San Fernando Valley State College

A Study of Relationships of Sequential Skills to Reading Comprehension

A project submitted in partial satisfaction of the requirements for the degree of Master of Arts in Secondary Education

by

Herbert Lee Schillerstrom

January, 1969
The project of Herbert Lee Schillerstrom is approved:

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Committee Chairman

San Fernando Valley State College

January, 1969
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Acknowledgments

The author would like to thank Dr. William C. Fledderjohann for his interest and cooperation in supplying the necessary information and materials for investigating sequential reading processes. Gratefulness is offered to my wife for her patience during the time of this study.
ABSTRACT

A Study of the Relationships of Sequential Skills to Reading Comprehension

by

Herbert Lee Schillerstrom
Master of Arts in Secondary Education

January, 1969

This study examined some sequential skills of serial learning as they related to reading comprehension. The present study tested the sequential skills of "association", "anticipation", "clustering" and "chunking" of junior high school students and then correlated these scores with the California Reading Achievement Test.

The hypothesis that the sequential skills of "association", "anticipation", "clustering" and "chunking" are related to reading comprehension skills was postulated.

The experimental test design considered four groups of sequential skills: (1) "association"; (2) "anticipation"; (3) "clustering"; and (4) "chunking".

The sequential tests consisted of four major tasks: (1) forming "associations" among serial items consisting of digits, letters and designs; (2) "anticipating" each digit or letter as it appears in a serial list; (3) remembering the digits or letters by "recoding" them into "clusters"; and (4) "chunking" the "clusters" into a visu-
al design or geometric figure.

The results of this study were as follows:

1. The results of the testing of the 7th and 8th grade population on the four tests of sequential processes indicate that the total tests are a fair predictor of school achievement and reading comprehension.

2. According to the population tested the sequential tests are a better predictor for successful comprehension for the upper and lower one third of the subjects tested than the middle one third of the group.

It was concluded that there appears to be a significant correlation between the four sequential tests and the standardized reading test scores.

The results of the testing on this population supported the hypothesis that the sequential skills of "association", "anticipation", "clustering" and "chunking" are related to reading comprehension skills.
CHAPTER I

THE PROBLEM

This study is an attempt to show that the ability to perceive sequential relationships while reading is an important skill closely related to reading comprehension.

It appears that few attempts have been made to develop highly valid and reliable diagnostic tests for detecting sequential difficulties.

The use of a technique developed for experimental investigation of sequential processes with subjects has been reported (Ebbinghaus, 1885). The technique consisted of nonsense syllables or (CVC) combinations. He showed that previously acquired verbal skills could be used and at the same time eliminate previous learning for the specific material to be learned. It was concluded from the test results that the technique was an effective means of experimentally influencing chaining of responses in subjects.

Later, a revised version of the original technique (calibrated nonsense syllables in terms of their association value) was used, and it was found that this version was also an important method in controlling verbal material in the study of sequential processes (Glaze, 1928; Hull, 1923). The findings of those studies were also taken
as evidence of the importance of calibrated nonsense syllables in terms of their association value.

Archer (1960) found that most experimenters ignore many of the (CVC) three-letter combinations which are crucial to the understanding of association value or meaningfulness. Glaze's and Hull's association experiments (1928, 1933) failed to explore all possible (CVC) three-letter combinations.

Since association value or meaningfulness has been an important part of sequential processes, there have been some studies since Glaze. The most extensive of these was one conducted by Archer (1960). He examined the meaningfulness of all possible (CVC) three-letter combinations. In Archer's study there were 510 (CVC) trigrams. The results proved that it takes many more trials for the subject to learn a list of nonsense syllables which have few or no associations than a list which research workers said produced many associations.

In the method of sequential learning we know that successive items are associated because the subject can anticipate the next item. The present study, by incorporating a series of criterion items to learn (digits and letters) investigated normal subject's abilities to recall the digits and letters and recode them into visual designs.

