A STUDY TO ASSESS RELATIONSHIPS
BETWEEN READING ACHIEVEMENT
AND RETENTION OF PROSE

DISSERTATION

Presented to the Graduate Council of the
North Texas State University in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF EDUCATION

By

Ruth Berrier, B.A., M.Ed.
Denton, Texas
December, 1980
This investigation was concerned with whether linguistic competence with printed material is related to the retention of information contained in prose passages of high readability. The specific purpose of the study was to investigate relationships between linguistic competence and free recall, immediate, delayed, and practiced, after the reading of a passage of high readability.

In a review of related literature, indications were found that linguistic competence could be expressed by test scores of reading achievement. Therefore, in this study linguistic competence was operationally defined by scores of literal and inferential reading comprehension. In a second analysis of the data, vocabulary scores were used also. Subjects for the two analyses were seventh grade students who scored either very high or very low in tests of these reading skills.

In a pilot study of recall procedures, no significant differences were found between oral recall and written recall. Therefore, in this study, free recall was measured by the written method because of comparative ease of administration.
For objective evaluation of the recall protocols, a criterion was prepared by listing a propositional representation of the text base of the test passage. The subjects' recall protocols were assessed by comparison to this criterion. Scores were then analyzed in a 2 (high and low achievement) x 3 (immediate, delayed, and practiced recall) analysis of variance procedure.

Results of this study indicated that high reading achievers performed significantly higher than low reading achievers in all three recall treatments. Further, when the recall treatments were compared, results indicated that immediate recall was significantly higher and delayed recall significantly lower than practiced recall.

In the second analysis of the recall of more stringently selected subjects, an interaction was found. Select high achievers, while scoring higher than the high achievers in the first analysis in immediate and practiced recall, scored lower in delayed recall. Further, select low achievers, while scoring lower than the low achievers in the first analysis in immediate and practiced recall, scored higher in delayed recall. Caution is urged in the interpretation of the results of the second analysis because of the extremely small cell sizes.

This investigation found that: (1) there is a relationship between memory and linguistic competence; (2) intervening
events before recall result in a significant decrease in retention for both high and low reading achievers; (3) similar memory patterns for high and low achievers seem to diverge as achievement levels approach extremes. The greater the difference in reading achievement, the greater appears to be the difference in memory for immediate and practiced recall, while delayed recall appears to be less affected by achievement differences. This investigation further found that (4) the real difference between achievement levels might be in acquisition of information or in short-term memory rather than in long-term memory, and (5) very high achieving readers may habitually rehearse after reading and very low achieving readers may fail to make substantial gains from practice.
TABLE OF CONTENTS

LIST OF TABLES ........................................ iv

LIST OF ILLUSTRATIONS ................................. v

Chapter

I. INTRODUCTION ..................................... 1

Statement of the Problem
Purpose of the Study
Definition of Terms
Hypotheses
Significance of the Study
Basic Assumptions
Methodology
Limitations

II. SYNTHESIS OF THE RELATED LITERATURE .......... 13

The Nature of Linguistic Competence
Memory
Recall/Recognition
Representation of Prose

III. METHODS AND PROCEDURES .......................... 31

The Pilot Study
The Research Design
The Subjects
The Materials
The Procedure

IV. DISCUSSION OF THE RESULTS ....................... 40

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS .... 52

Summary of the Study
Findings
Conclusions
Recommendations

APPENDICES ............................................. 62

BIBLIOGRAPHY .......................................... 71
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Means and Standard Deviations of High and</td>
<td>41</td>
</tr>
<tr>
<td>Low Reading Achievers in Free Recall of</td>
<td></td>
</tr>
<tr>
<td>a Test Passage, Analysis One</td>
<td></td>
</tr>
<tr>
<td>II. Analysis of Variance for Data Set One</td>
<td>41</td>
</tr>
<tr>
<td>III. Means and Standard Deviations of High and</td>
<td>42</td>
</tr>
<tr>
<td>Low Reading Achievers in Free Recall of</td>
<td></td>
</tr>
<tr>
<td>a Test Passage, Analysis Two</td>
<td></td>
</tr>
<tr>
<td>IV. Analysis of Variance for Data Set Two</td>
<td>43</td>
</tr>
</tbody>
</table>
LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A 2 x 3 analysis of variance</td>
<td>34</td>
</tr>
<tr>
<td>2.</td>
<td>Number of propositions recalled by high and low reading achievers in immediate, delayed, and practiced recall</td>
<td>47</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

During the 1970s there was an increasing interest in cognitive processes which may be affecting learning and memory. The earlier work of cognitive theorists, such as Wundt, Koffka, Kohler, and Lewin, led to the study of mediational activities of learners as they perceive and deal with information where the predominant medium is print.

This focus on cognitive processes has also captured the interest of educators concerned with teaching prospective teachers. The early emphasis of this research was on characteristics which typify the successful teacher and on the processes which teachers perform in affecting student product (16). Recently the emphasis has shifted to investigations of methods which might inspire the mediational efforts of students necessary for producing real learning (9), i.e., real changes in schema (2).

Researchers of the 1970s have developed models to explain the processing of information from print to mind. Furthermore, computer science has provided insights which have inspired models of information processing.

Ellen Cagné (7) reports that researchers have studied the effects on retention of conditions related to the act of dealing with prose discourse. Consideration has been given to the
student's prior knowledge, e.g., the effect on recall of his familiarity with information in the test passage (5) and the biasing effect that may be produced by prior knowledge when ambiguous material is read (3). Researchers have also studied the effect on recall of prior productions, i.e., previous work in related areas (4). Other studies have dealt with learner history, e.g., the effect on recall of learner self-confidence (10) and measured ability (22).

Events just prior to reading have been studied to discover effects on retention. Gagné reports events such as reminding students of prior knowledge; using advance organizers (1); providing objectives (6) or prequestions (8) which will increase attending and rehearsing; setting purposes, such as use of information contained in the test passage (21); and instructing students to use strategies, such as imaging (13).

Gagné also reviews conditions during the act of reading: the effects of structure (11), imagery of the discourse (15), and requiring students to do something while reading, such as take notes (17). Interspersed questions (18) and linking sentences (24) are examples of redundancy which may affect recall. Conditions which increase retention during the retention interval, such as quizzes (14), notes, inferring, paraphrasing (17), and feedback (12), have also been studied.

Other researchers have studied characteristics of memory and methods of representing memory. Simon (23) studied the properties of human memory by observation of the overt behavior
of subjects. Other psychologists, such as Kintsch (11) and Anderson (2), have sought ways of extracting and representing the propositions which form the linguistic core of meaning in discourse so that they might ascertain the nature of concepts and processes involved in retention and retrieval of information.

While "ability," as noted by Gagne (7), has been studied in relationship to memory, no studies of the correlation of memory and reading achievement were found by Gagne, nor were such studies found in the review of literature for this study. In the 1970 study conducted by Shuell and Keppel (21), "ability" was defined by the number of words recalled correctly after a controlled presentation of a list of thirty nouns. In a study by Foyer, Hambleton, and Cadorette (19), "ability" consisted of the I.Q. and prior knowledge of science students. Sanders (20) studied the interactions among aspects of "ability" using the college grade point average, question placement, and retention. Allen (1) studied the relationships among "ability," measured by I.Q. score, advance organizers, and retention. Finally, in a study by Miller (10), verbal "ability" was indicated by scores subjects made on a test of English usage. Thus, researchers have sought to account for differences in "ability" of subjects, but it appears that reading achievement has not been used for this purpose.

From an earlier concern with behavior and student product, recent attention has focused on cognitive processes, conditions and strategies to facilitate learning, and indicators of ability.
Statement of the Problem

The problem of the study was to determine whether and/or to what extent linguistic competence with printed material is related to the retention of information contained in passages of high readability.

Purpose of the Study

The purpose of the study was to investigate relationships between linguistic competence, indicated by high and low reading comprehension scores, and free recall, immediate, delayed, and practiced, after the reading of a passage of high readability.

Definition of Terms

The following terms are defined as they were used in reporting this study:

High achievers.--Subjects who scored in the seventh, eighth, or ninth stanine on both the literal and inferential items of the comprehension subtest of the Stanford Diagnostic Reading Test.

Low achievers.--Subjects who scored in the first, second, or third stanine on both the literal and inferential items of the comprehension subtest of the Stanford Diagnostic Reading Test.

