	1	belligerent	3	supercilious	1

<sup>a</sup> The number after the word is the Thorndike (1944) frequency code for the number of occurrences per million of the word in general reading material. Thorndike's general reading material included literature, textbooks, catalogs, concordances, newspaper articles, and magazines.

### Procedures

Four treatment conditions for teaching the target vocabulary were: (a) multisensory, (b) network, (c) mnemonic, and (d) context. Each condition had three identical components: (a) seeing the word, (b) hearing it pronounced and (c) reading the correct definition. Each condition had one mutually exclusive component. This component is detailed in the forthcoming explanation of each condition. Individual paper-and-pencil practice was used in the multisensory, network and context conditions (see Appendix A for complete practice materials.) For the mnemonic condition, the experimenter made a group presentation using the chalkboard for display of the lesson. For each condition the presentation time was approximately ten minutes. Working time for students on paper and pencil practice was limited to 20 minutes. Worksheets were returned to the experimenter at the conclusion of each treatment session.

#### Multisensory Condition.

In this condition the exclusive component consisted of vocalizing the words, doing visual perception drills, writing the targeted words and orally practicing rote association of the word and the definition. Vocalizing consisted of three choral readings and one individual reading of the target words. The first reading was echoic.

That is, the experimenter said the word, and then the students said the word. The second reading was by the group and experimenter together. The third reading was by the group alone. Next the students individually read each word aloud to a partner.

After the vocalizing practice, students worked a timed perceptual matching exercise with four variations. Students were then directed to read aloud the words and the definitions. This was done both in choral fashion and by students working in pairs.

Finally, the experimenter read each word individually and the participants were instructed to write the word and the definition without referring to the worksheet. Subjects were then allowed to check answers and correct errors and once more read the word and definition orally.

#### Network Condition.

For this condition, students worked with the target words in four ways. All words and instructions were read orally to the students before they began the individual written activities. First they chose synonyms for the target word from a set of four words. Secondly, the target words were matched with a correct antonym. Next, phrases were matched to a correct target word. For example, the phrase "a lion trainer" would match the word "intrepid." The final activity had a sentence completion format. For

example, " He went intrepidly to ask his boss for a raise. He was (fearful, fearless)." The student was directed to underline the correct choice in parentheses. When the working time was up, students checked their own papers as the experimenter read the correct answers.

#### Context Condition.

In this condition, students inferred the meanings of the targeted words by reading each word in three different sentences. These sentences contained facilitative context clues. The first sentence gave only minimal clues to meaning. The second sentence gave a little more help, and the third sentence gave optimal help. (Two independent judges determined the degree of context facilitation in each sentence.) The experimenter orally read the instructions and guided the students' completion of a sample set of sentences. Students were instructed to determine, to the best of their ability, a meaning for the word and write it on their worksheet. The correct definition was exposed on the following worksheet page. All target words were read orally to the class before the written work began.

#### Mnemonic Condition.

During this condition, students utilized a technique coined the "keyword" method. With this method, linking associations were formed between a part of the target word

and the definition of the target word. Students were given two examples using the method before being given the target words to learn.

One target word at a time was displayed on the chalkboard with a "key" underlined and the definition written beside it. The experimenter then orally gave an associative link; i.e., an image. The students were directed to close their eyes and visualize the linkage. All words, definitions and visualizations were repeated once. Finally, students were directed to close their eyes, listen to the word alone (spoken by the experimenter) and visualize the associative link.

### Performance Measures

Each treatment was administered on the first class day of the week and was followed on the next class day by two performance measures (See Appendix C). The first measure entailed students' recalling and writing the ten target word definitions. The second measure required the recognition of correct usage of the words in context. Each measure contained one trial each corresponding to the ten words presented during the instructional period. The time allowed for the completion of the performance measures was ten minutes.

At the end of four weeks, when all treatments and performances measures were completed, a multiple-choice test

of definition recognition covering all 40 words was administered (See Appendix D). The time limit for this test was 15 minutes.

## CHAPTER 3

### Results

#### Factor Structure of Ability Measures

The means, standard deviations, and estimates of reliability for 17 mental ability tests from the Kit of Factor-Referenced Cognitive Tests (Ekstrom et al, 1976) are presented in Table 3. These tests, as illustrated, theoretically represent six factors. Pearson product moment correlations between the tests are shown in Table 4.

It was expected that the six factors chosen for this study would be replicated to a certain degree with the Leeward Community College sample and that these factors could then be used as predictors of success in initial vocabulary acquisition. Unfortunately, a simple confirmation of the factors was not the case. The scores on the ability tests were factor analyzed by the principle components method, but when six factors were rotated both to a varimax and promax criterion, none of the six original factors was pure or well defined.

When five factors, indicated by the minimum eigenvalue criterion (1.0), were rotated to a varimax and promax solution, (Sarle, 1979) again none of the factors was pure or well-defined. These factor matrices are given in Appendix E.

Table 3

Means, Standard Deviations, and Reliability Estimates for Ability Tests

Test	N	No. of items	M	SD	$r_{xx}^*$
<b>Perceptual Speed</b>					
Finding As	66	200	38.79	6.88	.73
Identical Pictures	68	96	78.44	12.78	.84
Number Comparison	69	96	23.02	7.45	.84
<b>Verbal Closure</b>					
Hidden Words	67	111	73.78	16.74	.85
Scrambled Words	69	50	40.78	8.18	.78
Incomplete Words	67	36	19.24	5.28	.71
<b>Memory for Associations</b>					
Picture-Number	69	42	18.99	7.71	.76
Object-Number	68	30	10.69	5.64	.66
First-Last Names	65	30	13.11	6.32	.78
<b>Induction</b>					
Letter Sets	68	30	16.30	6.23	.82
Locations	69	28	6.08	4.50	.67
Figure Classification	68	224	73.80	31.21	.57
<b>Integrative Processes</b>					
Calendar Test	56	20	8.13	4.29	.77
Following Directions	57	20	6.75	3.74	.63
<b>Visualization</b>					
Paper Folding	64	20	6.96	4.26	.76
Formboard	64	120	0.02	15.38	.70
Surface Development	63	60	21.63	13.59	.86

\*All reliability estimates are based on the Spearman-Brown estimate of whole-test reliability from separately timed halves.

Table 4

Pearson Correlations Among Ability Measures <sup>a</sup>

Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 A	-																
2 IP	32	-															
3 NUM	17	18	-														
4 LETT	35	39	20	-													
5 LOCA	34	12	02	58	-												
6 FIG	16	47	10	47	32	-											
7 CAL	36	30	32	66	50	33	-										
8 DIREC	29	29	18	48	30	30	61	-									
9 PICNO	06	09	00	10	00	20	10	11	-								
10 OBJNO	11	15	-08	04	-01	19	-03	07	61	-							
11 FRLST	38	27	28	14	04	27	38	42	39	45	-						
12 PRFLD	09	35	-22	39	24	53	35	31	09	10	06	-					
13 FMBRD	21	34	-02	54	46	41	38	46	01	-01	05	55	-				
14 SRDEV	14	57	05	53	38	62	23	20	-02	08	-07	58	63	-			
15 SCRWD	45	24	16	32	18	17	38	26	00	-04	34	12	42	29	-		
16 INCWD	50	08	25	20	08	05	26	26	00	-03	31	-12	09	07	61	-	
17 HIDWD	58	32	19	43	36	14	43	41	07	09	33	06	27	15	40	45	-

<sup>a</sup>  
decimal omitted

Because neither a five nor a six factor solution was satisfactory, several other factor analyses were conducted. These analyses consisted of varimax and promax rotational solutions on subset groupings of the mental ability tests. For example, in one case, only the two most highly correlated tests in each original factor were retained. In a second case, the tests with reliability below .70 were deleted. The factor structures in these analyses were not markedly improved over earlier solutions. In a third case, all three perceptual speed tests were deleted, because in each previous factoring they loaded on separate factors. The results of this analysis approximate a meaningful structure. This finding is reported in Table 5 and discussed in Chapter 4.

