

THE RELATIVE EFFECTIVENESS OF MECHANICAL AND  
NON-MECHANICAL METHODS IN A READING  
IMPROVEMENT PROGRAM

By

ROBERT M. MORGAN

Bachelor of Science

Oklahoma Agricultural and Mechanical College

Stillwater, Oklahoma

1955

Submitted to the faculty of the Graduate School of  
the Oklahoma Agricultural and Mechanical College  
in partial fulfillment of the requirements  
for the degree of  
MASTER OF SCIENCE  
August, 1956

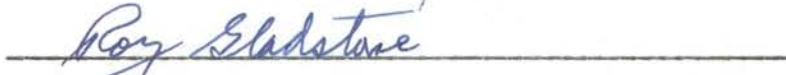
OKLAHOMA  
AGRICULTURAL & MECHANICAL COLLEGE  
LIBRARY

JAN 2 1957

THE RELATIVE EFFECTIVENESS OF MECHANICAL AND  
NON-MECHANICAL METHODS IN A READING  
IMPROVEMENT PROGRAM

Thesis Approved:

  
Thesis Adviser

  
\_\_\_\_\_

  
Dean of the Graduate School

369950

## PREFACE

Reading improvement is an issue of considerable importance in the educational field today. Work in this area is being done in secondary schools and colleges throughout the nation. A question that has frequently arisen in the schools having reading programs is how effective are the mechanical instruments in developing reading skills? Educators representing institutions not having great financial resources have wondered if the mechanical instruments were requisite to the minimal reading improvement program. The purpose of this study was to investigate the relative effectiveness of two methods of presenting a reading improvement course. The first method involved the use of mechanical devices in addition to regular practice reading. The second method did not include practice with the mechanical instruments, but relied solely on practice reading and vocabulary drill for development of reading skills.

The author wishes to express his appreciation to Steve Heckart, for his assistance in the presentation of the reading improvement sections throughout the investigation. Dr. Roy Gladstone, acting head of the Psychology Department, contributed much to this study by his friendly suggestions and counsel. Without the advice and encouragement of Dr. A. C. Pereboom relative to the statistical design, it is unlikely this research would have been consummated. Especial indebtedness to Dr. Roy E. Sommerfeld is acknowledged, whose foresight and guidance as the research director has served as a constant source of inspiration to the writer.

## TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION . . . . .	1
Nature of the Problem . . . . .	1
Reasons for Undertaking the Study . . . . .	2
Hypotheses . . . . .	4
II. REVIEW OF THE LITERATURE . . . . .	7
The General Reading Improvement Program . . . . .	7
Research on Techniques of Improvement . . . . .	17
Summary . . . . .	23
III. SUBJECTS, INSTRUMENTS, AND PROCEDURE . . . . .	24
Subjects. . . . .	24
Description of the Instruments Used in the Study. . . . .	25
Procedure . . . . .	33
IV. TREATMENT OF DATA AND ANALYSIS OF RESULTS. . . . .	40
The Initial Homogeneity of the Groups . . . . .	40
The Change in Reading Ability . . . . .	43
The Relative Effect of the Various Techniques . . . . .	47
Discussion. . . . .	52
V. SUMMARY AND CONCLUSIONS. . . . .	56
General Summary of the Investigation. . . . .	56
Conclusions . . . . .	59
BIBLIOGRAPHY. . . . .	61