Test passage.--An informational passage of no more than 200 words with readability of third grade as measured by the Spache Readability Formula.
Immediate recall.--Free recall listing in simple sentences or phrases all that can be remembered of the test passage before the occurrence of intervening events.

Delayed recall.--Free recall listing in simple sentences or phrases all that can be remembered of the test passage after the occurrence of intervening events.

Practiced recall.--Immediate recall followed by delayed recall.

Linguistic competence.--Skill in dealing with language, in this study indicated by reading achievement measured by literal and inferential reading comprehension scores in the first analysis and by literal and inferential reading comprehension scores and vocabulary scores, in combination, in the second analysis.

Easily accessible difficulty.--High readability, easily comprehended by most readers.

Hypotheses

The specific predictions of this study were as follows:

1. High reading achievers will significantly outperform low reading achievers in free recall whether it is immediate, delayed, or practiced.

2. In either group, practiced recall will be significantly superior to delayed recall.

3. In either group, immediate recall will be significantly superior to practiced recall.
Significance of the Study

In 1978, E. Gagné presented an extensive review of research on retention of information following learning from prose (7). For this review, she investigated studies of the relationships between memory and factors of learner history, such as ability, prior knowledge, prior work in related areas, and self concept. "Surprisingly," she reported, "no studies were found that related reading achievement test scores to retention following learning from prose." In a review of the literature this researcher also failed to find such a study. Therefore, the present study seeks to assess relationships that might exist between reading achievement test scores and the retention of prose.

The thrust of this paper was the study of factors relating to effective information-processing. Its purpose was to increase knowledge concerning the factors of learner history which contribute to retention and, thereby:

1. To assist teachers in understanding the nature of reading achievement including the difficulties of low achievers and the successes of high achievers.

2. To help teachers in their search for strategies to facilitate linguistic competence and produce mathemagenic, mediational behaviors.

3. To suggest direction to curriculum developers for the preparation of materials designed to help develop linguistic competence and produce mathemagenic, mediational behaviors.
Basic Assumptions

It was assumed that the Stanford Diagnostic Reading Test is sufficiently valid and reliable so that students who had a high score actually would be accomplished in the reading skills measured, and, likewise, students having a low score would lack the reading skills measured.

It was further assumed that the disadvantages of having a limited number of subjects, all of whom attended the same junior high school, were outweighed by the advantage of standardization of the treatment procedure.

It was further assumed that few, if any, subjects had appreciable prior knowledge concerning information in the test passage which might have increased the number of propositions recalled.

Methodology

Because it was assumed that linguistic competence could be expressed by reading achievement test scores, the researcher decided to describe the linguistic competence of subjects in this study by their scores in literal and inferential reading comprehension and, in a second analysis, in vocabulary also. Subjects for the two analyses, then, were students who achieved either very high or very low scores in tests of these skills.

To provide for the measurement of memory, a pilot study of recall procedures was conducted. No significant differences between oral, taped recall and written recall of either high or low reading achievers were found in the pilot study.
Therefore, it was determined to measure free recall by the written method.

Recall of the subjects was tested in three treatments: immediate recall following reading a simple prose passage, delayed recall one week later after intervening events had occurred, and practiced recall, immediate recall followed by delayed recall.

For objective evaluation of the recall protocols, a criterion was prepared by listing a propositional representation of the text base of the test passage. The subjects' recall protocols were assessed by comparison to this criterion.

A 2 (high and low reading achievement) x 3 (immediate, delayed, and practiced recall) analysis of variance was used to analyze the data which had been obtained.

Limitations

1. Definitions of high and low achievers were based on results obtained from the comprehension subtest of the Stanford Diagnostic Reading Test, Level II. A potential limitation of these definitions is in the unreliability of any test. Under other circumstances, scores might differ from these.

2. Readability of the test passage should allow easy comprehension by all subjects; however, even though the readability of the test passage was 3.1 according to Spache, other factors affecting readability, such as concept load, might make the passage more difficult than indicated by the measured readability score.
3. The test passage was shorter and easier than most reading assignments read by junior high students; therefore, application of results to school situations must be made with caution.

4. The subjects were all enrolled in a suburban school predominately populated by mid-SES, Caucasian students whose motivation and interest in school might inflate scores.

Summary

In this chapter, the researcher addressed the problem of the study, i.e., whether and/or to what extent a relationship might exist between memory and linguistic competence. The significance of this study is found in the insights gained for assisting teachers and curriculum developers to guide students to greater linguistic competence. Procedures were described for measuring linguistic competence and memory. Limitations suggested thoughtful interpretation of results.
CHAPTER BIBLIOGRAPHY


CHAPTER II

SYNTHESIS OF THE RELATED LITERATURE

Several areas of literature regarding reading and educational psychology were explored in conceptualizing this study and in seeking insights regarding these questions: (1) What is the nature of linguistic competence? Is it a product and/or a companion of reading achievement? Or is linguistic competence, especially competence with print, prerequisite to or synonymous with reading achievement? (2) Is reading achievement distinct from ability? How can achievement in reading be confidently measured? (3) What is the nature of memory, comprehension-retention-retrieval? Is recall an appropriate measure of the product of the mediational processes involved? (4) Would an objective instrument be the best measure of the recall product? (5) If free recall is used, how might subject protocols be evaluated? Can prose discourse be satisfactorily represented so that a criterion instrument can be prepared? (6) What sort of passage should be selected, what should be its difficulty, and how should it be presented to the subjects? (7) What procedures should be followed, e.g., what sort of introduction or instructions should be given to prevent confounding of the results of the study by providing superordinate statements or by setting purposes which might impose effects on student performance?
In this review of literature, the following will be discussed: (1) the concept of linguistic competence, (2) the relationship between reading achievement and intelligence, (3) the nature of memory and recall, and (4) the measurement of the meaning of prose discourse.

The Nature of Linguistic Competence

Linguistic competence implies skill in using language, a familiarity with common usage, the ability to make logical guesses about forthcoming information while listening or reading, and the ability to speak or write so that other language users can understand. Schank's (26) concept of linguistic competence implies the ability to extract what is explicit and attach that information to what the language receiver already knows so that questions may be formulated to fill the gaps in meaning. He states that communication between people depends largely on what is implied rather than on what is directly expressed.

The importance of schemata in gaining skill with language has been addressed by some theorists. Rumelhart and Ortony (25) describe schemata as the building blocks of information-processing and state that "... existing knowledge is utilized in and required for the acquisition of new knowledge" (p. 132). According to P. C. Anderson (2), learning to comprehend and to build memory occurs when appropriate schemata are used in processing information. Further, learning to pattern elements helps in building schemata. The formation of schema helps people order
sensory input. The learner acts on new information by utilizing schema (assimilation) or by altering schema (accommodation). Meaning is not in the message but in the interaction between text and the learner's interpretation. This interaction will be affected by the learner's purpose, i.e., by his perception of the task, writes Anderson. According to these theorists, schemata are used to represent knowledge and to acquire new knowledge. It might be said that schemata form the framework of linguistic competence.

In the same vein, Bower (4) says, "It is a truism that we only remember our mental acts, our perceptions, thoughts, and imaginings" (p. 94). It is not events or facts that we remember but our own encoding, or interpretation, of these events. Our interpretations are processes which recall Gestalt laws of grouping and figure-ground segregation. Memory, then, is not a literal reproduction of events but a "redintegration of our cognitive biography" (p. 111). As students seek meaning, they are exposed to unknown material which must be assimilated with prior knowledge. Students gain linguistic competence as they discover and apply rules for processing new information and as they organize it in memory.

J. R. Anderson (1) explains linguistic competence in terms of his computer-like model for information-processing. Through experience students acquire a "set of productions" which enables them to store information with redundant connections, links, or retrieval pathways. Their memory for the
to-be-learned material will be better if they can store this material in a form which has many connections or "elaborative productions" (p. 433).

Linguistic skills interact with a student's comprehension of text, according to Fredericksen (14). He writes, "The manner in which an individual uses knowledge transmitted in a text will affect the nature of the 'semantic model' of the text which he produces, and hence his comprehension of the text" (p. 228). Schank (26) writes of the interaction between memory and language processing, "The role of memory in language processing is to direct it, control it, and provide the solution for it; therefore, the solution to the problem of memory is the solution to the problem of language processing and possibly vice versa" (p. 189).