A perusal of the raw score distributions of the 17 measures indicated non-normality in some cases. Therefore, Kendall's tau-b was used to create a correlation matrix which was subsequently examined in two ways: (a) multidimensional scaling using KYST-2 (Kruskal, Young & Seery, 1976) and nonmetric hierarchical clustering (Johnson, 1967). Neither scaling nor clustering confirmed the original six factor interpretation.

Because the six ability factors were not distinguishable in the Leeward Community College sample, the

resolution, for this study, was to use individual marker tests, rather than the factors, as predictors.

Table 5

Varimax Rotated Factor Matrix: Ability Tests Without  
Perceptual Speed<sup>a</sup>

Test	Factor					h <sup>2</sup>
	I	II	III	IV	V	
<b>Induction</b>						
Letter Sets	47	03	48	-27	60	88
Locations	27	-04	30	-25	81	88
Figure Classification	83	-27	10	00	-00	78
<b>Integrative Processes</b>						
Calendar	02	10	85	-28	32	91
Follow Directions	12	13	91	-03	06	87
<b>Memory for Associations</b>						
Picture/Number	-22	-41	-18	76	-19	86
Object/Number	-12	-33	-31	83	-21	96
First/Last Names	-49	14	33	55	-50	91
<b>Visualization</b>						
Formboard	79	15	22	-26	34	87
Paperfolding	89	-22	15	-04	08	88
Surface Development	89	-05	-13	-31	23	95
<b>Verbal Closure</b>						
Scrambled Words	-01	89	09	-30	-08	90
Hidden Words	-33	69	28	02	45	86
Incomplete Words	-48	77	04	-26	-12	91

<sup>a</sup> .  
Decimal points are omitted

### Results of the Performance Measures

Means and standard deviations for the eight performance measures and the cumulative forty word quiz are presented in Table 6. Intercorrelations among the performance measures are presented in Table 7.

Table 6

---

Means and Standard Deviations of Performance Measures:  
1 = Recall, 2 = Recognition

---

Measure	N	M	SD	Min	Max
Multisensory 1	51	4.07	2.46	0	8
Multisensory 2	51	4.08	1.80	0	7
Network 1	54	3.03	2.71	0	10
Network 2	54	3.37	1.78	0	7
Keyword 1	58	1.79	1.91	0	7
Keyword 2	58	3.36	1.64	0	7
Context 1	50	0.82	1.12	0	5
Context 2	50	1.80	1.32	0	5
Forty Word Quiz	57	18.86	5.18	10	33

---

Table 7

Intercorrelations Among Performance Measures: 1 = Recall,  
2 = Recognition

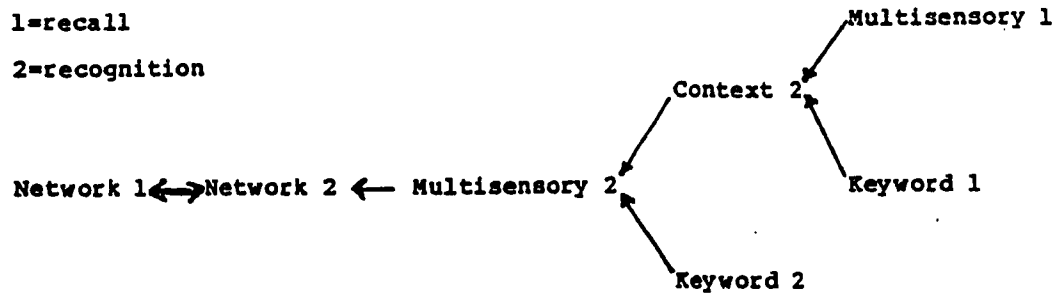
Measure	M1	M2	N1	N2	K1	K2	C1	C2	40 wd quiz
1. Multil	-								
2. Multi2	.31	-							
3. Net1	.33	.33	-						
4. Net2	.33	.45	.59	-					
5. Key1	.24	.29	.33	.32	-				
6. Key2	.22	.27	.22	.24	.21	-			
7. Contx1	.27	.41	.57	.26	-.01	.19	-		
8. Contx2	.40	.48	.12	.41	.39	.00	.04	-	
9. 40 wd	.37	.31	.53	.31	.28	.26	.59	.06	-

Note: Tabled values are Pearson product moment correlations

Intercorrelations among the performance measures (Table 7) indicated that, for this sample, the measures were more related in "type of task" than in content. This is illustrated in Figure 2 by McQuitty's (cited in Dunn-Rankin, 1983) elementary linkage analysis. Linkage analysis classifies variables into objectively determined "types." Double line arrows indicate the highest correlation in the matrix, and single line arrows indicate sequentially related variables based on correlation

strength. Recall and recognition tasks were highly related only under the Network condition.

Figure 2  
Elementary Linkage Analysis of Intercorrelations  
Among Performance Measures



The forty word quiz had a statistically significant correlation ( $p < .05$ ) with each performance measure except recognition following the context method. The split-half reliability was .93.

For all subsequent analyses, subjects who had missing data on two or more performance measures were deleted. This created a subject pool of 50.

A repeated measures analysis of variance of mean performance on performance measures following each of the four treatments revealed a significant difference between

most of the variables . Results are reported in Tables 8 and 9.

Results of Tukey's test of multiple comparisons on separate tasks are reported in Tables 10 and 11.

Table 8

Analysis of Variance of Recall Performance

Source	SS	df	MS	F	P
Trials	298.74	3	99.58	30.07	<.01
Subjects	361.55	50	7.23		
Error	496.74	150	3.311		
Total	1157.03	203	5.699		

Table 9

Analysis of Variance of Recognition Performance

Source	SS	df	MS	F	P
Trials	120.52	3	40.17	22.85	<.01
Subjects	234.33	50	4.68		
Error	265.09	150	1.76		
Total	619.94	203	3.05		

Table 10

Tukey's Multiple Comparisons Test: (Q) Recall Performance

Measure	Multil	Netl	Keyl	Contxl
Multil				
Netl	4.04*			
Keyl	8.34*	4.29*		
Contxl	12.44*	8.67*	4.07*	

\*p < .05

Table 11

Tukey's Multiple Comparisons Test:

(Q) Recognition Performance

Measure	Multi2	Net2	Key2	Contx2
Multi2				
Net2	3.30			
Key2	3.50	.21		
Contx2	11.04*	7.73*	4.53*	

\*p < .05

The order of the mean differences between treatments was the same following both performance tasks. Multisensory, in each case, was first, followed by networking, mnemonic, and context.

Repeated measures analysis of variance using the two types of performance conditions (recall and recognition) as a fixed factor revealed significant main effects for the four treatments, the two performance measures, and interaction. Results are shown in Table 12 and Figure 3.