The original Ebbinghaus (1885) study relied on the serial anticipation method. Each item in the list served
in turn as a stimulus and as a response. The subject was given a list of nonsense syllables to learn. He then learned a second list obtained by systematically rearranging the first list. The results showed that he could relearn systematically rearranged list much more quickly than he could relearn ones haphazardly rearranged or an entirely new list.

Current researchers in the field of testing and measurement have noted that there seems to be a need for valid and reliable batteries of test to measure sequential skills to be used in checking reading comprehension. Ebbinghaus (1885) neglected to design any sequential diagnostic test and therefore failed to differentiate between a subject's ability to form associations between criterion items and anticipate responses.

Because of this measurement weakness, this study investigated research into the work of Bousfield's (1953) "clustering" and Miller's (1956) "chunking".

There is a great deal more to the problem of sequential processes than whether the responses are retained (Bousfield, 1953; Cohen, 1963; Miller, 1956). These investigators point out that responses are reorganized by the individual's previous habits, motives, and other unique characteristics. This reorganization is perhaps the most basic aspect of verbal learning.

The Bousfield technique of "clustering" relies on a
subject's ability to reorganize the responses according to his previous habits, motives and other unique characteristics. The experiments of Bousfield (1953) and Cohen (1963) hit upon an extremely influential notion on sequential processes. This notion was that of "chunking" (Miller, 1956). Miller points out that people have fixed capacities for memorizing and the average college student can recall about seven "chunks" of information. Miller argues that people can remember more than seven items of information because people "recode" information into "chunks". According to Miller a sentence is more than a string of words; that it is a sequence of words held together by relations in meaning and association. To remember a sentence, one has only to remember the key words and the general form.

Miller and Smith (1956) conducted an experiment on "reencoding" binary digits into octal units. Smith could remember 40 binary numbers after a single hearing. These studies point out the fact that all verbal material can be recalled by reorganizing the material into small "chunks".

It would appear that sequential processes are basic to reading comprehension.
CHAPTER II

REVIEW OF THE LITERATURE

The center of the present study is the relationships between sequential skills and reading comprehension. Research studies and experiments that relate to this problem can be classified under three main headings: (1) studies related to the complexity and definition of reading; (2) studies related to reading comprehension and serial learning; and (3) correlation and clinical studies of seeing relationships in details.

1. Studies of Reading

Austin (1957) in a broad survey of the research in reading concludes that reading is a subtle and complex act. Reading is a complex and immense field because it can be considered from many different aspects. Numerous articles have been written on visual problems and eye movements (Luckiesh and Koss, 1942; Paterson and Tinker, 1940; Berens, 1936). Some workers have emphasized all the perceptual aspects of reading (Buswell, 1922; Gilbert, 1942; Tinker, 1936). Reading can also be considered as reasoning or a process of continual evaluation (Thorndike, 1917). From still another standpoint, reading has been viewed as
a statistical process (Davis, 1944; Langson, 1941; Robinson and Hall, 1941; Burkart, 1954). One of the most important aspects of reading is the comprehension and the skills associated with it (Dechant, 1964; Harris, 1961; Russell, 1949; Strang, 1962). Since comprehension is a major goal of reading instruction, this particular study will be focused on comprehension through its basic elements.

For the purpose of clarity let us compare some of the definitions of reading and then educe a definition of reading for this paper. Some research workers define reading in the broadest sense (Spencer, 1946; Richards, 1929; Leary, 1941). This involves the reading of the environment directly, including things, persons, places, processes, and etc. Reading may be defined in the limited sense which involves getting facts from the printed page (Dechant, 1964; Gray, 1940; Harris, 1946; Smith, 1961). In view of the fact that the reading field is already complex, and since most research workers define reading as working with printed symbols that viewpoint is taken in this study. Therefore a working definition for this study sees reading as the "interpretation of the printed page and in the process of interpretation the reader relates graphic symbols to his own fund of experience" (Smith, 1961, p.23).