Kintsch (18) describes a type of schema that enables the linguistically competent student to deal with stories. The student possesses a schema for the macrostructure of a story. He expects a main character, which he quickly identifies, and episodes or chunks, which end or begin where connectivity is low. At these points, which the student monitors, he assigns headings in retrospect which together form an abstract of the text. If a linguistically naive person recalls insignificant details instead of the gist of the story, it is probably due to a lack of an appropriate schema for organizing stories, not because of an intellectual deficit.

Bormuth (3) says that there are three classes of skills by which knowledge is acquired from written language. These
are competence in dealing with sentences, with "anaphora" (a
pronoun-like structure which shortens or substitutes for an
expression which is usually antecedent to it and which has
the same referent as the antecedent, e.g., "this boy" shortens
the antecedent "the small boy"), and intersentence structure,
in which a question involves more than one sentence.

Some researchers believe that experience with language
and skill in decoding produce greater linguistic competence.
Bransford et al (5) report the need for students to have a
framework to guide them in acquiring information. They sug-
gest that experience with print may provide this framework
and assist students in learning what to do in order to go
beyond their present ability. Perfetti and Hogaboam (21)
suggest that a lack of automaticity with decoding leads to
or shares a limited comprehension processing capacity.

These definitions of the nature of linguistic competence
have lead to studies concerned with improving linguistic com-
petence. In E. Gagné's comprehensive review (15) of the
nature of linguistic competence and print, she organized a
large number of studies into four major areas: (1) history
of the learner, (2) events occurring just prior to reading,
(3) conditions present during involvement in reading, and
(4) events following reading. The goal of the events and
conditions investigated in these studies was to facilitate
mediational behavior on the part of the student resulting
in real learning. Pothkopf (24) has coined the descriptor
"mathemagenic behavior" to describe student behaviors which
give birth to learning. During the past thirty years, he says, educational researchers have treated learning as if it were passive, the result of bombardment from outside forces such as the teacher and the environment; but, in the final analysis, learning is determined by what the student does, by his mathemagenic behavior. To encourage this behavior the teacher can arrange for "effective stimuli," results of which are inferred indirectly, rather than "nominal stimuli," which are indicated by learner performance measured by product. Effective stimuli might cause anticipation rehearsal, a mathemagenic response to test-like events. Students can learn from badly prepared material, contends Rothkopf, if the to-be-learned information merely appears in the contents and if the student works with the material until he learns it. The teacher needs, first, to discover ways to encourage the student to work, and second, to teach the student practical approaches for gaining information from prose. Rothkopf writes, "This is the problem of the environmental control of mathemagenic behavior" (p. 216).

Mathemagenic behaviors may result from various stimuli. Means and Means (19) reported better performance for students with low grade point averages who had received positive information about themselves, while students with high grade point averages who had received negative information about themselves compensated by using mathemagenic behavior to produce higher performance. According to Frase, this behavior can be produced by giving directions, providing incentive
(which in some studies has been money), and teaching students the characteristics of text material. Cobb (8) reports that fourth grade students who were observed attending to task and talking to peers about academic material scored higher in achievement. Evidently mathemagenic behavior had produced clarification, schema work, or insights during the period of observed behaviors.

Learning to read is a result of mathemagenic behavior. Some studies indicate a close relationship between reading achievement, i.e., linguistic competence, and comprehension. Golinkoff (16) reviews research on the characteristics and strategies of "good and poor comprehenders." She described poor comprehenders as having weak decoding skills; fifty-one per cent of the substitution errors they made in oral reading changed the meanings of the passages. They possessed semantic skill similar to good comprehenders in dealing with single printed words, but they lacked skills for text organization, i.e., for handling larger units than single words, as they read passages. They had shorter eye-voice span in oral reading, during which they typically read word-by-word. They failed to use context clues and were unsuccessful with cloze tasks, indicating a lack of linguistic competence, a naivete regarding language patterning.

Good comprehenders, on the other hand, used the largest unit possible to gain meaning while reading and imposed structural organization on incoming text, perhaps seeking schema-fit. They were adaptable and flexible and seemed aware of what good
comprehension is. They read to gain information and evidently sensed their successful accomplishment.

In the studies in this review, the authors were concerned with the nature of linguistic competence. They discussed aspects of comprehension, such as skill with language usage and syntactic patterns, as well as perception, information-processing, and memory building. The term "linguistic competence" implies comprehension and the various factors which are involved in the acquisition of comprehension. Therefore, a reading achievement test which measures comprehension would appear to be measuring linguistic competence with printed material.

Achievement versus Intelligence

Some theorists state that achievement is not a distinct concept but it is interwoven with intelligence. Wesman (32) claims that "all ability tests--intelligence, aptitude, and achievement--measure what the individual has learned--and they often measure with similar content and similar process" (p. 206). We can justify labeling these tests differently, he says, only because of our purposes in giving the tests. However, Farr (11) believes that there is insufficient evidence that reading tests and intelligence tests measure the same skills. Tanyzer's 1962 study reported that retarded readers who had made gains in reading did not show score gains on an individual intelligence test (28). Intelligence tests, says Farr, can be useful
in measuring reading achievement and predicting success, but other factors such as language development, self-concept, experiences, and opportunity to learn also play an important part in reading achievement. However, he states, "This is not to say that intelligence does not underlie language development or initial reading skill development" (p. 179).

Cattell (7) claims that there are two kinds of intelligence. One type which he calls "fluid" intelligence is not related to memory of cultural experiences, but involves judgment and reasoning and may be high even in illiterate persons. The other type, "crystallized" intelligence, describes skills acquired by cultural experiences, such as vocabulary, numerical skills, mechanized knowledge, a well-stocked memory, and some habits of logical reasoning, such as dealing with analogies. He says that the age curves for the two are different after about age fourteen, when fluid intelligence levels off and begins a decline after age twenty-two, while crystallized intelligence increases to sixteen and beyond and holds constant into later years. He suggests that to predict future academic achievement, one should not use intelligence as an indicator but this year's grades, which reflect not only intelligence but also personality, motivation, and other factors.

These studies give support to the decision to measure linguistic competence, not with an intelligence test, but with a test of skills acquired for dealing with language in print.
Memory

This investigation is concerned with the relationship between linguistic competence and the recall of prose. Therefore, an understanding of memory, retention, and retrieval is necessary.

Frase (12) describes two types of memory. Reproductive memory is simply recalling, but productive memory involves performing logical operations.

Tulving (30) uses another pair of descriptors of memory. He divides memory into "episodic" and "semantic" areas. Semantic memory is cognitive; it deals with the use of language and contains such information as the formula for salt, June's following July in occurrence but March alphabetically, and the fact that table and chair are more closely associated than table and nose. These are "linguistic translations of information...about general concepts and their interrelations" (p. 387). Episodic memory, on the other hand, is autobiographical; it receives and stores information about events or episodes in terms of its prior contents and contains such information as having seen a flash of light or having met a person or having kept an appointment. To retrieve from episodic memory, the information only need be stored. This memory does not infer or generalize; and if forgetting occurs, it is probably caused by transformation of information due to interference with temporal coding. The encoded information which is in semantic memory comes from perception and thought and becomes part of cognitive structure, a "rich multidimensional" (p. 391) network, which
protects it from interference. To retrieve from semantic memory a person infers, reasons, applies rules, and generalizes, thus enabling him to retrieve knowledge which he has not learned directly.

Other frameworks for memory, the associationistic and organizational views, have been theorized by psychologists. Postman (22) describes the organizational view that information-processing involves such acts as grouping by semantic characteristics and serial order of presentation. The organizational view points to Gestalt influences: that mnemonic organization is established by initial perception of the event; that organization is determined by "relations among the component units, such as proximity and similarity" (p. 5); that recall depends on "the temporal stability of the memory traces laid down by these experiences," the "continuing cohesiveness"; and that recall is affected by similarity of traces to current stimuli. Postman concludes that, in organizational theory, one thinks of higher order units and chunks, and, in associationistic theory, one thinks of associative chains and networks.