LIST OF TABLES

Table	Page
I. DISTRIBUTION OF THE SUBJECTS BY SEX AND ACADEMIC LEVEL WITHIN GROUPS I, II, III, AND IV. . . . .	25
II. CORRELATION OF ALTERNATE FORMS A AND B OF THE NELSON- DENNY READING TEST. . . . .	30
III. COMPARISON OF MEANS OF THE ADMINISTRATION OF FORM B AND THEN FORM A OF THE NELSON-DENNY READING TEST TO THE SAME POPULATION (N = 31). . . . .	31
IV. COMPARISON OF MEANS OF THE ADMINISTRATION OF FORM A AND THEN FORM B OF THE NELSON-DENNY READING TEST TO THE SAME POPULATION (N = 27). . . . .	31
V. COMPARISON OF MEANS OF FORM A AND FORM B OF THE NELSON- DENNY READING TEST IRRESPECTIVE OF ADMINISTRATION SEQUENCE (N = 58) . . . . .	32
VI. DAILY SCHEDULE OF TIME IN MINUTES DEVOTED TO THE VARIOUS TRAINING TECHNIQUES FOR GROUPS I, II, AND III . . . . .	39
VII. ANALYSIS OF VARIANCE OF THE "L" SCORES OF THE ACE TEST FOR GROUPS I, II, III, AND IV . . . . .	41
VIII. ANALYSIS OF VARIANCE OF PRE-TRAINING, NELSON-DENNY READING TEST, (FORM A) SCORES FOR GROUPS I, II, III, AND IV . . . . .	42
IX. ANALYSIS OF VARIANCE OF BAKER'S WORDS PER MINUTE PRE- TRAINING READING SPEED SCORES FOR GROUPS I, II, III, AND IV. . . . .	42
X. ANALYSIS OF VARIANCE OF BAKER'S WORDS PER MINUTE PRE- TRAINING COMPREHENSION SCORES FOR GROUPS I, II, III, AND IV. . . . .	43
XI. SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE PRE-TRAIN- ING TEST SCORES (FORM A) AND THE POST-TRAINING TEST SCORES (FORM B) OF THE NELSON-DENNY READING TEST FOR GROUPS I, II, III, AND IV . . . . .	44

XII.	SIGNIFICANCE OF DIFFERENCES BETWEEN THE PRE-TRAINING READING SPEED SCORES AND THE POST-TRAINING READING SPEED SCORES FOR THE BAKER WORDS PER MINUTE EXERCISE FOR GROUPS I, II, III, AND IV. . . . .	45
XIII.	SIGNIFICANCE OF DIFFERENCES BETWEEN THE PRE-TRAINING COMPREHENSION SCORES AND THE POST-TRAINING COMPREHENSION SCORES FOR THE BAKER WORDS PER MINUTE EXERCISE FOR GROUPS I, II, III, AND IV. . . . .	46
XIV.	ANALYSIS OF VARIANCE OF THE MEAN DIFFERENCES BETWEEN THE PRE-TRAINING SCORES (FORM A) AND THE POST-TRAINING SCORES (FORM B) OF THE NELSON-DENNY READING TEST FOR GROUPS I, II, III, AND IV. . . . .	47
XV.	ANALYSIS OF VARIANCE OF THE MEAN DIFFERENCES BETWEEN THE PRE-TRAINING READING SPEED SCORES AND THE POST-TRAINING READING SPEED SCORES OF THE BAKER WORDS PER MINUTE EXERCISE FOR GROUPS I, II, III, AND IV . . .	48
XVI.	SIGNIFICANCE OF DIFFERENCES BETWEEN THE MEAN DIFFERENCES OF THE READING SPEED SCORES OF THE BAKER WORDS PER MINUTE EXERCISE FOR GROUPS I, II, III, AND IV. . . . .	49
XVII.	ANALYSIS OF VARIANCE OF THE MEAN DIFFERENCES BETWEEN THE PRE-TRAINING COMPREHENSION SCORES AND THE POST-TRAINING COMPREHENSION SCORES OF THE BAKER WORDS PER MINUTE EXERCISES FOR GROUPS I, II, III, AND IV. . .	50
XVIII.	SIGNIFICANCE OF DIFFERENCES BETWEEN THE MEAN DIFFERENCES OF THE READING SPEED SCORES OF THE BAKER WORDS PER MINUTE EXERCISE FOR GROUPS I, II, III, AND IV. . . . .	51

## CHAPTER I

### INTRODUCTION

#### Nature of the Problem

There has been a great deal of attention brought to bear in the past few years on the inadequacy of the reading level of both children and adults. The interest in this problem of poor reading has manifested itself in a wealth of editorial and research publication in both the popular media and in the research and experimental journals. Early thinking in this area was to relegate the learning of reading to the elementary school period. If efficient habits of reading were not then obtained the individual was classified as a "poor reader" with little chance of later altering this situation. However, the colleges and universities have come to recognize the fact that many intelligent students do not possess the requisite reading skills for academic achievement of quality and that something can be done about this. Psychologists and educators have been and are investigating the learning of efficient and rapid reading. The educational journals are replete with reports of experimentation relative to learning to read with greater facility.