2. Studies of Reading Comprehension and Serial Learning

Dechant (1964, p.353) reports that "the goal of all
reading is the comprehension of meaning." For purposes of clarity let us also deduce a definition of comprehension for this paper. Traxler (1952) reports that a definition of comprehension is difficult to constitute. Yoakam (1952) indicates that reading comprehension involves association of meanings with word symbols and the organization of ideas as they are read. Edwards (1957) reports that the comprehension of ideas depends on adequate motivation and the skill to reason one's way through details in order to grasp the main idea. A working definition for this study sees comprehension as the understanding of the reading material as intended by the author. This understanding is therefore contingent in noting and following the sequence of central and subsidiary ideas in the materials.

The major reading comprehension skills that have been reported are reading for the main idea, reading to note and recall details, reading to follow a sequence of events and reading to see relationships among ideas (Dechant, 1964; Harris, 1961; Russell, 1949; Strand, 1962; Dawson and Bamman, 1959). Dechant (1964, p. 360) reports that "the ability to identify the main idea is necessary for interpretation and understanding of what is written. It is based on an accurate comprehension of the words, the phrase and the sentence." He goes on to say that "after the child has had some success in reading for and stating the main idea, he is ready to read for details." Harris
(1961, p. 437) reports that "an essential part of the understanding of the narrative material whether fictional or historical, is the ability to note the order or sequence of events." Strang (1962, p. 159) reports that "teachers have to be careful to encourage children to form the habits of seeing relationships among the ideas they gain from reading."

Since the four major reading comprehension skills appear to be related to seeing relationships among the ideas presented, this study examined further the research of sequential skills of serial learning.

Studies related to serial learning and sequential learning skills have been reported (Ebbinghaus, 1885; Bousfield, 1953; Miller, 1956). Ebbinghaus (1885) found that subjects can learn series of nonsense syllables and can later recall them in their original positions. Two sequential skills were identified, ability to form "associations" between related items and the ability to "anticipate" the adjacent items in a serial list. Bousfield (1953) found that if subjects are allowed to impose organization on the serial list of items, they were able to recall up to 60 nouns after a single hearing. Subjects could recall more words if they "clustered" the words into four categories. Bousfield (1953) called this sequential skill "clustering". The experiment of Bousfield (1953) led to Miller's (1956) finding of "chunking". Miller
points out that the average college student can recall about seven "chunks" of information. In order to remember a sentence one has only to "recode" or remember a few key words and the pattern of the sentence. Miller (1956) called this sequential skill "chunking".

Since people have fixed capacities for recalling information, other techniques were used which increased the immediate memory span from seven up to thirty-six items of information. These techniques were identified as the sequential skills of "association", "anticipation", "clustering" and "chunking". Since the sequential skills can increase the immediate memory of subjects working with nonsense syllables, noun lists, binary digits and sentences, then perhaps these sequential skills can be used to increase reading comprehension.

3. Correlation and Clinical Studies of Seeing Relationships in Details

Studies related to seeing relationships in details have been reported (Lowder, 1956; Potter, 1949; Robinson, 1958; Small, 1958). Lowder (1956) tested 1500 public school children in the first three grades and he reported a high correlation between seeing relationships among forms and achievement in school. Potter (1949) reported a high correlation between seeing relationships and reading achievement among children in the primary grades.
Robinson (1958) found a high correlation between seeing relationships among designs and the Chicago Reading Test in first-grade children. Small (1958) compared the ability of kindergarten children to see relationships among simple designs and the Metropolitan Readiness Test. He also found high correlations. On the basis of these studies it would appear that there is a significant relationship between seeing relationships among visual designs and reading achievement in the primary grades.