Wood (33) notes that free recall studies support the view of organization of memory, but, he says, "Evidence can also be interpreted within an associationistic framework" (p. 86). Bower (4) also writes that there is "not much substantive conflict" (p. 109) between organizational and associationistic views. A cue such as "recall list one" is the entry point. New information is stored by what is already known. To recall, the subject chains and uses a retrieval plan--generative rules,
a pegword system, or an hierarchical or associative plan. Both Wood and Bower agree with Postman that there are not major differences between associationistic and organizational positions.

Another view of the nature of memory has been hypothesized by Simon (27) in his studies of the storage of information in short-term and long-term memory. In short-term memory there is rapid access but limited capacity, and interference causes forgetting. Long-term memory, which requires longer processing into a semantic net after recognition of familiar patterns, has a large capacity and can retain information even during intervention. Kintsch (17) writes about the differences between storage and retrieval phases of learning, and suggests the occurrence, during these steps, of (1) initial recording of experiences, and (2) organization of experiences into memory nets (p. 94).

The studies of Simon are particularly interesting because of his concepts of short-term and long-term memory, which support the focus of this study on immediate, delayed, and practiced recall.

Recall/Recognition

Once information has been stored in memory, it can be retrieved either by recall or recognition. In free recall, subjects are required to recall without cues, while in recognition, subjects may choose from a list or by multiple choice the information to be recalled. Paivio (20) found small and
generally nonsignificant differences between the two methods. Tulving (29) also feels that recall and recognition are essentially the same. However, Warrington (31) asserts that recall depends on the "differential strength of items in memory" while recognition depends on "associative retrieval mechanisms" (p. 228).

Several different measures of memory have been suggested by psychologists. Warrington (31) studied four methods of retrieval: free recall, yes/no recognition, cueing with initial letters, and cueing with fragmented forms of words. Brown (6) had subjects choose from a list the items that appeared in a test passage. Dawes (10) measured recognition and recall by a theory of set relations based on identity, exclusion, inclusion, and disjunction. Frase's (13) method consisted of networks of directed graphs.

In this study, it is proposed that free recall will be the most appropriate method for measuring memory because recognition lists and multiple choice tests provide clues for recall. Free recall would seem to be a truer measure of memory.

Representation of Prose

Researchers have sought to formulate linguistic descriptions of prose in various ways. In the past, says Schank (26), researchers spoke of language processing as merely parsing (assigning a syntactic structure) or generating (constructing syntax trees using structural rules and substituting words at terminal nodes). During the 1970s, however, emphasis focused
on representing the semantic structure. Rower (4) believes that information is stored in the mind as propositions, perhaps only as relationships among familiar concepts. In W. Kintsch's system of propositional representation (18), a proposition consists of one relation, or "predicator," and one or more "arguments." The predicator may be a verb, adjective, or conjunction; and arguments may be nouns or other propositions. A proposition corresponds to a simple sentence.

Kintsch theorizes that meaning can be represented by a list of propositions called "text base." These "n-tuples" of word concepts are formed according to rules in semantic memory. The same meaning may be expressed equally well by several paraphrases, says Kintsch (p. 91). "Text bases are conceptual, not linguistic, structures" (p. 104). While function words appear in surface structure, content words are in base structure. Kintsch suggests that thinking may represent "operations at the level of the semantic base structure before it has been transformed into actual sentences through the application of syntactic rules" (p. 253). Kintsch's method of propositional representation was appropriate for the present study because of its straightforwardness and because of the availability of thorough explication.

In order to evaluate recall protocols, Crothers (9) offers a four-stage plan: (1) Formulate a linguistic description of the structure of the prose passage. (2) Compare subjects' recall protocols to this description. (3) Find relationships
between the criterion and the subject protocols. (4) Develop a process model to describe the linguistic and temporal aspects of memory of the prose text. Rickards (23) used a similar method, and for a criterion measure he reduced each text sentence to a minimum number of words.

The methods of Crothers and Rickards were adapted for the present study. Propositional representation of a passage was prepared for use as a criterion. Subjects' recall protocols were compared to the criterion. The examiner judged the acceptability of propositions found in these protocols so that analyses could be conducted.

The review of literature related to this study was directed to concepts of linguistic competence, the relationship between reading achievement and intelligence, the nature of memory and recall, and the measurement of prose discourse.
CHAPTER BIBLIOGRAPHY


CHAPTER III

METHODS AND PROCEDURES

This chapter presents explanations and descriptions of (1) a pilot study to determine recall procedures, (2) the research design, (3) the subjects, (4) the materials, and (5) the procedure.

The Pilot Study

A pilot study (1) was conducted to determine whether there would be a significant difference between the oral and written recall of high and low achievers.

Two test passages were prepared (Appendix A). The readability of these passages was 3.1 and 3.3 as measured by the Spache Readability Formula (7). This high readability was desired so that comprehension would be easily accessible to both high and low achievers and thereby would not confound the memory results which were being studied. Also propositional representation of each passage (Appendix B) was prepared according to Kintsch (6) to use in evaluating subject protocols. The validity of the propositional representations was verified by Kintsch (5).

Sixteen eighth grade subjects were chosen for this study. Eight of these subjects were designated high reading achievers because they scored in the top two stanines of the Stanford
Diagnostic Reading Test's measure of total comprehension, and eight were designated low reading achievers because they scored in the lower two stanines (4). Subjects were assigned to read the two passages in a counterbalanced order, to recall one passage in writing, and to recall the other on a tape recorder. Subjects' free recall was evaluated by checking protocols against the lists of the propositional representations.

Analysis by t-test showed that there were no significant differences between written and oral free recall for either the high or low group. For nine of the sixteen subjects, six high and three low achievers, taped protocols resulted in slightly greater percentages of criterion propositions. For the other seven subjects, written protocols contained the greater percentages of propositions.

While it might be hypothesized that low achieving readers would be penalized by being required to write protocols, results of the pilot study did not support this expectation. It appears that, in the measurement of comprehension by free recall, expressive linguistic skills, whether oral or written, are comparable, unless use of the tape recorder itself produced a singular effect which would not be present in direct oral recall to another person. It was assumed, however, that the widespread familiarity with tape recorders in the population of this study would preclude such an effect. Tape recorders are used throughout the school district and are available in the homes of many of the students as well.
In a similar study, comparing oral and written recall, Harker (3) found that oral protocols were longer, but that they did not contain more text information. Their greater length was due to additions and errors.

In addition to the pilot study described above, to insure that the passage would be easily comprehended, the lowest reading achievers were asked to read orally to the examiner a passage of equal difficulty, according to the Spache Readability Formula (7), and to recall immediately what they could remember. The oral fluency and the recall of the selection were judged to be sufficient for ease of comprehension of the test passage of the present study.

The Research Design

High and low reading achievers were asked either to recall immediately following reading the test passage, to delay recalling until one week after reading the passage, or to recall immediately following reading the test passage and again one week after reading to assess effects of practice. The design of the experiment, then, was a 2 (high reading achievers and low reading achievers) x 3 (immediate recall, delayed recall, and practiced recall) factorial design. A graphic representation of this design is shown in Figure 1 below. The variables were analyzed using the analysis of variance technique.
Fig. 1--A 2 x 3 analysis of variance was used to analyze recall protocols of high and low reading achievers.

The Subjects

The subjects who participated in this study attended a public junior high school in a suburb of 36,000 residents. The town is situated within a large metrop lex area in southwestern United States. The school district's enrollment was 15,997 students: 15,226 Caucasian, 55 American Indian, 151 Asian/Pacific Islander, 139 black, and 426 Hispanic.

The subjects of this study were one hundred twenty-three seventh grade students selected from developmental reading classes at one of the five junior high schools of the district.

Students who scored in the first, second, or third stanine in both literal and inferential comprehension on the Stanford Diagnostic Reading Test: Level II (4) were classified as low achievers. The fifty-four subjects in this group were randomly assigned for recall treatments. Fifteen were assigned to treatment one, immediate recall after reading; twenty-four were assigned to treatment two, delayed recall after reading; and fifteen were assigned to treatment three, practiced recall.
Those students who scored in the seventh, eighth, or ninth stanine in both literal and inferential comprehension on the test were classified as high achievers. The sixty-nine subjects in this group were randomly assigned for recall treatments. Eighteen were assigned to treatment one, immediate recall after reading; thirty-two were assigned to treatment two, delayed recall after reading; and nineteen were assigned to treatment three, practiced recall.