Table 12

Repeated Measures Analysis of Variance Between Performance (Recall and Recognition) and Treatments

Source	SS	DF	MS	F	P
Performance (P)	49.07	1	49.07	18.8	<.01
Treatments (T)	391.25	3	130.42	43.3	<.01
P * T	36.10	3	12.03	5.7	<.01
Subjects (S)	473.49	50	9.47		
P * S	130.41	50	2.61	1.2	
T * S	452.13	150	3.01	1.4	
P * T * S	316.25	150	2.11		

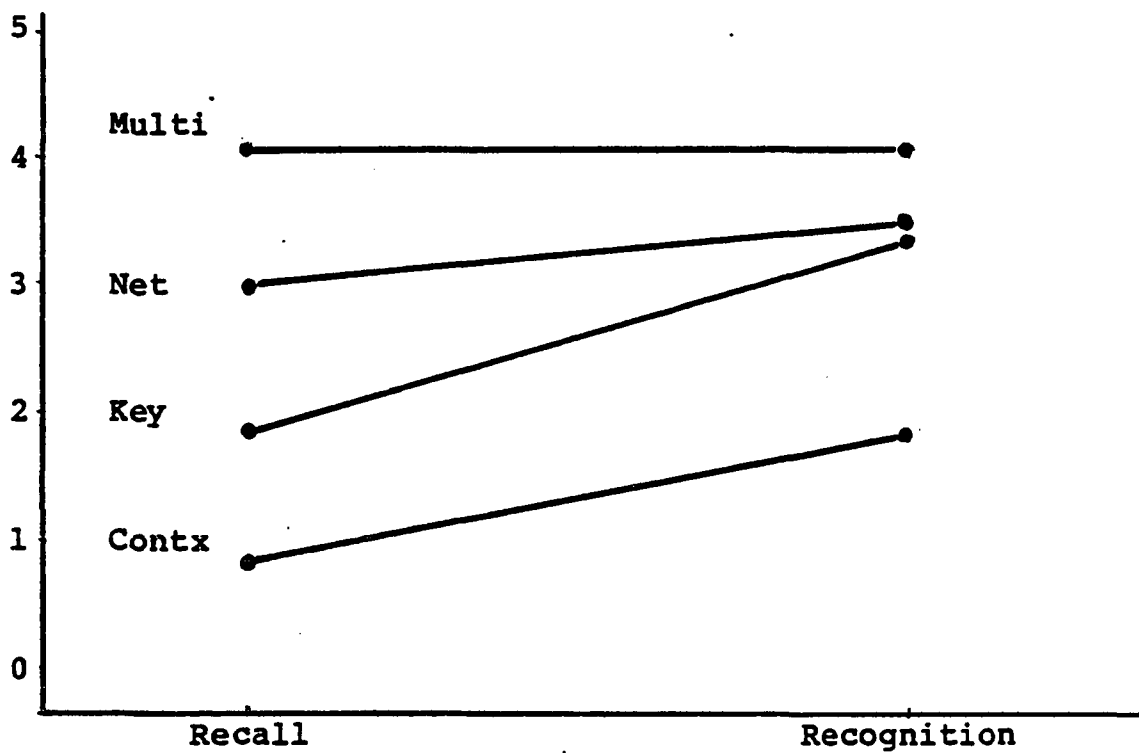
Figure 3

Graph of Interaction Between Treatment and Performance Type

---

	Means			
	Multi	Network	Keyword	Context
Recall	4.09	2.99	1.85	.84
Recognition	4.01	3.35	3.31	1.87

---



Effects of treatment order were tested by calculating and comparing the performance means as they occurred in the

counterbalanced design. There was a slight learning effect over the four trials, but no order effect.

#### Relationship Between Ability Tests and Performance Measures

The initial thrust of this study was predicated on using six factors from the KFCT as predictors for performance following four treatments. However, factors did not emerge as expected, and as the elementary linkage analysis (Dunn-Rankin, 1983) indicated, performance measures related more to the type of task (i.e., recall and recognition) than to the type of treatment (i.e., multisensory, mnemonic, etc.). Therefore a question that seemed apropos was whether a set of ability variables would predict performance separately on recall and recognition. To determine the answer, the following procedures were performed.

First, scores on the performance measures were aggregated to create two variables called recall and recognition. Second, in order to maximize the n size for each analysis, means were substituted for missing data (Britton, 1986). Missing data were randomly dispersed among the 50 subjects and the replacement of the mean only affected two percent of the total number of scores. Third, with scores from the 17 ability measures as the independent set, and with scores from the recall and recognition

variables as the dependent set, relationships were investigated by canonical correlation.

Results of the canonical correlation revealed only one statistically significant ( $p < .05$ ) correlation. However, the standardized correlation coefficients suggested that there were specific ability tests relating to recall and recognition. Therefore, using the qualification that there be a .20 or greater differential in correlation coefficients between recall and recognition, (see Table 13) with the restriction that at least one test from each factor be included, six ability variables were chosen for another canonical analysis.

The ability tests that met the qualifications were (a) Identical Pictures, (b) Letter Sets, (c) Calendar, (d) First-Last Names, (e) Form Board, and (f) Incomplete Words. Using these six tests, two significant canonical Rs were found. See Table 14.

Table 13

Pearson Correlations Between Recall, Recognition, and Ability Tests<sup>a</sup>

Measures	Recall	Recognition
A	22	-05
IP	46	22
NUM	-02	-07
LETT	35	55
LOCA	27	46
FIG	33	31
CAL	35	61
DIREC	34	28
OBJNO	26	18
PICNO	28	30
FRLST	39	19
PRFLD	36	38
SRDEV	39	31
FMBRD	49	38
HID	20	05
INCWD	-04	-31
SCRWD	20	08

<sup>a</sup>  
decimal omitted

Table 14

Canonical Correlations Between Recall and Recognition and Six Ability Tests

	Canonical Correlation	Approximate Standard Error	Squared Canonical Correlation	Pr > F
1	0.62	0.09	0.04	0.0007
2	0.49	0.11	0.24	0.0306

Standardized canonical coefficients for treatments

	Dependent Variable 1	Dependent Variable 2
Recall	-0.19	1.24 <sup>a</sup>
Recognition	1.10 <sup>a</sup>	-0.60

Standardized canonical coefficients for abilities

	Independent Variable 1	Independent Variable 2
IP	0.03	0.50
INCWD	-0.71	0.28
FRLST	0.20	0.52
LETT	0.56	-0.20
CAL	0.30	-0.39
FMBRD	0.17	0.50

<sup>a</sup>

The weights greater than 1.0 suggest the existence of some form of suppression.

Canonical correlations were also performed using the individual performance measures (i.e., multisensory, recall and recognition; networking, recall and recognition; etc.)

and the six ability tests listed above. None of these correlations was significant.

### Multiple Regression

Pearson correlations were computed between scores on each ability test and scores on each performance measure. See Table 15. A two-stage conditional regression approach was then employed to assess the combined contributions of ability test variables to success on performance measures. First, appropriate ability test variables for entry into the equation were selected based on a combination of the intercorrelations between the ability tests and the performance measures and theoretical considerations. That is, a relationship between ability and performance was judged to exist if a test appeared to require, from the subject, the same skill that appeared to be required for the performance.

When one test from each KFCT factor was placed in the equation, no combinations were found in which all six tests contributed significantly to the multiple R. Subsets of the ability tests that appeared to contribute to the multiple R were then created and entered into the equations. In four cases, there were statistically significant results. These models are presented in Tables 16 through 19.