The early programs for the development of more effective reading skills were frequently called "remedial reading" classes. This title seemed to connote the teaching of basic reading skills to very poor or backward readers. Since a great many of the reading courses, particularly at the adult level, are so constructed as to offer benefits to the

average and good reader as well as the poor one, the title "remedial reading" has become somewhat inappropriate. Consequently, this type of training, when involving students whose reading performance is generally adequate, has more often come to be known as a "reading improvement program" or a "reading development course."

There is considerable evidence that reading habits can be improved. This obtains for the good reader as well as the poor one and for adults as well as children (8, 23).

Broadly conceived, the problem involved in this study is a comparison of the relative effectiveness, in terms of reading improvement, of two general methods of presenting a reading program. The two methods are the "mechanical" method and the "non-mechanical" method. The former technique involves the use of instruments or mechanical devices designed for improving the quality of reading ability. The latter technique makes no use of mechanical devices, depending rather upon the inculcation of principles of more effective reading by lecture and discussion, and developing in the student better reading habits through practice in reading.

#### Reasons for Undertaking the Study

The implications of this investigation are of a most practical nature. The number of educational institutions, college, secondary and elementary, that are establishing reading improvement programs is increasing every year. From a recent survey of all senior colleges and universities and a representative number of Junior Colleges, Oscar S. Causey (20) indicates that four hundred eighteen institutions report having a reading improvement program in 1956 as compared to two hundred sixty-eight in the preceding year, a jump of thirty per cent in one year.



This represents an increase from 33,431 students taking a reading course at the college level to 57,052 students. There are probably a number of elementary and secondary schools that also have reading programs. Of the schools surveyed by Causey only forty-six reported using no instruments in their programs. The general feeling in the field appears to be that the use of the instruments must result in some value to the students. Regarding the development of a reading improvement program George S. Speer stated:

. . . the minimum program would include, for diagnostic work, one telebinocular, and one ophthalmograph and, for the instructional work, four reading pacers and one tachistoscope. In addition a variety of books, pamphlets and slides would also be needed. (60, p. 47).

This list does not include reading improvement films such as the Harvard Reading Films, which are also frequently used. The expense involved for this "minimum" program described by Speer would approximate:

ophthalmograph . . . . .	\$400
telebinocular . . . . .	200
tachistoscope . . . . .	300
reading pacers . . . . .	310
books and pamphlets . . . . .	300
miscellaneous supplies . . . . .	<u>100</u>
Total . . . . .	..\$1610

There are numerous reports of success in improving reading skills by using those instruments described by Speer as well as others (31, 44, 60). Renshaw reported gains of about 100 per cent in rate of reading through the use of the tachistoscope (50). In contrast there are also a number of reports relative to increased reading proficiency resulting from training without any mechanical equipment (5, 10, 18).

If reading ability can become more effective through either method then is there justification for the use of instruments? A glance at the tabulation of cost above will readily show that the major portion of this budget suggested by Speer is allocated for mechanical equipment. If an adequate reading program can be devised without using instruments how much effectiveness, if any, is lost by this elimination? Which of the devices is the most essential and which is the least essential? These are questions immediately pertinent to an institution which might be considering the implementation of a reading program. To the smaller colleges and secondary schools the financial issue might be the critical point in deciding whether or not such a program could be undertaken.

Also, from the point of view of the student, is the time spent working with the instruments "paying-off" as much as the non-mechanical practice? In view of the heavy academic loads that many students carry this investment of time is an important consideration. Dearborn and Wilking (23) report the meeting of a reading class at Harvard University at five o'clock in the evening because of conflicting activities. They also commented on how much of their students' time was occupied with the regular curricular activities. If it can be known how much good is derived from an instrument or a combination of instruments as opposed to training without any devices then many of the questions posed will be partially answered.

#### Hypotheses

The specific questions to which this investigation seeks answers are as follows:

What does the regular presentation of tachistoscopic exercises,

using only verbal phrases as tachistoscopic stimuli, add to a reading improvement program? The reading improvement program includes, in addition to the tachistoscope, the use of a controlled reader, practice reading exercises, and discussion of effective reading procedure with vocabulary instruction.