In addition to these reports, clinical studies have also shown the importance of seeing relationships to school achievement. Strauss's and Lehtinen's (1947) finding is that brain-damaged children have difficulty taking a globular mass of details, seeing relationships between the details, and then putting them back into an integrated coordinated unit. Strauss's and Kephart's (1955) finding is that training programs, designed to increase seeing relationships in a consistent fashion, can aid the child in increasing his achievement. None of the studies investigated the relationship between sequential skills and reading comprehension in the upper grades.

Summary

First, reading is a complex and subtle act. Second, comprehension is the major goal of reading instruction. Comprehension is the understanding of the reading material as it was intended by the author. The major comprehension
skills are: reading for the main idea, reading to note details, reading to follow a sequence of events and reading to see relationships and ideas. Third, the literature suggests that sequential skills of serial learning "association", "anticipation", "clustering" and "chunking" appear to be closely related to the reading comprehension skills. This is demonstrated by the high correlation that exists between seeing figure relationships and reading achievement. Furthermore, clinical reports of brain-damaged children show that training programs designed to help them see relationships can aid children in increasing their reading achievement level. This study then suggests the premise that certain sequential skills are closely related to reading comprehension.
CHAPTER III

PROCEDURE

Chapter Two reported on the complexity and definition of reading, definition of reading comprehension and its related skills, sequential skills of serial learning, and correlations between seeing relationships and school achievement with normal and brain-injured children.

The purpose of the present study was to investigate some relationships of sequential skills of serial learning to reading comprehension.

The hypothesis that the sequential skills of "association", "anticipation", "clustering", and "chunking" are related to reading comprehension was postulated.

1. Basic Design

The present study tested the sequential skills of "association", "anticipation", "clustering" and "chunking" of junior high school students and then correlated these scores with a standardized reading test.

By using the technique of Ebbinghaus (1885), previously acquired sequential skills were measured and at the same time skills unrelated to previous learning for the specific material were tested. The four sequential tests were made of serial lists of digits, letters, visual
designs and geometric figures.

The California Reading Achievement Test served as the standardized reading test. The test was designed to measure the subjects' reading vocabulary and comprehension level.

2. Test Instrument

The testing materials used in this study were made up of two major types. One type was the four sequential tests. The second type was the California Reading Achievement Test.

The materials that were used in the testing portion of this study provided a fairly accurate measure of the subjects' abilities in sequential skills of serial learning, reading vocabulary and reading comprehension.

Sequential Tests

Each of the six reading classes was given the four sequential tests. The test attempted to measure the sequential skills of "association", "anticipation", "clustering" and "chunking".

The instructions were prerecorded on a tape recorder. For the visual portions of the test the items were projected on a large screen by using an overhead projector. This control measure was necessary due to the particular test design used.

The sequential skills of serial learning were mea-
sured by having the subjects perform four major tasks: (1) forming "associations" among serial items consisting of digits, letters and designs; (2) "anticipating" each digit or letter as it appears in a serial list; (3) remembering the digits or letters by "recoding" them into "clusters"; and (4) "chunking" the "clusters" into a visual design or geometric figure.

**Standardized Reading Test**

Each of the six reading classes was given the California Reading Achievement Test for the Junior High Level. The test consisted of two major parts. The first part of the test measured the vocabulary level of the subjects. The second part measured their comprehension level. The instructions were prerecorded on a tape recorder and the test items were presented in the test booklets.

Part 1 was the vocabulary test which included a key word, the word to be selected and three distracters. The first forty-five items were divided among mathematics, science, social science and a general vocabulary.

Part 2 was designed to reveal the subjects' comprehension of what they read. The test was divided into three sections: following directions, reference skills and the interpretation of materials.

The results, correlations, item-analysis and other findings of the present study are presented in Chapter IV.
3. Subjects

Six classrooms of average junior high school students were selected for this study. Five of the classrooms were seventh-grade students. The sixth classroom was made up of eighth-grade students. Seventh and eighth-grade students were used for two reasons. First, the sequential tests were designed to be used for the upper grades. Second, the seventh and eighth-grade students needed very little direction in order to take the sequential tests.