Table 15

Pearson Correlations Between Ability Tests and Performance

<sup>a</sup>  
Measures: 1 = recall, 2 = recognition

Measures	MLTI 1	MLTI 2	NET 1	NET 2	KEY 1	KEY 2	CNTX 1	CNTX 2	40 wd quiz
A	31	07	05	-13	25	-24	-01	14	03
IP	14	22	31	16	28	-13	15	22	15
NUM	00	10	04	-15	05	08	01	-22	15
LETT	14	41	25	35	37	04	08	33	18
LOCA	08	45	33	27	37	05	14	45	09
FIG	-10	27	25	27	46	-00	-04	25	-00
CAL	24	35	14	35	40	28	-10	20	18
DIREC	26	14	29	32	25	33	-06	-01	16
OBJNO	13	03	22	33	21	-00	25	-07	34
PICNO	30	09	18	30	08	09	10	06	26
FRLST	26	22	22	19	23	18	21	-08	36
PRFLD	05	22	25	31	36	18	07	30	05
SRDEV	-02	19	25	22	31	-03	11	25	-07
FMBRD	11	24	34	23	34	21	06	24	06
HID	21	16	17	02	23	-03	19	-05	35
INCWD	11	-09	17	-15	05	-14	-04	-16	13
SCRWD	13	20	19	04	15	13	08	-07	12

a

decimal omitted

Table 16

Regression Model Predicting Success on Recall Performance  
Following the Multisensory Treatment (p < .002)

---

$$\text{Multil} = .41\text{picno} + .31\text{a} - .26\text{fig} \quad \text{Multiple R} = .52$$

---

Table 17

Regression Model Predicting Success on Recall Performance  
Following the Keyword Treatment (p < .0003)

---

$$\text{Key1} = .43\text{fig} + .21\text{fmbrd} \quad \text{Multiple R} = .54$$

---

Table 18

Regression Model Predicting Success on Aggregated Recall  
Performance (p < .002)

---

$$\text{Recall} = .35\text{frlst} + .29\text{fmbrd} \quad \text{Multiple R} = .48$$

---

Table 19

Regression Model Predicting Success on Aggregated  
Recognition Performance (p < .001)

---

$$\text{Recog} = .47\text{cal} - .31\text{incwd} \quad \text{Multiple R} = .50$$

---

## CHAPTER 4

### Discussion

The results reported in the previous section establish three focal points for discussion. These are (a) the nature of the factor structures created from the scores of the Leeward Community College group, (b) the comparisons between the four different instructional treatments, and (c) the relationships between the ability tests and performance measures following treatment.

#### Factor Structures

The factors, based on tests from the Kit of Factor-Referenced Cognitive Tests (KFCT), in this study were (a) perceptual speed, (b) verbal closure, (c) induction, (d) integration, (e) memory for associations, and (f) visualization. The nature of the abilities of the sample, however, became an issue after the data were initially analyzed. According to field studies with the KFCT, cognitive factors resist strict classification (Ekstrom, French & Harmon, 1976) and this phenomenon was manifested in the present study. Ability factors in the KFCT were originally created from scores of normal adolescents and adults. These same ability factors were not clearly defined in the community college sample. Three anomalies found in the study sample data are particularly noteworthy. These anomalies concern the tests defining (a) perceptual speed,

(b) memory for associations, and (c) visualization (see Appendix E for factor matrices).

Each of three perceptual speed tests loaded on separate factors. The failure to "find" perceptual speed as a factor in this study could possibly be due to the lack of "purity" of the perceptual speed factor as reported by other researchers (Adcock & Webberley, 1971; Coombs, 1941; Thurstone, 1938; Vandenberg, 1973). A more likely explanation, however, is that surface test features rather than the postulated cognitive process were more salient for the community college group. Specifically: (a) the Identical Pictures test has a graphic format and loaded strongly on a factor defined by the visualization tests which also have graphic formats; (b) The Hidden As Test, which consists of finding all words containing an "a" from a column of words, loaded on a factor defined by the verbal closure tests. The tasks on the verbal closure tests, like the Hidden As Test, are dependent on perception of the linear arrangements of individual letters as they form words; and (c) Number Matching consistently loaded as a separate factor and was the only test, from all measures given, that dealt exclusively with numbers.

Memory for associations has defined a single factor in other studies (French, 1951; Kelley, 1964), but that finding was not supported here. In this study, the three KFCT

tests which mark the associative memory factor loaded bipolarly on several factors. This phenomenon does not appear to have been previously reported, and it is not easily explained. To merely say that if one does well in associative memory tasks, one does not do well in visualization, verbal closure, etc. seems inadequate. Further use of these ability measures with comparable samples would be helpful in exploring this result.

Ability tests with visual or spatial orientations are generally reported to define a strong visualization factor that is clearly separate from verbal factors (Cattell, 1971; Royce, 1973; Thurstone, 1938). The lack of confirmation for a strong visualization factor from this sample was the most surprising result of the factor analyses.

One explanation for the lack of definitive factor structures is the small sample size. Also, as Gorsuch (1974) explained, the general low ability of most individuals in the study may have prevented their handling of the intricacies of certain tests. Evidence of this inability appears especially on the Form Board Test (visualization factor) which had, from a possible total score of 120, a mean of 0.02 (scores were corrected for guessing) with a range of -40 to 36.

Another reasonable explanation for lack of structure is implicit in the cross-cultural studies of how people

think. Coles and Means (1981) stated that every aspect of an experiment with unequal groups is subject to differing amounts of variance attributable to motivation, interpretation, and familiarity. Theoretically, then, this extraneous variance could account for the occurrence of different ability factor structures between subgroups of a population. Therefore, ability structures may need to be defined differently with a low achievement population. In fact, community college remedial students might be described as "being from a different culture than traditional college students." Rouche (cited in Ramey, 1981) described the culture of the remedial student as:

characterized by lower social and economic status, lower educational achievement, marginal employment, and limited participation in community affairs. Students are dis-advantaged to the extent that their culture has failed to provide them with experience typical of the students that traditional colleges serve.

(page 17)

An assumption could be made that the difference in "culture" of the non-traditional student would create a unique pattern of response to "traditional" ability tests. Evidence of a subgroup ability factor structure is supported by the rational interpretations that can be made for the factor loadings that occurred in this study.

For instance, tests with high loadings on factor one are from the original factors of (a) visualization, (b) induction, and (c) memory for association (bipolar). According to Ekstrom, et al. (1975), subjects sometimes use analytic reasoning to solve certain kinds of problems presented by visualization tests. This may partially explain why, with this sample, the induction and visualization tests loaded on the same factor.

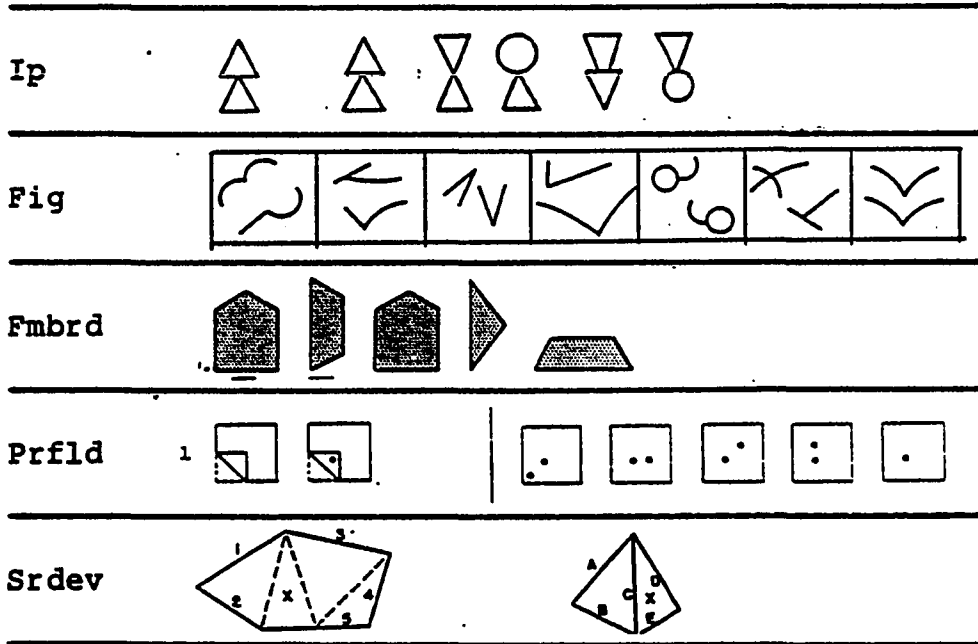
Loading highest on factor two are all three tests from the original verbal closure factor and one test from the perceptual speed factor. As suggested earlier, this combination could be explained by the similarity between the perceptual speed test of Hidden As and the verbal closure tests.