It was assumed that a second analysis of the data with more stringent requirements for group membership would be informative even though this would restrict the number of subjects available for the analysis. Therefore, for the second analysis the requirement was made that low achievers would have scored in the first three stanines in vocabulary as well as in both literal and inferential comprehension. Protocols had been written by nine of these subjects in immediate recall, fifteen of the subjects in delayed recall, and ten subjects in practiced recall. For the second analysis the requirement was made that high achievers would have scored in the top three stanines in vocabulary as well as in both literal and inferential comprehension. Protocols had been written by four of these subjects in immediate recall, eight of the subjects in delayed recall, and four of the subjects in practiced recall.

The Materials

The reading achievement measure. While no report was found suggesting a measurement of "linguistic competence,"
it was discovered that "reading achievement" is most often measured by standardized reading tests. The Stanford Diagnostic Reading Test: Level II (4) was judged to be the best indicator of linguistic competence with printed material. This judgment was based on the test's measurement of two aspects of comprehension: literal understanding and, beyond that, inferential understanding. Other bases for this judgment were the length of the comprehension subtest (sixty items) and the fact that this is primarily a test of power, although speed is considered. The suggested time of thirty minutes has proved to be ample for most students. In addition, this researcher judged that the vocabulary subtest would be another measure which would be an indicator of linguistic skills.

Reliability and validity of the test were judged to be high by examination of the test's manual. Reliability coefficients for seventh grade are .92 for the total comprehension subtest and .87 for the vocabulary subtest (4). Buros reports that the full test split-half reliability is .90 for seventh grade (2).

The test passage.--The informational passage for this experiment was chosen for its short length (178 words) and high readability (3.1 by the Spache Readability Formula (7)) from Be a Better Reader, C, Basic Skills Edition by Mila Banton Smith (8). It is entitled "Knives, Forks, and Spoons." The test passage (Appendix A) includes the first three paragraphs of the selection with minor changes.
The recall criterion.--A list of propositions was prepared from the test passage in accordance with the theory of Kintsch (6). A copy of the list, which was approved by Kintsch is Appendix B. This list of propositions was used as a criterion against which to score the subjects' recall protocols. This procedure was used to obtain an objective scoring system. Subjects' protocols were assessed for subjects' ability to reproduce only the literal meaning of the passage. Any inferences, intrusions, and distortions made by the subjects were ignored in scoring.

Kintsch's procedure for propositional representation was chosen over others because of explanations and examples found in the survey of related literature. These explanations gave the researcher confidence in possessing the ability to use the procedure correctly. The researcher also judged that Kintsch's method was best suited for measuring free recall of the text base of the test passage because of its simplicity and adaptability.

Instructions to the subjects.--Instructions (Appendix C) were read to each group to provide for standardization of treatment and to control for effects which might be induced by providing superordinate statements or by establishing purposes, goals, or objectives.

The Procedure

Literal and inferential comprehension scores were used to assign subjects to high and low achiever groups. For these
two groups, answer sheets used in administering the test were
shuffled and then grouped for treatments, assigning the sub-
ject of the first answer sheet for treatment one, the subject
of the second sheet for treatment two, etc.

On the day for treatment one, instructions (Appendix C)
were read to all students in their reading classes. Treatment
two subjects, as they finished reading the test passage, were
given a sheet of paper with interference instructions, "DO
NOT write about 'Knives, Forks, and Spoons' this time. Write
about your favorite food, TV show, or what you did last week-
end."

A week later, all students were asked to write what they
could remember about the selection. The protocols were then
sorted into treatment group assignments and scored against
the criterion (Appendix B).

Scores were number of acceptable propositions found in
subject protocols. This data were analyzed by an analysis of
variance procedure: 2 (high and low reading achievers) x 3
(immediate, delayed, and practiced recall).


CHAPTER IV

DISCUSSION OF THE RESULTS

In this chapter, discussion will focus on the results of the analyses of variance for both groups: (1) the high and low reading achievers defined by scores in literal and inferential comprehension and (2) the select high and low reading achievers defined by scores in vocabulary as well as in literal and inferential comprehension.

Results of the Analyses

Hypothesis 1.—High reading achievers will significantly outperform low reading achievers in free recall whether it is immediate, delayed, or practiced.

This hypothesis is supported by analysis of the recall scores of high and low reading achievers. For immediate recall, the mean number of propositions recalled by high achievers was 20.3, with a standard deviation of 6.7. The mean number of propositions recalled by low achievers was 14.1, with a standard deviation of 4.5.

For delayed recall, the mean number of propositions recalled by high achievers was 9.4, with a standard deviation of 4.5. The mean number of propositions recalled by low achievers was 4.6, with a standard deviation of 3.8.

For practiced recall, the mean number of propositions recalled by high achievers was 15.6, with a standard deviation
of 8.0. The mean number of propositions recalled by low achievers was 9.1, with a standard deviation of 5.5.

The means and standard deviations of this analysis of high and low reading achievers in free recall of a test passage are shown in Table I.

**TABLE I**

MEANS AND STANDARD DEVIATIONS OF HIGH AND LOW READING ACHIEVERS IN FREE RECALL OF A TEST PASSAGE, ANALYSIS ONE

<table>
<thead>
<tr>
<th>Recall Treatment</th>
<th>Immediate</th>
<th>Delayed</th>
<th>Practiced</th>
</tr>
</thead>
<tbody>
<tr>
<td>High achievers</td>
<td>X</td>
<td>S.D.</td>
<td>n=</td>
</tr>
<tr>
<td></td>
<td>20.3</td>
<td>6.7</td>
<td>18</td>
</tr>
<tr>
<td>Low achievers</td>
<td>14.1</td>
<td>4.5</td>
<td>15</td>
</tr>
</tbody>
</table>

The results of the analysis of variance show that the difference between high and low achievers in immediate, delayed, and practiced recall was significant, $F (1, 117) = 31.9, p < .0001$. No interaction was found, as shown in Table II.

**TABLE II**

ANALYSIS OF VARIANCE, DATA SET ONE (METHOD OF UNWEIGHTED MEANS)

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>Deg. Fr.</th>
<th>Mean Squares</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement</td>
<td>979.1077</td>
<td>1</td>
<td>979.1077</td>
<td>31.9058</td>
<td>0.0000</td>
</tr>
<tr>
<td>Treatment</td>
<td>1993.4450</td>
<td>2</td>
<td>996.7225</td>
<td>32.4798</td>
<td>0.0000</td>
</tr>
<tr>
<td>Interaction</td>
<td>16.9429</td>
<td>2</td>
<td>8.4714</td>
<td>0.1761</td>
<td>0.7593</td>
</tr>
<tr>
<td>Within</td>
<td>3590.4315</td>
<td>117</td>
<td>30.6876</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In a second analysis of more stringently selected high and low subjects, high reading achievers again outperformed low reading achievers in recall of the test passage in all recall treatments. For immediate recall, the mean number of propositions recalled by select high achievers was 32.0, with a standard deviation of 2.5. The mean number of propositions recalled by select low achievers was 12.4, with a standard deviation of 4.6.

For delayed recall, the mean number of propositions recalled by select high achievers was 9.0, with a standard deviation of 4.6. The mean number of propositions recalled by select low achievers was 4.7, with a standard deviation of 3.5.

For practiced recall, the mean number of propositions recalled by select high achievers was 18.8, with a standard deviation of 4.0. The mean number of propositions recalled by select low achievers was 8.1, with a standard deviation of 4.4.

Results of the second analysis are shown in Table III. The means and standard deviations in this table represent the

<table>
<thead>
<tr>
<th>Recall Treatment</th>
<th>Immediate</th>
<th></th>
<th>Delayed</th>
<th></th>
<th>Practiced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>X</td>
<td>S.D.</td>
<td>n=</td>
<td>X</td>
<td>S.D.</td>
</tr>
<tr>
<td>High achievers</td>
<td>32.0</td>
<td>2.5</td>
<td>4</td>
<td>9.0</td>
<td>4.6</td>
</tr>
<tr>
<td>Low achievers</td>
<td>12.4</td>
<td>4.6</td>
<td>9</td>
<td>4.7</td>
<td>3.5</td>
</tr>
</tbody>
</table>
scores of the stringently selected high and low reading achievers.