Any students with serious hearing or visual problems, who would not benefit from the tests, were not enrolled at this school. Students with an IQ below 85 were not enrolled. The district provided a special school for those students. Therefore none of the subjects was eliminated from the study on the basis of low abilities.
CHAPTER IV

RESULTS

The focus of the present study was to examine the sequential skills of serial learning to see if they were related to reading comprehension. This study correlated the four sequential tests scores with the California Reading Test scores. The purpose of the sequential tests was to measure the sequential skills of "association", "anticipation", "clustering" and "chunking". The standardized reading test was given to measure the reading abilities of six classrooms of students. If the students' sequential tests scores correlated with the standardized reading test scores there is a possibility that sequential skills are related to reading comprehension.

The statistical results of the four sequential tests and the California Reading Achievement Test were calculated by the Computer Center of the San Fernando Valley State College.

The correlations tested the hypothesis postulated for this study. The hypothesis is that the sequential skills of "association", "anticipation", "clustering" and "chunking" are related to reading comprehension skills.
Complete results were obtained for the six reading classrooms making a total of 207 subjects. The tables included in this chapter give the means, standard deviations, correlations and item-analysis for all the variables of the four sequential tests and the California Reading Achievement Test.

The first comparison made in the present study was to examine the means and standard deviations for the four sequential tests and the California Reading Achievement Test.

Table 1 (p. 18) gives the means and standard deviations for the four sequential tests.

Sequential Test No. 1 was made up of 12 items. The average score or mean for this test was 10.08. The standard deviation from the mean was 2.47.

Sequential Test No. 2 was made up of 10 items. The average score or mean for this test was 7.52. The standard deviation from the mean was 1.98.

Sequential Test No. 3 was made up of 20 items. The average score or mean for this test was 16.31. The standard deviation from the mean was 2.99.

Sequential Test No. 4 was made up of 20 items. The average score or mean for this test was 8.31. The standard deviation from the mean was 3.53.

The total sequential tests were made up of 62 items. The average score or mean for this test was 42.22. The standard deviation from the mean was 8.95.
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<th>Range in Compre.G.L.</th>
<th>Mean Compre.G.L.</th>
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<td>42.22</td>
<td>8.95</td>
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Table 1 (p. 18) gives the means and standard deviations for the California Reading Achievement Test.

The mathematics vocabulary section had 15 items. The average score or mean for this section was 10.81. The standard deviation from the mean was 2.64.

The science vocabulary section had 15 items. The average score or mean for this section was 10.46. The standard deviation from the mean was 3.24.

The social science vocabulary section had 15 items. The average score or mean for this section was 9.69. The standard deviation from the mean was 3.27.

The general vocabulary section consisted of 15 items. The average score or mean for this section was 9.45. The standard deviation from the mean was 3.38.

The total vocabulary section had 60 items. The average score or mean for the total vocabulary section was 10.30. The standard deviation from the mean for the total vocabulary section was 10.72.

The test on following directions had 15 items. The average score or mean for this test was 9.91. The standard deviation from the mean was 2.77.

The test on reference skills had 26 items. The average score or mean for this test was 16.56. The standard deviation from the mean was 5.15.

The test on interpretation of material had 45 items. The average score or mean was 22.43. The standard devia-
tion from the mean was 8.46.

The total comprehension test consisted of 86 items. The mean score for this test was 48.90. The standard deviation from the mean was 14.36.

The second comparison made in the present study was to examine the six groups' performance with the four sequential tests in relation to their achievement in reading vocabulary and comprehension.

Table 2 (p. 21) gives all the correlations of the four sequential tests to the California Reading Achievement Test.