The four tests with the highest loadings on factor three are from the original factors of induction and integration. Finding the two factors together supports Ekstrom, et al. (1975) who found certain types of reasoning factors, such as induction, combining with integration.

All the tests with high loadings on factor four have graphic rather than verbal formats. See Figure 4 for sample items. This similarity of format is a plausible explanation for the result.

Figure 4

Sample Items From Tests Loading On Factor Four



When the perceptual speed tests were deleted from a factor analysis, a promax rotation of the remaining tests resulted in a structure that approached that of the KFCT. Replication is needed to test whether or not the same ability factors are stable in community college samples.

Treatment Comparison

The instructional treatments used in this study were (a) multisensory, (b) networking, (c) mnemonic, and (d) context. The performance measures following each treatment required two types of responses. The first task was to recall and write the target word definitions. The second

task entailed the recognition of correct usage of a target word in context. Each performance measure contained ten trials corresponding to the ten words presented during the instructional period. One should keep in mind that this study deals only with initial acquisition of word knowledge and not with long term retention or usage.

The order of the mean differences between treatments was the same following both performance tasks and most of these differences were significant ( $p < .05$ ). Multisensory, in each case, was first, followed by networking, mnemonic, and finally, context. So, although highly touted in the literature on vocabulary instruction, strong support for the context method of vocabulary acquisition was not borne out in this study. In fact, for initial vocabulary acquisition, with the community college group, context was significantly worse than the other three methods on both performance measures. This result occurred despite the fact that definitions for words were provided as part of the context treatment. The poor showing on the recognition performance measure was particularly surprising because the treatment consisted of reading sentences with the target words in context.

Under the recall performance measure the multisensory method was significantly better than the other three methods. An examination of individual scores confirmed that

there were only three cases out of all the performance measures in which a subject scored lower following the multisensory treatment than following another treatment.

The multisensory instructional technique had a component consisting of verbalizing and writing the definition of words. Therefore, success on the recall measure following the multisensory treatment was expected. On the other hand, the multisensory method had no component similar to the recognition task, i.e., words were not presented in context at all. Nevertheless, on recognition performance, a significantly higher mean was maintained by the multisensory method over the mnemonic and the context methods. The overall success of the multisensory method may be due in part to the social interaction created when students verbalized the words and definitions with each other (Vgotsky, 1978).

One should keep in mind, however, that in the analysis of variance, performance type differences i.e., recall and recognition, accounted for a significant amount of variance. In addition, there was an interaction between treatment and type of performance. (The mnemonic method was relatively more successful on the recognition task.) These results confirm (a) that relationships between variables in educational research are often complex and (b) that a task-treatment-interaction paradigm may be required for

meaningful interpretation of treatment comparison data.

Based on results of the treatment comparisons some recommendations can be made for curriculum development. Instructional materials for initially teaching vocabulary to remedial community college students should be composed of exercises like those found in the multisensory method. Networking, keyword, and context exercises should be introduced and practiced as reinforcement rather than as initial instructional devices. Then, for a more comprehensive picture of student achievement, evaluation should encompass different performance modes.

#### Relationship between Ability Tests and Performance Measures

An important question intended for this study was that of the relationship between ability factors and performance following different instructional treatments. The learning outcomes supported the notion that the four treatments were indeed different, and this bodes well for differential prediction. However, because the original factors did not emerge as expected, only separate ability measures could be used as predictors in post hoc analyses.

As cited earlier, when one test representing each of six KFCT factors was entered in a regression equation, no equation was found to be significant. However, there were four subsets of the six ability tests that did make sizable and significant contributions to prediction ( $p < .01$ ). The

performance variables that could be significantly predicted were (a) recall following the multisensory treatment, (b) recall following the mnemonic treatment, (c) recall as an aggregate, and (d) recognition as an aggregate.

Success on recall following the multisensory treatment was predicted by the Picture-Number associative memory test, the Hidden As perceptual speed test, and the Figure Classification induction test. The Picture-Number Test and the Hidden As Test are from factors hypothesized, for this study, to be predictors of success following the multisensory treatment. The relationship of the Figure Classification Test cannot be readily explained. Although it marks an induction factor in the KFCT, Thurstone and Thurstone (1941) found it to mark a general intelligence factor. In this study, as noted earlier, it loaded on a factor with the visualization tests. The ability underlying success with the Figure Classification Test appears to be not clearly defined.

Success on recall following the mnemonic treatment was predicted by the Figure Classification Test and the Form Board Test. The Formboard test marks the KFCT visualization factor, and was hypothesized to be a predictor of the mnemonic treatment. The Figure Classification Test has a graphic format similar to the visualization tests.

Therefore, its appearance as a significant predictor in this equation is plausible.

Recall, as an aggregate, was predicted by First-Last Names, an associative memory test, and Form Board, a visualization test. Recognition, as an aggregate, was significantly predicted by Incomplete Words, a verbal closure test, and Calendar, an integration test.

Two of the relationships from the aggregate results are quite rational. One would expect a memory test to relate to later recall of information, and one would expect an integration test to relate to a more complex task, such as recognition of correct information embedded in context. However, because canonical correlations, at best, are complex representations and difficult to interpret, one must be cautious in the conclusions to which one comes without the foundation of validating replications.

Replication would, of course, be important for all aspects of this study. The results indicate that such replication could make a worthwhile contribution to the bodies of research on ability structures and on aptitude-treatment-interaction. In the meantime, one can assert with some confidence that structuring learning tasks and performance measures so that they are congruent with individuals should continue to be explored.

**APPENDIX A**  
**INSTRUCTIONAL WORKSHEETS**

**NETWORK PRACTICE**

Here are ten valuable vocabulary words to add to your lexicon. Use the definitions to help you complete the exercises that follow.

implacable	adroit	scurrilous	assiduous	fortuitous
innocuous	garrulous	belligerent	enervate	intrepid

Here are definitions for the ten study words.\*

implacable	not placable; that cannot be appeased or pacified; relentless; inexorable
adroit	skillful in a physical or mental way; clever; expert
scurrilous	using indecent or abusive language; coarse; vulgar; foul-mouthed
assiduous	done with constant and careful attention
fortuitous	happening by chance; accidental
innocuous	that does not injure or harm; harmless
garrulous	talking much or too much, especially about unimportant things; loquacious
belligerent	seeking war; warlike
enervate	to deprive of strength, force, vigor, etc.; to weaken physically, mentally, or morally
intrepid	not afraid; bold; fearless; dauntless; very brave

\* from Webster's (1974) New World Dictionary (college edition)

Here are five of the words to work with first.

enervate    adroit    assiduous    intrepid    belligerent

1. Circle the three words in each line that are related in meaning.

enervate	weaken	energize	exhaust
incompetent	adroit	skillful	competent
assiduous	persevering	lazy	industrious
brave	intrepid	fearless	cowardly
warlike	unaggressive	belligerent	militant

2. Match the words in the two columns that are most nearly opposite by drawing lines between them.

belligerent	lazy
adroit	cowardly
assiduous	peaceful
intrepid	strengthen
enervate	unskilled

3. Match the correct study word to a phrase by drawing a line between them.

A person who shows extreme anger.	intrepid
A fine surgeon.	belligerent
The feeling a person might have after eight hours of hard work.	assiduous
A lion trainer.	adroit
A serious athlete in training.	enervated

4. Underline the best word or phrase to complete the sentence.  
Sometimes both words will be correct.

His shrewd strategy on the tennis court made him an easy winner. He (is, is not) adroit.