In this analysis of the recall protocols of more select high and low reading achievers, the difference between select high achievers and select low achievers was, as in the first

**TABLE IV**

**ANALYSIS OF VARIANCE, DATA SET TWO**

METHOD OF UNWEIGHTED MEANS

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>Deg. Fr.</th>
<th>Mean Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement</td>
<td>1321.4048</td>
<td>1</td>
<td>1321.4048</td>
<td>79.5150</td>
<td>0.0000</td>
</tr>
<tr>
<td>Treatment</td>
<td>1584.7050</td>
<td>2</td>
<td>792.3525</td>
<td>47.6795</td>
<td>0.0000</td>
</tr>
<tr>
<td>Interaction</td>
<td>388.7172</td>
<td>2</td>
<td>194.3586</td>
<td>11.6955</td>
<td>0.0000</td>
</tr>
<tr>
<td>Within</td>
<td>731.2056</td>
<td>44</td>
<td>16.6183</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

analysis, significant, F (1, 44) = 79.5, p < .0001, as shown in Table IV. In overall recall performance, select high reading achievers scored significantly higher than select low reading achievers. However, in the second analysis, a significant interaction was found. The Scheffé multiple comparison procedure was used to test for the interaction. Results of this procedure showed that the delayed recall of select high achievers was not significantly higher than the delayed recall of select low achievers. In addition, results of the Scheffé procedure showed that the practiced recall of select low achievers was not significantly greater than their delayed recall. In all other expected comparisons between the select high and low
achievers in each of the recall treatments (immediate, delayed, and practiced), differences were significant, $F (5, 44) = 2.45, p < .05$. Select high achievers scored higher in immediate and practiced recall, but in delayed recall even lower than the high achievers in analysis one. Select low achievers, while scoring lower than the low achievers in analysis one in immediate and practiced recall, scored higher in delayed recall, thus appearing to have gained less from practice. Select high achievers outperformed select low achievers in all treatments.

**Hypothesis 2.**—In either group, practiced recall will be significantly superior to delayed recall.

Results of analysis one showed that for both high and low reading achievers, practiced recall was significantly superior to delayed recall. High achievers recalled a mean of 15.6 propositions in practiced recall and a mean of only 9.4 propositions in delayed recall. Standard deviations were 8.0 and 4.5, respectively.

Low achievers recalled a mean of 9.1 propositions in practiced recall and a mean of only 4.6 propositions in delayed recall. Standard deviations were 5.5 and 3.8, respectively.

Practiced recall was significantly greater than delayed recall for both high and low reading achievers, $F (2, 117) = 32.5 p < .0001$.

Results of the second analysis of the recall protocols of more stringently selected high and low reading achievers
supported the second hypothesis, that practiced recall would be superior to delayed recall. Select high achievers recalled a mean of 18.8 propositions in practiced recall and a mean of only 9.0 propositions in delayed recall. Standard deviations were 4.0 and 4.6, respectively.

Select low achievers recalled a mean of 8.1 propositions in practiced recall and a mean of only 4.7 propositions in delayed recall. Standard deviations were 4.4 and 3.5, respectively.

Practiced recall was significantly greater than delayed recall for the select group of high achievers, \( F(2, 44) = 47.7, p < .0001 \). Practiced recall for select low achievers was greater, but not significantly greater, than their delayed recall, as shown by the Scheffe analysis discussed above.

**Hypothesis 3.** In either group, immediate recall will be significantly superior to practiced recall.

Both analysis one of high and low reading achievers and analysis two of select high and low reading achievers support this hypothesis. The first analysis showed that high achievers recalled a mean of 20.3 propositions in immediate recall, but a mean of only 15.6 propositions in practiced recall. Standard deviations were 6.7 and 8.0, respectively.

Low achievers recalled a mean of 14.1 propositions in immediate recall, but a mean of only 9.1 propositions in practiced recall. Standard deviations were 4.5 and 5.5, respectively.
Immediate recall was significantly greater than practiced recall for both high and low achievers, $t(2, 117) = 32.5, p < .0001$.

Results of the second analysis of recall by more stringently selected high and low reading achievers showed that in immediate recall select high achievers recalled a mean of 32.0 propositions, but in practiced recall a mean of only 18.8 propositions. Standard deviations were 2.5 and 4.0, respectively.

Select low achievers recalled a mean of 12.4 propositions in immediate recall, but a mean of only 9.1 propositions in practiced recall. Standard deviations were 4.6 and 4.4, respectively.

In the second analysis of the recall protocols of more stringently selected high and low reading achievers, immediate recall was significantly greater than practiced recall for both high and low achievers, $F(2, 44) = 47.7, p < .0001$.

Similar results were obtained from both analyses, one with a larger number of subjects and one with fewer, but more stringently selected, subjects. A graphic description of the results of the two analyses is shown in Figure 2 below. The results of both analyses indicated that high achievers outperformed low achievers in free recall whether the time of recall was immediately following reading, following intervening events, or practiced by immediately recalling and then recalling again after intervening events. Further, for both high and low reading achievers, greatest recall was performed immediately
Fig. 2--Number of propositions recalled by high and low reading achievers in immediate, delayed, and practiced recall.

Following reading and poorest recall was performed after intervening events when there had been no practice. For both high and low reading achievers, recall practice immediately after reading appeared to be effective for improving retention. For both high and low achievers, the absence of immediate practice appeared to produce forgetting of a significant nature.

The small cell size of the second analysis of more stringently selected subjects necessitates extreme caution in the interpretation of results. It may be that the small cells contained exceptional scorers, and this may account for the extremely high recall of the select high achieving group in immediate and practiced treatments. Exceptional scorers in the small cells might also account for the extremely low
recall performance of select high achievers in the delayed
treatment. In spite of the extremely high scores of the
select high achievers in immediate and practiced recall, find-
ings of the two analyses were similar. The high reading achiev-
ers of both analyses scored higher than the low achievers in
all recall treatments. Further, for both high and low achiev-
ers, immediate recall was greatest and delayed recall was
smallest. For both high and low achievers, practice appeared
to have improved retention.

In other studies of high and low groups, support is found
for the apparently different retention patterns of the two
analyses of the present study, one of high and low achievers
and one of more stringently selected high and low achievers.

The results of the first analysis, that high achievers
significantly outperformed low achievers in all recall treat-
ments, are similar to those of Shuell and Keppel (5). When
immediate recall scores were taken into account, percentage of
retention was comparable in delayed and practiced recall, i.e.,
the difference between high and low achievers appeared to be
mainly in acquisition rather than in retention. However, when
results of the second analysis were considered, agreement was
indicated with the hypothesis of Tuyet, et al (4), that there
appear to be differences in underlying memory structures
between high and low achievers. The interaction effect seen
in the unexpected low scores of select high achievers in
delayed recall indicates the presence of a condition not seen
in the delayed recall scores of either high, low, or select low achievers. The difference in memory structure which Royer hypothesized, however, was that high ability students would be significantly superior in retention because of prior knowledge. He did not find high ability students to be inferior in delayed recall.

When studying effects of advance organizers and level of question on retention of high and low I.Q. subjects, Allen (1) found that there were differences for both groups which were attributable to specific questions, but that advance organizers resulted in facilitation of learning for high ability subjects only, not those of lesser ability. The second analysis of this study indicated similarly that lowest achievers benefited less from practice than either highest, high, or low achievers.

In a study of the retention effects of readability level, inserted question difficulty, and individual differences, Hiller (2) reported, "Nonsignificant but consistent patterns suggested that low aptitude students performed best under idiosyncratic directions, while high aptitude students performed best under passive reading" (p. 207). The idiosyncratic directions were to "study just as you do typically. If you like to underline, or pen notes in the margins, or just read straight, then do so now." In Hiller's study, he suggests differences in successful acquisition methods between high and low ability students.

Royer, mentioned above, hypothesized differences in memory structure.
In a study of "Achievement as a Function of the Presence of Prior Information Concerning Aptitude," Means and Means (3) reported different responses of high and low achievers. When low achievers expected failure, their performance was less; but when high achievers expected failure, their performance was greater.

The studies mentioned above suggest possible extent or direction of individual ability differences, at least in the areas of acquisition (Shuell and Keppel, and Hiller), (2) response to facilitating events (Allen), (3) response to expectations (Means and Means), and (4) memory structure (Poyer, et al). The second analysis of the present study also suggests possible differences in memory patterns, but the small cell sizes caution thoughtful interpretation. The first analysis suggests, with Shuell and Keppel, that differences between high and low achievers may be in areas other than long-term memory.


CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The discussion of this chapter is directed to (1) a summary of the study, (2) the findings of the statistical analysis, (3) conclusions drawn from the study, and (4) recommendations suggested as a result of the study.

Summary of the Study

This investigation was concerned with an assessment of the possible relationship between memory and linguistic competence with printed material.

The measurement of memory was by written, rather than oral, free recall. It had been determined in a pilot study of recall procedures that there were no significant differences between the taped and written recall performances of either high or low reading achievers.

A review of the related literature indicated that the degree of linguistic competence with printed material could be determined through reading achievement test scores in comprehension, both literal and inferential. In a second analysis of the data, vocabulary scores were included in the definition to increase its stringency.

Recall of the subjects was tested in three memory treatments: immediately following the reading of a passage of
high readability, delayed until after the occurrence of intervening events, and practiced, i.e., both immediately following reading and after intervening events.

In order to obtain an objective measure of the subjects' recall protocols, a criterion was prepared by representing the text base of the passage in a propositional listing. The data for the analyses were numbers of acceptable propositions found in the recall protocols which the subjects had written.

A 2 (high and low reading achievers) x 3 (immediate, delayed, and practiced recall) analysis of variance was used to analyze the scores, first of subjects who had scored in the upper three stanines or the lower three stanines, respectively, in both literal and inferential comprehension. Then a second analysis was made of the protocols of only the highest achievers (those who scored in the upper three stanines on the vocabulary test as well as the two comprehension measures) and the lowest achievers (those who scored in the lower three stanines on the vocabulary test as well as the two comprehension measures).

The researcher judged that this second analysis would be valuable in spite of the much smaller cell numbers because the subjects were more stringently chosen. By adding the requirement of extreme vocabulary scores, another aspect of linguistic competence was recognized.

The second analysis was, like the first, a 2 (high and low reading achievers) x 3 (immediate, delayed, and practiced recall) analysis of variance.
Findings

1. High reading achievers in both analyses significantly outperformed low reading achievers in overall recall; however, in delayed recall, select high achievers were higher, but not significantly higher, than select low achievers.

2. Practiced recall for both high and low reading achievers was significantly superior to delayed recall in the first analysis. However, in the analysis of the select groups practiced recall was significantly superior to delayed recall only for the select high achievers. For the select low achievers, practiced recall was higher, but not significantly higher, than delayed recall.

3. Immediate recall was significantly higher than practiced, and therefore delayed, recall for all readers, high, low, select high, and select low.

Conclusions

1. Results of this investigation indicate an effect between memory and linguistic competence. In many studies, researchers have been concerned with differences in ability and achievement levels of learners. In their investigations, these researchers have addressed the effects of different variables on high and low groups. Bloom (1) argues, however, that mastery learning, which provides extra time and support for students encountering difficulty, will equalize learning for most students. This researcher theorized, therefore, that retention of easy material might be similar for high and low
achieving readers, and that factors other than memory might be responsible for the differences in achievement. However, memory expressed by free recall in immediate, delayed, and practiced temporal arrangements appears in this study to be related to reading achievement. In effect, then, appears to exist between memory and linguistic competence.

2. A further conclusion based on data in this study is that intervening events are damaging to the recall of all achievers. For most of the subjects of both analyses, recall after intervening events was only about one-third that of immediate recall. The practice of immediate recall appears to have been most effective for low achieving readers and also for select high achieving readers. Moderately low and select high achievers doubled their delayed recall scores in the practiced recall treatment. Results of this study indicate that both select high and moderately low reading achievers have much to gain from immediate practice and also much to lose from neglect of practice.

3. Similar memory patterns for high and low achievers seem to diverge as achievement levels approach extremes. The greater the difference in reading achievement, it appears that the difference in memory for immediate and practiced recall is greater. Select high achievers, in the second analysis, recalled 2.6 times the number of propositions that select low achievers did in immediate recall. However, in the first analysis of moderately high and low achievers, the high achievers recalled only 1.4 times more propositions than low achievers. Similarly
in the second analysis, in practiced recall, select high achievers recalled 2.3 times more propositions than select low achievers. In the first analysis, however, moderately high achievers recalled only 1.7 times more propositions than did moderately low achievers. In contrast, in delayed recall the subjects of analysis one and analysis two scored similarly, with both moderately and select high achievers recalling less than twice as many propositions as both moderately and select low achievers. It appears that students across achievement levels are similar in delayed recall performance, and that differences are more apparent in immediate and practiced recall situations.

4. If results of the second analysis are spurious because of unusual membership in the small cells and if the first analysis presents a truer description of the differences between high and low reading achievers, it may be concluded that the real difference is in acquisition of information, as suggested in Kurth's (2) study of information-processing strategies of good and poor comprehenders, rather than in memory itself.

Another explanation of the difference between high and low achievers in immediate recall is suggested by Shuell and Keppel (3). They found that, when high and low ability subjects were equated for degree of original learning, long-term retention was comparable. In the report of their study, the distinction is made between short-term memory and long-term memory, and they speculate that there may be individual differences in short-term memory but not in long-term memory.
Shuell and Kempel write, "It is possible that these differences could exist in the capacity of STM [short-term memory], the ability to transfer information from STM to LTM [long-term memory], differential susceptibility to interference, . . . , or differing degrees of learning" (p. 64).

Another explanation of the difference between high and low achievers in any study of retention might come simply from the procedure of using written free recall. Slater and Palmer (4), in questioning the use of written recall as the only measure of comprehension, comment, "Written recall protocols may reflect as much about how much students care to write as about how much they remember." The difference could be in how high and low achievers feel about writing, although the pilot study for this paper indicated that this should not be the case.

Finally, a lack of motivation to perform may be felt by low achievers as a result of a lack of success experiences. Low scores could reflect this feeling rather than inferior retention or problems with the written recall procedure.

5. If the second analysis presents a truer picture of the memory pattern of high achievers, then it appears that higher achievers may habitually practice or rehearse in some way after reading, which produces higher long-term retention. When these readers were experimentally denied practice, their retention was very low. Further, if the second analysis is a truer picture of low achieving readers, then very low achievers appear not to gain as much from practice as other students, although gains were produced. Directed practice rather than
free recall might lead to greater gains in memory for very low achievers. Again, however, caution is urged in the interpretation of the results of analysis two because of the small cell sizes.

Recommendations

1. The primary recommendation, based on the conclusions above, is that some type of practice be arranged immediately after reading when the greatest memory gains are sought. For most reading done in the content areas of secondary schools, high retention is desired. Simple free recall might serve as one type of practice, as well as traditional types of review, such as taking comprehension tests or answering questions at the ends of chapters. Even for pleasure reading, linguistic competence might be enhanced by simply recalling events in, or impressions experienced by reading, a selection.

2. Further study is recommended with stringent selection of high and low groups of subjects. The interaction in the second analysis suggests that there may be real differences in memory patterns. It was expected that select high achievers would score higher than moderate high achievers in all recall treatments; however, the low scores of select high achievers in delayed recall suggest that lack of immediate practice may result in a higher rate of forgetting for very high reading achievers than for other readers. Furthermore, in the second analysis select low reading achievers appeared to gain less from practice than other readers.
If this is so, then low achievers may be hampered by deficiencies in both short-term and long-term memory.

Studies of the different characteristics of memory in low and high reading achievers may give insights for effecting maximum gains for both levels.

3. Study is also recommended concerning the relationship between memory and verbal linguistic competence. Observers of student behavior will note that some low scholastic achievers appear to be skillful in verbal discourse. A major problem of a study of this type would seem to be the measurement of verbal linguistic competence. Taped recall protocols could be evaluated by a method similar to the procedure used in this study, i.e., comparison to a criterion, which could be the propositional representation of a story which was told. If this format were used, it would have to be determined if linguistic competence could be described by listening scores or if some other description would be more appropriate.

4. In addition to the above recommendation for a study of the relationship between verbal linguistic competence and memory, it is recommended that investigation be made of the relationship between verbal linguistic competence and linguistic competence with prose. Is there a significant difference between the two skills in a population or does the difference occur only in an occasional individual student? This type of study might provide insights which would help the verbally competent student use his linguistic skills to greater
advantage when dealing with printed material in the academic setting.