The four sequential tests were significant on all the variables in reading vocabulary: mathematics; science; social science; and general vocabulary. The correlations for mathematics were .51, .51, .51 and .46. The correlations for science were .45, .43, .42 and .44. The correlations for social science were .41, .47, .51 and .38. The correlations for general vocabulary were .37, .42, .46 and .35. The correlations for the total vocabulary were .51, .52, .54 and .48.

The four sequential tests were significant on all the variables of reading comprehension: following directions; reference skills; and interpretations. The correlations for following directions were .46, .53, .47 and .39. The correlations for reference skills were .52, .51, 53 and .48. The correlations for interpretation of
Table 2

Matrix Correlation Table for the California Reading Achievement Test and Four Sequential Tests

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material were .44, .41, .53 and .51. The correlations for the total comprehension were .52, .52, .58 and .56.

The correlations for the total sequential tests with each of the four sequential tests were .61, .61, .61 and .65.

Since the four sequential tests were not standardized an item-analysis was made in order to see if higher correlations existed between sequential skills and the standardized reading test.

**Item-Analysis**

The third comparison made in the present study was to examine the item-analysis of the four sequential tests. The purpose of this analysis was to get figures on (a) the success of the groups on each item; (b) the discrimination power of each item; and (c) how many high-scoring and low-scoring students chose each response to each item.

For the present study the "high-low" type of item-analysis was used in order to reveal the discrimination power of each item or see how many more high-scoring than low-scoring students got it right. The top 27% was used as the "high" group and the bottom 27% as the "low". This study had a total of 207 subjects or 56 subjects represented the "high" group and 56 subjects represented the "low".

The professional minimum acceptable high-low differ-
ence is 10% of the group. In the present study the minimum accepted high-low difference was 20. If an item exceeded this number, it's discrimination was satisfactory; if not, the item failed in it's purpose.

The item-analysis for the four sequential tests is given in Table 3 (p. 24).

Sequential Test No. 1 had items 1, 2, 4, 5, 6, 7 and 12 which were considered discriminating.

Sequential Test No. 2 had items 3, 4, 5, 7 and 8 which were considered discriminating.

Sequential Test No. 3 had items 1, 2, 4, 5, 6, 9, 10 and 17 which were considered discriminating.

Sequential Test No. 4 appeared to be the most difficult of the four test presented according to the number of high-low responses reported. Notice that item 13 had no correct responses for either "high" or "low" groups. Items 2, 4, 5, 6, 8, 9, 10, 11, 12, 14, 17, 18 and 19 are considered discriminating. Items 7, 13, 15, 16 and 20 appeared too difficult for both the "high" and "low" groups.

Subsequent Analysis

After the item-analysis was completed, items that were non-discriminating between the "high" and "low" groups were deleted. A subsequent analysis of data showed higher correlations.

Table 4 (p. 25) gives all the correlations of the four
Table 3.
Item-Analysis for the Sequential Tests.

|       | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| High  | 55  | 51  | 55  | 55  | 54  | 56  | 55  | 55  | 56  | 54  | 55  | 56  | 51  | 56  | 56  | 49  | 56  | 55  | 54  |
| Low   | 25  | 28  | 39  | 27  | 26  | 34  | 19  | 40  | 39  | 41  | 37  | 36  | 41  | 34  | 22  | 23  | 37  | 40  | 35  | 37  | 38  |
| High+Low | 80  | 79  | .94 | 82  | 80  | 90  | 74  | 95  | 95  | 95  | 91  | 92  | 97  | 85  | 64  | 74  | 93  | 96  | 69  | 91  | 92  | 92  |
| High-Low | 30  | 23  | 16  | 28  | 28  | 28  | 36  | 15  | 17  | 13  | 17  | 20  | 15  | 17  | 20  | 28  | 19  | 16  | 29  | 21  | 18  | 16  |