Because the boy was completely enervated, the coach had him (stay in the game longer, leave the game sooner).

He went intrepidly to ask his boss for a raise. He was (fearful, fearless).

She spent a great deal of time at the coffee machine. She was not (attentive, assiduous) in her commitment to the job.

The accused sat quietly in the courtroom. He (did, did not) show any belligerence.

Here is the second set of five words.

implacable . scurrilous fortuitous garrulous innocuous

5. Circle the three words in each line that are related in meaning.

unchangeable	implacable	unyielding	inflexible
slandorous	flattering	scurrilous	ridiculing
fortuitous	by luck	intentional	by chance
inoffensive	innocuous	harmless	harmful
multiloquent	overtalkative	garrulous	using few words

6. Match the words in the two columns that are most nearly opposite by drawing lines between them.

innocuous	intentional
garrulous	flattering
fortuitous	persuaded to give in
scurrilous	deadly
implacable	not talkative

7. Match the correct study word to a phrase by drawing a line between the two.

Being unwilling to change an opinion.	innocuous
Teenager telephone talk	scurrilous
Mild muscle soreness	implacable
Winning a lottery	garrulous
Playing a dirty joke on someone	fortuitous

8. Underline the best word or phrase to complete the sentence correctly. Sometimes both words may be correct.

She was implacable about her decision. Her mind (could, could not) be changed.

He praised her in glowing terms. His manner (was, was not) scurrilous.

She had not intended to see him. Their meeting (was, was not) fortuitous.

If you want to hear idle chatter you (will, will not) seek out a garrulous person.

The bite of a malaria-carrying mosquito (is, is not) innocuous.

MULTISENSORY PRACTICE

The exercises that follow are to help you learn the meaning of these ten words.

erudite      dissonance...      deleterious      enigma      ostentatious  
ennui      supercilious      vociferous      evoke      colloquy

1. This practice is for quick visual recognition of the study words. Mark the word on the right that is the same as the target word. For example:

ennui      erratic      erudite      ennuui      evoke      exploit

Go as fast as you can and record your time when you are finished.

enigma	enervate	engross	exploit	evoke	enigma
colloquy	conclusion	confidence	colloquy	complacent	consummate
erudite	exploit	engross	erudite	erratic	esoteric
evoke	erratic	erudite	exploit	esoteric	evoke
supercilious	sporadic	sedentary	sanguine	surreptitious	supercilious
vociferous	vacillate	vivacious	verbose	vivid	vociferous
deleterious	deleterious	dissonance	disparage	diversity	dubious
ostentatious	ominous	omnivorous	obscure	ostentatious	omnipresent
dissonance	deleterious	diversity	dissonance	disparage	dubious
ennui	exploit	ennui	erratic	erudite	evoke

Seconds \_\_\_\_\_

Lines correct \_\_\_\_\_

Here is the same type of exercise, but in this case the words are close together and may appear more than once. The target word is listed first.

deleterious dissonance disparage diversity deleterious dubious

ennui exploit ennui erratic evoke ennui

dissonance deleterious dissonance diversity dissonance dubious

ostentatious ominous ostentatious omnivorous obscure ostentatious

vociferous vociferous vacillate vivacious verbose vociferous

supercilious sporadic sedentary supercilious surreptitious sanguine

erudite erudite engross erratic erudite exploit

colloquy cursory colloquy confidence conclusion complacent

enigma enervate engross exploit evoke enigma

Seconds \_\_\_\_\_

Lines correct \_\_\_\_\_

Here are definitions of the study words. Read the word and the definition out loud.

enigma	a perplexing, usually ambiguous statement; riddle
colloquy	a conversation; especially a formal discussion; conference
erudite	having or showing a wide knowledge gained through reading
evoke	to call forth or summon (a spirit, demon, etc.) as by chanting magical words; conjure up
supercilious	haughtiness; disdainful or contemptuous
vociferous	loud, noisy, or vehement in making one's feelings known; clamorous
deleterious	harmful to health; well-being, etc.; injurious
ostentatious	showy display, as of wealth, knowledge, etc.; pretentiousness
dissonance	an inharmonious sound or combination of sounds; discord
ennui	weariness and dissatisfaction resulting from inactivity or lack of interest; boredom

\*from Webster's (1974) New World Dictionary (college edition)

Now spend ten minutes in oral practice associating the word and definition in memory. Work with a partner.

Read the definition and see if you can write the word on the line without referring back to the list. Check your spelling from the list before going on to the next word.

Haughtiness; disdainful and contemptuous

\_\_\_\_\_

A conversation; especially a formal discussion conference

\_\_\_\_\_

Loud, noisy, or vehement in making one's feelings known; clamorous

\_\_\_\_\_

To call forth or summon (a spirit, demon, etc.) as by chanting magical words; conjure up

\_\_\_\_\_

Weariness or dissatisfaction resulting from inactivity or lack of interest; boredom

\_\_\_\_\_

A perplexing, usually ambiguous statement

\_\_\_\_\_

Showy display, as of wealth, knowledge, etc.; pretentiousness.

\_\_\_\_\_

Having or showing a wide knowledge gained through reading.

\_\_\_\_\_

An inharmonious sound or combination of sounds; discord.

\_\_\_\_\_

CONTEXT PRACTICE

Sometimes when you are reading you will be able to figure out the meaning of a word by using the ideas in the sentence containing the word. This analysis is called "using context". See if you can determine the meaning of the word "gregarious" from these sentences. Write your guess each time on the line below.

Gregarious people are usually fun to know.

-----

A gregarious person, not an introvert, is most likely to become class president.

-----

Someone who is gregarious will never turn down a chance to be with other people.

-----

Answer: gregarious fond of the company of others; sociable

The context exercises that follow are to help you learn the meaning of these words.

ingenuous      blatant      empirical      specious      credulous  
concomitant    astute      pernicious      parsimony    introspect

After you read the sentence, make a guess at the meaning of the underlined word, and write your guess on the line. When you have completed the three sentences, turn the page to find the correct definition.

1. Sometimes her ingenuous manner made her seem insensitive.

-----

2. Although he seemed ingenuous, he was really hiding his true feeling.

-----

3. She was very frank with her opinions, very ingenuous.

---

Answer: ingenuous frank; open; candid; naive; artless; without guile

The blatant colors of the rug and furniture, red, orange, and bright yellow, made the room seem hot.

---

Contemporary heavy metal music is blatant rather than melodious.

---

A quiet discussion can become blatant if a great deal of disagreement is evident.