What is the value of using a controlled reader in a reading improvement program? The training in this case will include, in addition to the controlled reader, the same training described in the preceding paragraph.

What improvement in reading ability will be observed in a reading program utilizing only practice reading, instruction in effective reading procedures and vocabulary drill, excluding the use of the tachistoscope and the controlled reader?

Will any or all of the methods described result in reading improvement in excess of that observed in a similar group of students having no special training in reading during the same period of time?

The experimental method will be best served if these questions are restated in terms of the acceptance or rejection of four basic hypotheses. Formulated as null hypotheses they take the following form:

First Hypothesis: In a reading improvement program there will be no differences in the mean gains in reading ability between a group receiving regular training with tachistoscopic exercises and equivalent groups which do not receive such practice.

Second Hypothesis: In a reading improvement program there will be no differences in the mean gains in reading ability between a group receiving regular training with the controlled reader and equivalent

groups which do not receive such training.

Third Hypothesis: A book centered reading program, not using mechanical instruments to facilitate improvement, will not result in a mean gain in reading ability at the termination of that program, different from the level reached by equivalent groups trained with mechanical devices.

Fourth Hypothesis: The reading program, whether using mechanical or non-mechanical methods, will not result in gains in reading ability different than the gains observed in an equivalent group receiving no reading training.

A valid test of these hypotheses will reveal answers to most of the questions previously presented.

## CHAPTER II

### REVIEW OF THE LITERATURE

It is proposed in this chapter to review that part of the literature which is related to the investigation outlined in the previous chapter. It is deemed worthwhile to survey the research which generally impinges on the problem as well as that which is more directly related. In order to furnish background for the development of the problem the first section in the review of the literature will include a general discussion of the experimental work related to reading improvement. The latter portion of the survey will be devoted more narrowly to presenting the works directly pertinent to "mechanical" versus "non-mechanical" methods of improving reading.

#### The General Reading Improvement Program

A question that has been asked by college professors and deans, parents and even students is why is it necessary to teach reading at the college level. Reading ability is a skill usually developed in elementary school and traditionally is not taught at any higher educational level. Reading ability, however, is a process of development which probably is never completely mastered. There is evidence that individuals of any age can improve their reading ability (55). Regarding this adult reading training Paul Witty stated:

Several investigators have pointed out that the reading ability of a considerable number of college students is regrettably inadequate

[and have] demonstrated that systematically planned remedial instruction will yield remarkably beneficial results . . . (72, p. 464).

The reading skills demanded of the grade school pupil show a marked difference from those required of a college student or business executive. The reading level attained in the elementary educational program may be quite adequate for the sixth grader. There isn't too much material that must be read and the slow, methodical reading approach may suffice. However, the adult may have a great mass of reading that must be accomplished over relatively short periods of time. The slow reading pace developed in his early years is far from satisfactory. Reading skills undergo a long genetic development but as Weber pointed out, ". . . any skill may congeal into a fixed habit long before it has realized its full potential" (70, p. 428). For this reason it is desirable to develop a program through which the adult may develop his reading proficiency (55).

Development of ineffective reading skills.---Is reading composed of a general ability or is it a complexity or interaction of a number of contributing abilities? This is a question that should be prominent when engaging in reasearch in this area. A. I. Gates believes that, "Reading composes of highly complex abilities that are not easily detected and observed" (29, p. 4). Weber stated, "No doubt numerous functions display an ideal 'whole action' in the normal reader, but the analytical approach is more suitable for understanding reading disability" (70, p. 427). Miles Tinker concurred in this opinion, stating:

Further analysis justifies the conclusion that there are many reading skills which are somewhat independent, rather than either a general silent reading ability, a general comprehension or a general speed of reading ability (65, p. 160).

Pressey and Pressey (48) concluded that there are four distinct factors related to silent reading ability. One: the individual should be

free from oral reading habits. Two: the subject must have a large reading vocabulary and a good general background of information. Three: interest must be developed within the individual to motivate reading of a proper sort. Four: the individual must develop effective habits of application and attention. Regarding this, F. P. Robinson stated:

Usually associated with small span in poor readers are carry-over habits from oral reading, e. g., lip movement and word by word reading, or at least failure to progress from word perception to phrase perception (52, p. 555).