|       | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| High  | 56  | 47  | 56  | 55  | 51  | 53  | 55  | 53  | 54  | 56  | 56  | 51  | 56  | 56  | 56  | 47  | 55  | 54  | 56  |
| Low   | 36  | 22  | 46  | 30  | 25  | 27  | 47  | 40  | 34  | 25  | 39  | 33  | 49  | 41  | 47  | 48  | 34  | 42  | 43  | 42  |
| High+Low | 92  | 69  | 102 | 85  | 76  | 80  | 102 | 93  | 88  | 81  | 95  | 84  | 105 | 96  | 103 | 104 | 81  | 97  | 97  | 98  |
| High-Low | 20  | 25  | 10  | 25  | 26  | 26  | 8   | 13  | 20  | 31  | 17  | 18  | 7   | 14  | 9   | 8   | 34  | 13  | 11  | 14  |

|       | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| High  | 53  | 50  | 56  | 52  | 51  | 55  | 18  | 25  | 38  | 47  | 29  | 33  | 0   | 24  | 4   | 12  | 45  | 28  | 21  | 14  |
| Low   | 46  | 24  | 47  | 26  | 29  | 31  | 5   | 2   | 0   | 20  | 8   | 3   | 0   | 1   | 0   | 2   | 12  | 4   | 1   | 1   |
| High+Low | 99  | 74  | 103 | 78  | 80  | 86  | 23  | 27  | 38  | 67  | 37  | 36  | 0   | 25  | 4   | 14  | 57  | 32  | 22  | 15  |
| High-Low | 7   | 26  | 9   | 26  | 22  | 24  | 13  | 23  | 38  | 27  | 21  | 30  | 0   | 23  | 4   | 10  | 33  | 24  | 20  | 13  |
Table 4
Correlation Table after Subsequent Analysis

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Sequential tests to the California Reading Achievement Test after the subsequent analysis was completed.

Higher correlations were found on all the variables in reading vocabulary: mathematics; science; social science and general vocabulary. The correlations for mathematics were: .81, .65, .77, and .78. The correlations for science
were .76, .59, .70 and .73. The correlations for social science were .77, .66, .70 and .69. The correlations for general vocabulary were .68, .58, .70 and .65. The correlations for the total vocabulary were .84, .66, .78 and .78.

Higher correlations were found on all the variables in reading comprehension: following directions; reference skills; and interpretations. The correlations for following directions were .76, .74, .69 and .72. The correlations for reference skills were .86, .67, .78 and .80. The correlations for interpretation of material were .80, .59, .74 and .79. The correlations for the total comprehension were .87, .68, .79 and .86.

The correlations for the total sequential tests with each of the four sequential tests were .79, .74, .74 and .79.

The hypothesis that the sequential skills of "association", "anticipation", "clustering" and "chunking" are related to reading comprehension was supported.

The conclusions and implications are included in Chapter V.
CHAPTER V

CONCLUSIONS

The first conclusion of this study is that there appears to be a significant relationship between sequential skills of serial learning and reading comprehension. This conclusion is based on the results of the four sequential tests and the California Reading Achievement Test. The final correlations between the four sequential tests and the California Reading Vocabulary Section were .84, .66, .78, and .78. The correlations between the four sequential tests and the California Reading Comprehension Section were .87, .68, .79 and .86. The correlations between the total sequential tests and each of the four sequential tests were .79, .74, .74 and .79.

The second conclusion is that certain test items failed to discriminate between the "high" and "low" groups. This conclusion is based on the results of the item-analysis. With an unpublished test usually at least half of the items that are pretested in this way are either discarded or revised, and the final form of the test contains only items that are likely to work well.

Sequential Test No. 1 measured the sequential skills of "association", "anticipation", "clustering" and "chunk-
ing". Items 3, 8, 9, 10 and 11 failed to discriminate between the "high" and "low" groups. A closer examination of these items showed that perhaps they could be touched up and saved. The main difficulty appears to be in the distracters. The items in Sequential Test No. 1 were multiple choice type design. The three distracters were too remote from the correct design. The "low" group immediately detected the error and chose the correct answer.