---

Answer: blatant disagreeably loud or boisterous; offensively noisy; clamorous

The scientist backed up his statement with empirical evidence.

---

Some beliefs are empirically based and others are theoretical.

---

She carefully observed the animal's behavior, empirically checking all sleeping, eating, mating, hunting, and playing habits.

---

Answer: empirical relying or based solely on experiment or observation rather than theory

He gave a specious rationalization for his actions.

---

The debater used logic that was specious rather than true.

---

Most advertisements contain specious information that sounds true, but is in fact, false.

---

Answer: specious seeming to be good, sound, correct, logical, etc. without really being so; plausible, but not genuine

Many salespersons hope their customers will be credulous.

---

He was skeptical rather than credulous about the story.

---

She is so credulous she believes everything she reads.

---

Answer: credulous tending to believe too readily; easily convinced

During the experiment, the concomitant problems were severe.

---

Sky diving, with the concomitant danger, appeals to only a small percentage of the population.

---

When one has an income there is usually a concomitant outgo in the form of taxes.

---

Answer: concomitant accompanying; attendant

In business, one must be very astute.

---

The best chess players are astute, not careless, about the moves they make.

---

She is an astute doctor who rarely makes an incorrect diagnosis.

---

Answer: astute having or showing a clever or shrewd mind; cunning; crafty; wily

Alcoholism is pernicious.

---

A poisonous animal's bite can be pernicious.

---

Alcoholism is a pernicious habit.

---

Answer: pernicious causing great injury, destruction or ruin;  
fatal, deadly

She was well known for her parsimony.

---

His extreme parsimony had resulted in a huge savings account.

---

Her designer clothes and expensive jewelery indicated  
extravagance rather than parsimony in her spending habits.

---

Answer: parsimony a tendency to be overcareful in spending;  
unreasonable economy; stinginess

The diving champion was described as an introspective man.

---

A way to learn about oneself is to introspect.

---

She was careful to introspect before she acted or spoke.

---

Answer: introspect to look into one's own mind, feelings,  
etc.

**KEYWORD IMAGES (Key shown on board; image given orally)**

<b>Sanguine</b>	<b>sanguine</b>	A person singing because he/she is cheerful and confident. (Visualize someone singing cheerfully)
<b>Voluble</b>	<b>voluble</b>	Lubricating gears to make them turn easily; a voluble person talks easily. (Visualize someone lubricating their vocal cords and then talking very fast with lots of words.)
<b>Perspicacious</b>	<b>perspicacious</b>	A spy (spi) has to be very clever; with keen understanding. (Visualize spy with magnifying glass looking for clues or having to cleverly escape an enemy.)
<b>Connotation</b>	<b>connotation</b>	The notion associated with a word; the "extra" meaning. (Visualize the word "home" with all the things that go into a home hanging on it.)
<b>Ubiquitous</b>	<b>ubiquitous</b>	I won't quit working for disarmament until it is "all over everywhere". (Visualize yourself carrying a poster for disarmament in U.S., Russia, etc.)
<b>Vicarious</b>	<b>vicarious</b>	In my imagination I drive an Alfa Romero convertible.
<b>Diffident</b>	<b>diffident</b>	I feel shy about going to the dentist. (Visualize the scene)
<b>Ephemeral</b>	<b>ephemeral</b>	Hem lengths only last a short period of time. (Visualize hems going up and down quickly)
<b>Tacit</b>	<b>tacit</b>	You and your boyfriend, girlfriend, spouse, have a silent agreement that you will go to sit (cit) in a corner when you are ready to go home from a party. (Visualize the scene. See yourself looking at each other without talking.)
<b>Surreptitious</b>	<b>surreptitious</b>	Reptiles move in a secretive, sneaky manner. (Visualize a snake quietly moving across the floor.)

**APPENDIX B**  
**DIRECTIONS AND SAMPLES FROM ABILITY TESTS<sup>a</sup>**

<sup>a</sup>  
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These consist of pages:

Appendix B Pages 97-113

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**APPENDIX C**  
**PERFORMANCE MEASURES**

MULTISENSORY PRACTICE QUIZ

As completely as you can, write the definition for each word. If you do not recall the exact definition, write anything you remember about the word.

1. ennui

---

---

2. evoke

---

---

3. enigma

---

---

4. erudite

---

---

5. colloquy

---

---

6. vociferous

---

---

7. dissonance

---

---

8. deleterious

9. ostentatious

10. supercilious

Place a check beside any sentence in which the study word is used correctly. Another form of the word may be used.

- 1. He felt very energized and full of ennui.
- 2. His enigmatic behavior caused everyone to understand him.
- 3. We knew she was erudite because she never used fancy words.
- 4. She spoke harshly to him in order to evoke his attention.
- 5. The colloquy was held so everyone could express his or her opinion.
- 6. The dog barked in a vociferous manner at the stranger.
- 7. The singer was right on key and created a good deal of dissonance.
- 8. Expert nutritionists recommend whole grains as being deleterious to one's health.
- 9. He dressed in an ostentatious manner with few jewels and no fancy suits.

\_\_\_10. With her head down and her shoulders drooping, she gave the appearance of being supercilious.

NETWORK PRACTICE QUIZ

As completely as you can, write the definition for each word. If you do not recall the exact definition, write anything you remember about the word.

1. adroit

---

---

2. enervate

---

---

3. intrepid

---

---

4. assiduous

---

---

5. innocuous

---

---

6. garrulous

---

---

7. fortuitous

---

---

8. scurrilous

---

---

9. implacable

---

---

10. belligerent

---

---

Place a check beside any sentence in which the study word is used correctly. Another form of the word may be used.

- 1. His adroit strategy resulted in his winning the tournament.
- 2. She drank some orange juice in order to become enervated.
- 3. The intrepid diver was afraid to go into the water with the sharks.
- 4. The assiduous worker was often not on the job.
- 5. For an alcoholic, a single drink is innocuous.
- 6. Since she needed to talk to him, his arrival at the party was fortuitous.
- 7. A gentleman will often use scurrilous language.
- 8. The garrulous gentleman never opened his mouth.
- 9. She was implacable in her decision, determined not to change.
- 10. Belligerent behavior often leads to peace.

**CONTEXT PRACTICE QUIZ**

As completely as you can, write the definition for each word. If you do not recall the definition, write anything you remember about the word.

1. **astute**

---

---

2. **blatant**

---

---

3. **specious**

---

---

4. **empirical**

---

---

5. **ingenuous**

---

---

6. **parsimony**

---

---

7. **credulous**

---

---

8. introspect

-----  
-----

9. pernicious

-----  
-----

10. concomitant

-----  
-----

Place a check beside any sentence in which the study word is used correctly. Another form of the word may be used.

- 1. He used all the money in his astute business deal.
- 2. A mail-order diploma is a specious document.
- 3. In periods of drought it is unwise to be parsimonious in water consumption.
- 4. She spoke softly in a blatant manner.
- 5. Good research is always empirical.
- 6. His wide experience made him very ingenuous.
- 7. Thunder is not concomitant with lightning.
- 8. She was so credulous she believed nothing she read.
- 9. When he is talking, he is being introspective.
- 10. A mosquito bite is very pernicious.

**KEYWORD PRACTICE QUIZ**

As completely as you can, write the definition for each word. If you do not recall the exact definition, write anything you remember about the word.

1. tacit

---

---

2. voluble

---

---

3. sanguine

---

---

4. ephemeral

---

---

5. diffident

---

---

6. vicarious

---

---

7. ubiquitous

---

---

8. connotation

---

---

9. perspicacious

---

---

10. surreptitious

---

---

Place a check beside any sentence in which the study word is used correctly.