5. A recommendation which has resulted from the procedures of this study is the use of propositional representation as an objective measure of free recall. While this method practice, skill can be increased and confidence gained in evaluating subjects' protocols. Further, confidence in securing an honest measure is increased with the freedom of concern about guessing among choices and clues given by traditional evaluation techniques, such as true-false and multiple choice tests. Literal recall is, of course, more easily evaluated by propositional representation, but inference can be accommodated. Evaluators may be disinclined to prepare criterion lists of propositions for all tests of comprehension, but may see the value of this method for periodic estimates of progress.


APPENDIX A

Test Passages
Knives, Forks, and Spoons

In early times, people used knives for hunting and for protecting themselves. In fact, knives were one of the very first inventions. Knives made of flint were used in the Stone Age. In later years knives of bronze and iron were used by many different groups of people.

English people were fond of boiled or roasted meat. They needed knives for carving this meat into slices. During the Middle Ages, people began bringing their knives to the table, so the knife became a table tool. The carver may have been the only person at the table with a knife. He or she cut the meat for the others. They ate it with their fingers.

The knife was not the only one of the table tools that was made early in history. Spoons also have been in use for many, many years. A sign of how old spoons are is the word spoon itself. It comes from an Old English word that means "wood splinter," because the early spoons were made of wood.

Forks came much later.

(Readability is 3.1 according to the Spache Readability Formula.)
Why Does India Have So Many Problems?

Most of India's people are poor. Their houses are one-room huts made of bricks. There is no plumbing in these houses. The people cannot pay for electric lights or telephones. The people have only a few pans to use for cooking and sleep on beds of woven strings. They may have only one old chair. They get drinking water from a well and the water is not always clean.

The farmers of India do not grow enough food to meet the needs of the people. Most of the people work on very small farms. They do not know about modern ways of farming. So most of the people have little to eat and many die.

It takes years for people to change their thinking about a custom such as the caste system. In this system, the people of Hindu India are in different groups, or castes. The upper group has many benefits. The lower group has few or not any benefits. This system was made unlawful a few years ago, but the caste system continues and may go on for many more years. So old ways of thinking hold people back.

(Readability is 3.3 according to the Spache Readability Formula.)
APPENDIX B

Propositional Representations
Knives, Forks, and Spoons

1 (TIME: EARLY, TIMES) 2 (USED, PEOPLE, KNIVES) 3 (HUNT, WITH, KNIVES) 4 (FIGHT, WITH, KNIVES) 5 (FIRST, INVENTIONS, KNIVES, ONE) 6 (TIME: STONE AGE) 7 (MADE, KNIVES, PEOPLE) 8 (STONE, KNIVES) 9 (USED, KNIVES, PEOPLE) 10 (TIME: LATER) 11 (USED, KNIVES, PEOPLE) 12 (METAL, KNIVES) 13 (LIKED, MEAT, PEOPLE) 14 (ENGLISH, PEOPLE) 15 (BOILED, MEAT) 16 (ROASTED, MEAT) 17 (NEED: PEOPLE, KNIVES, MEAT) 18 (CUT, MEAT) 19 (TIME: MIDDLE AGES) 20 (BRING, KNIVES, PEOPLE, TO TABLE) 21 (BECAME, TOOL, KNIFE) 22 (TABLE, TOOL) 23 (IS, WITH, KNIFE, PERSON) 24 (ONLY, PERSON) 25 (CUT, MEAT) 26 (LOC: AT TABLE, 23-25) 27 (OR, HE, SHE) 28 (CUT, MEAT, 27) 29 (FOR OTHERS, 27-28) 30 (ATE, MEAT, THEY) 31 (WITH FINGERS, 30) 32 (TIME: EARLY, IN HISTORY) 33 (WAS NOT, KNIFE, TOOL) 34 (ONLY, TOOL) 35 (TABLE, TOOL) 36 (TIME: MANY, YEARS) 37 (USED, SPOONS, X) 38 (SHOWS, AGE/HOW OLD SPOONS ARE/, WORD) 39 (REL: WORD, SPOON) 40 (COMES, IT, FROM WORD) 41 (ENGLISH, WORD) 42 (OLD, ENGLISH) 43 (MEANS, WORD, SPLINTER) 44 (WOOD, SPLINTER) 45 (BECAUSE: 40-44, 46-47) 46 (MADE, SPOONS, X) 47 (OF WOOD, SPOONS) 48 (TIME: LATER) 49 (CAM, FORKS)
Why Does India Have So Many Problems?

1 (APE, POOR, PEOPLE)
2 (INDIA'S, PEOPLE)
3 (MOST, PEOPLE)
4 (ARE, HUTS, HOUSES)
5 (ONE-ROOM, HUTS)
6 (BRICK, HUTS)
7 (MUD, BRICK)
8 (LOC: IN HOUSES)
9 (NEGATIVE: IS, PLUMBING)
10 (NEGATIVE: PAY, PEOPLE, FOR (11))
11 (OR: LIGHTS, TELEPHONES)
12 (ELECTRIC, LIGHTS)
13 (HAVE, PANS, PEOPLE)
14 (FEW, PANS)
15 (PANS, FOR COOKING)
16 (SLEEPS, PEOPLE, ON BEDS)
17 (STRONG, BEDS)
18 (WOVEN, STRING)
19 (HAVE, CHAIR, THEY, MAYBE)
20 (ONE, CHAIR)
21 (OLD, CHAIR)
22 (GET, WATER, THEY, FROM WELL)
23 (DRINKING, WATER)
24 (NEGATIVE: IS, CLEAN, WATER, ALWAYS)
25 (GROW, FOOD, FARMERS)
26 (NOT ENOUGH, FOOD, FOR PEOPLE)
27 (OF INDIA, FARMERS)
28 (WORK, PEOPLE, ON FARMS)
29 (MOST, PEOPLE)
30 (SMALL, FARMS)
31 (NEGATIVE: KNOW, WAYS, THEY)
32 (MODERN, WAYS)
33 (OF FARMING, WAYS)
34 (SO: HAVE, TO EAT, PEOPLE, LITTLE)
35 (MOST, PEOPLE)
36 (AND: (34), DIE, PEOPLE)
37 (MANY, PEOPLE)
38 (TIME: YEARS)
39 (TO CHANGE, THINKING, PEOPLE)
40 (THINKING, ABOUT CUSTOMS)
41 (RELATIONSHIP: CUSTOM, SYSTEM)
42 (CASTE, SYSTEM)
43 (IN, 42, 44)
44 (ARE, PEOPLE, IN GROUPS)
45 (DIFFERENT, GROUPS)
46 (RELATIONSHIP: GROUPS, CASTES)
47 (OF INDIA, PEOPLE)
48 (HINDU, INDIA)
49 (HAS, BENEFITS, UPPER GROUP)
50 (MANY, BENEFITS)
51 (HAS, BENEFITS, LOWER GROUP)
52 (OP: FEW, NOT ANY)
53 (TIME: FEW YEARS AGO)
54 (WAS MADE, ILLEGAL, SYSTEM)
55 (BUT: (53-54), (56-57))
56 (CONTINUES, SYSTEM)
57 (CASTE, SYSTEM)
58 (AND: (56-57), MAY GO ON)
59 (TIME: MORE YEARS)
60 (MANY, MORE)
61 (SO: HOLD BACK, PEOPLE, WAYS)
62 (OLD, WAYS)
63 (OF THINKING, WAYS)
APPENDIX C

Instructions to Subjects
Instructions to Subjects

All seventh grade students are being asked to read this short passage. After reading, all students will be asked to make a list of what they remember about the passage. Some students will be asked to make a list right after reading, some will make a list after a week has passed, and some will make a list right after reading and again in a week.

This is not a test for you, but you will be helping us find out about how memory works for different people.

When you have finished reading, turn the passage face down. I will have special instructions for part of you, but all the rest should write from memory all you remember about what you read.
BIBLIOGRAPHY

Books


Articles


Frase, L. T., "Structural Analysis of the Knowledge that Results from Thinking about Text," *Journal of Educational Psychology*, LX (1969), Monograph Supplement 6, b.


Publications of Learned Organizations


Unpublished Materials


Kintsch, W., letter, Department of Psychology, University of Colorado at Boulder, October 15, 1979.


Test