Sequential Test No. 2 measured the skills of "clustering" and "chunking". Items 1, 2, 6, 9 and 10 failed to discriminate between the "high" and "low" groups. The geometric designs formed from the "clusters" of letters appeared uncomplicated at the junior high level. According to the results from the item-analysis most of the "low" group were able to answer the items correctly. The geometric designs in items 2, 3, 4, 5, 7 and 8 appeared more complex.

Sequential Test No. 3 measured the sequential skills of "association", "anticipation", "clustering" and "chunking". This test was of a completion type of design. The subjects were required to complete a design from a serial list of digits. Items 3, 7, 8, 11, 12, 13, 14, 15, 16, 18, 19 and 20 failed to meet their purpose. A closer examination of these items showed that the serial list of digits, which determined the design, was shorter in number and it's arrangement was less complex then the discriminat-
ing items. The nondiscriminating items could be saved by
including more digits and rearranging them into more com-
plex patterns.

Sequential Test No. 4 measured the sequential skills
of "association" and "anticipation". This test appeared
to be the most difficult of the four tests administered.
The task required for this test was to form "associations"
among a series of various designs. The subjects were then
to draw in or "anticipate" the missing design. Items 7,
13, 15, 16 and 20 were not discriminating because the items
were too difficult for both the "high" and "low" groups.
It is interesting to note that items 7, 8, 13, 14, 15, 16,
19 and 20 appeared to be a challenge for upper subjects
of the "high" group. Item 13 was not answered correctly
by either the "high" or "low" group. One conclusion of
Sequential Test No. 4 is that perhaps tests can be con-
structed to measure the sequential skills of "association"
and "anticipation" at higher grade levels.

The third conclusion is that one key to understanding
reading comprehension may lie in the sequential skills of
serial learning. This conclusion is based on the studies
related to reading comprehension and serial learning. Per-
haps the reason that reading has been reported as a subtle
and complex act is that the reading comprehension skills
are interrelated with the sequential skills of serial
learning. The recent studies of Bousfield (1953) and
Miller (1956) reported that the greatest problem in verbal learning is not whether the responses are retained but how the responses are reorganized by the individual's previous habits, motives, and other unique characteristics. This study saw reading comprehension as the understanding of reading material as it was intended by the author. Therefore it appears that this is not possible unless one uses the sequential skills of "association", "anticipation", "clustering" and "chunking".

Implications

The results of the present study have pointed out several important implications which could be used to improve the reading ability of students.

The first implication pertains to the problems that students have when reading. In order for students to have full interpretation, to integrate ideas gained from several sources, and to summarize and organize ideas, they should use the sequential skills of serial learning. In most classrooms there are evidences of weakness in this area of reading. Students who have difficulty seeing associations, clustering and chunking ideas together are probably unable to answer questions that require them to tell why something happened or why a character did or said what he did. Many students are unable to make a simple outline. Other students may not understand or remember
what they read in other areas of the curriculum. A common problem is that students find it almost impossible to summarize and remember what they have read. The answer to these problems may lie in the sequential skills of serial learning.

The second implication, arising out of the problems that students have when reading, is the need for good diagnostic tools to measure the sequential skills of serial learning. The present study has been an organized effort in this direction. These tests could be used as a much needed tool to inform the teacher as to which students need special help and instruction in sequential processes and reading comprehension.

The third implication, arising out of the sequential diagnostic test, is the need for sequential teaching units. Organized sequential reading materials that hold promise of efficiency in time, effort, and materials should be developed. These should be available at all grade levels for the classroom teacher. These materials should be compact, easily available and could be coordinated with reading textbooks and supplementary readers.
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BIBLIOGRAPHY


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SAMPLE TEST

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1, 2, 5, 7, 2, 8, 6, 4

(Test copyright W. C. Fledderjohann 1969)
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