- 1. Their tacit agreement was clearly spoken.
- 2. His speech was short and voluble.
- 3. Her tears showed how sanguine she was.
- 4. In comparison with the life span of some turtles, man has an ephemeral existence.
- 5. He was diffident and outspoken.
- 6. Vicarious adventures cost a good deal of money.
- 7. In this country, small businesses are less ubiquitous than they once were.
- 8. The word "slender" has a more positive connotation than the word "skinny".
- 9. Guerrilla bands must never meet surreptitiously or they will be discovered.
- 10. Self-made millionaires are perspicacious.

**APPENDIX D**  
**FORTY WORD QUIZ**

Record the letter of the word or words that is closest in meaning to the underlined word.

1. colloquy means
  - a. illustrate
  - b. discuss
  - c. write
  - d. sing
2. voluble means
  - a. quiet
  - b. full
  - c. empty
  - d. talkative
3. belligerent behavior is
  - a. belittling
  - b. warlike
  - c. friendly
  - d. unfriendly
4. to introspect is to
  - a. discuss
  - b. think
  - c. observe
  - d. go blank
6. to envoke means to
  - a. expel
  - b. call forth
  - c. demonstrate
  - d. send back
7. vociferous means
  - a. eating and drinking
  - b. weeping and wailing
  - c. shouting and crying
  - d. fun and laughter
8. ostentatious means
  - a. fat
  - b. skinny
  - c. showy
  - d. plain
9. to be implacable is to be
  - a. expressionless
  - b. impressionable
  - c. merciful
  - d. unyielding

5. perspicacious means
- a. having keen judgment
  - b. jumping to conclusions
  - c. keen judgment
  - d. gaining perspective
10. specious means
- a. absolutely false
  - b. apparently false
  - a. absolutely false
  - d. absolutely true
11. a vicarious experience is
- a. fascinating
  - b. vicious
  - c. imaginary
  - d. unique
16. surreptitious behavior is
- a. surprising
  - b. irrational
  - c. secretive
  - d. rational
12. empirical evidence is
- a. impractical
  - b. practical
  - c. political
  - d. social
17. a fortuitous event is
- a. rare
  - b. accidental
  - c. planned
  - d. unfortunate
13. ennui means
- a. patience
  - b. nervousness
  - c. boredom
  - d. happiness
18. dissonance is
- a. discord
  - b. dissuasion
  - c. disgust
  - d. disturbance

14. deleterious means
- a. offensive
  - b. injurious
  - c. delightful
  - d. courteous
15. scurrilous means
- a. eloquent
  - b. facetious
  - c. slanderous
  - d. adulatory
21. a tacit agreement is
- a. mutual
  - b. group
  - c. broken
  - d. unspoken
22. concomitant is
- a. preceding
  - b. accompanying
  - c. passing
  - d. following
19. a credulous audience is
- a. quiet
  - b. skeptical
  - c. noisy
  - d. believing
20. something pernicious is
- a. lively
  - b. deadly
  - c. strong
  - d. weak
26. a sanguine temperament is
- a. calm and easygoing
  - b. excitable and moody
  - c. gloomy and shy
  - d. cheerful and confident
27. assiduous attention is
- a. fleeting
  - b. varying
  - c. constant
  - d. invariable

23. innocuous means
- a. harmful
  - b. important
  - c. harmless
  - d. trivial
24. a garrulous person is
- a. quiet
  - b. talkative
  - c. quarrelsome
  - d. bitter
25. an enigma is a
- a. puzzle
  - b. situation
  - c. disaster
  - d. disease
31. to be astute is to be
- a. clever
  - b. bold
  - c. shy
  - d. stupid
28. ubiquitous means
- a. above and below
  - b. nowhere in particular
  - c. side by side
  - d. everywhere at one time
29. parsimony is
- a. generosity
  - b. meanness
  - c. recklessness
  - d. stinginess
30. blatant means
- a. increasingly fast
  - b. pleasantly soft
  - c. increasingly slow
  - d. unpleasantly loud
31. an ephemeral vision lasts
- a. a brief period of time
  - b. a long period of time
  - c. an indefinite period of time
  - d. a definite length of time

32. an energized person has
- a. energy
  - b. nerves
  - c. no energy
  - d. no nerves
33. a connotation is an
- a. exact definition
  - b. opposite idea
  - c. inferential idea
  - d. associated idea
34. a diffident person is
- a. confused
  - b. timid
  - c. stubborn
  - d. defiant
35. an erudite person
- a. violent
  - b. shallow
  - c. learned
  - d. calm
37. to be adroit means to be
- a. indirect
  - b. skillful
  - c. careless
  - d. dominating
38. a supercilious person is
- a. friendly
  - b. brilliant
  - c. scornful
  - d. superb
39. an ingenuous person is
- a. not genuine
  - b. not smart
  - c. innocent
  - d. imaginative
40. to be intrepid is to be
- a. fearless
  - b. timid
  - c. rude
  - d. skillful

APPENDIX E  
FACTOR MATRICES

Varimax Rotated Factor Matrix: Ability Tests

Test	Factor					h
	I	II	III	IV	V	
<b>Perceptual Speed</b>						
Hidden As	-09	89	05	02	03	80
Identical Pictures	05	23	04	92	05	86
Number Comparison	-13	10	08	-13	96	98
<b>Induction</b>						
Letter Sets	59	01	66	25	-06	86
Locations	70	-02	55	-11	-19	84
Figure Classifying	28	-37	13	71	-21	78
<b>Integrative Processes</b>						
Calendar	20	17	90	01	17	90
Follow Directions	-06	12	89	12	-01	82
<b>Memory for Associations</b>						
Picture/Number	-59	-54	-22	-28	-32	87
Object/Number	-62	-46	-35	-14	-42	91
First/Last Names	-91	10	14	-15	08	90
<b>Visualization</b>						
Formboard	68	03	35	39	-34	86
Paperfolding	42	-30	21	57	-50	88
Surface Development	68	-14	-01	67	-20	97
<b>Verbal Closure</b>						
Scrambled Words	17	85	05	-01	06	76
Hidden Words	-04	74	39	-17	02	73
Incomplete Words	-11	86	-04	-28	25	89

<sup>a</sup> Decimal points are omitted

Promax Rotated Factor Matrix Ability Tests

Test	Factor					h
	I	II	III	IV	V	
<b>Perceptual Speed</b>						
Hidden As	-05	86	14	-12	-25	80
Identical Pictures	27	-04	10	89	-07	86
Number Comparison	-20	29	04	-24	96	98
<b>Induction</b>						
Letter Sets	75	04	76	42	-11	86
Locations	75	01	64	11	-21	84
Figure Classification	46.	-45	18	81	-42	78
<b>Integrative Processes</b>						
Calendar	36	28	93	08	21	90
Follow Directions	14	19	88	15	02	82
<b>Memory for Associations</b>						
Picture/Number	-67	-58	-38	-33	-40	87
Object/Number	-68	-55	-49	-21	-48	91
First/Last Names	-88	13	-01	-36	19	90
<b>Visualization</b>						
Formboard	83	-03	49	58	-40	86
Paperfolding	60	-41	28	74	-66	88
Surface Development	81	-23	13	83	-36	97
<b>Verbal Closure</b>						
Scrambled Words	17	85	17	-06	32	76
Hidden Words	01	78	45	-23	28	73
Incomplete Words	-17	90	02	-41	54	89

<sup>a</sup> Decimal points are omitted

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