According to Weber (70) the propensity of poor reading in adults is not a result of any special organic or physiological cause. Poor reading is rather a result of inefficient habits. Relative to this Weber stated:

Habit refers to a prevailing disposition in the form and tempo of an activity without implying primary disorder in the mechanism involved (70, p. 427).

Weber feels that these bad reading habits may operate independently or they may serve to aggravate and magnify the effects of any special disabilities an individual might have. Any special disorders and dysfunctions probably have become less significant through physical correction or remedial work by the time the individual approaches the college level. There is no question that reading difficulties do exist at the adult level but the causes are possibly less clinical than at the lower age levels (70).

Witty, et. al., (73) describe the characteristics of poor readers based on the experience of their research findings. Poor readers read most material at a very slow, uneven pace and could not modify their rate of reading to the level of difficulty of the material. These slow readers were more successful with getting meaning from short passages than from long passages but generally lacked accuracy in their reading.

They lacked the ability to concentrate upon difficult materials and were often unable to sustain their efforts for a long enough time to enable them to complete assignments. These people also had poorer than average vocabulary scores and did very little leisure reading.

Importance of the reader's attitude.---Perhaps the essence of a good reading program is the development of a positive attitude toward reading (40). If such an attitude is not present it is unlikely that reading improvement will have much permanence. Barry (8) felt that one of the critical factors in increasing reading ability was to focus the attention of the pupil on the possibility of his own self improvement in reading. Regarding this Moore said the most valuable indication of the success of his technique was a:

. . . change in the attitude toward work from one of despair to one of frankly facing a difficulty and finding a way out, and a gradual growth of the conviction that difficulties and weaknesses are not so much due to native inabilities as to inadequate technique or background (40, p. 632).

Sheldon pointed up this need for an attitude change in his statement, "Reading . . . demands continuous and specific practice in order to maintain a high level of efficiency" (55, p. 227). Consequently the individual who isn't aware of the need of making an effort to maintain a higher reading level quite likely will not.

Benefits from a reading improvement course.---With the increased awareness of the serious need of assistance in reading at the adult level many programs have been developed. Witty, et. al., (73) believed that improvement in reading often helped the college student in his total adjustment in college. Burke (16) also stated that an attendant benefit of such a program was the improved morale and confidence of the student in his other college courses.



Do students obtain increases in reading ability as a result of a reading improvement program and, if so, how much improvement takes place? Remmers and Stalnaker, (51) at Purdue University, investigated the gain of seven students in terms of rate and comprehension, using remedial speed drills. During the program the need for urging oneself beyond one's accustomed rate was continually stressed, keeping in mind, of course, that understanding and remembering material was also essential. Remmers and Stalnaker reported, "The results indicate . . . that the increase in both these functions [rate and comprehension] approximate twenty-five per cent for the material read" (51, p. 800).

A study by Lauer, (34) of Ohio State University, verified the expectation that the reading speed of college students may be improved as much as one hundred per cent in many cases. Dearborn and Wilking (23) conducted a study at Harvard using the Harvard Films in conjunction with exercises of reading phrases of gradually increasing length. This was a six weeks course meeting three, fifty minute periods a week. The students were pre- and post-tested on the Co-operative Reading Tests, the Nelson-Denny Reading Tests, and the Iowa Silent Reading Test and made gains on all three which were significant at the .01 level of confidence. Dearborn and Wilking (23) didn't use a control group so it is impossible to determine how much of the improvement reported would have occurred without any training.

Using vocabulary building exercises, the Keystone Flashmeter, speed reading practice, and other techniques, Witty, et. al., (73) report gains of reading rate from 272 words per minute to 474 words per minute, as well as an increase in comprehension. Barry and Smith (8) got rather substantial gains on the Nelson-Denny Reading Test with a class of ninth

graders, using the Iowa Reading Films.

Whether to emphasize speed or comprehension.--There are several approaches to reading improvement apart from the "mechanical versus non-mechanical" issue. Some educators (5, 42, 51, 70) favor emphasizing increase in speed; others (21, 67) feel that stressing comprehension gains is the key to improved reading. C. O. Weber felt that the first and most important hurdle to overcome in reading is sheer slowness, and stated:

To begin with I ask my subjects to read more rapidly even at the cost of failing to grasp most of what they read. In time, comprehension returns to its original level but speed remains on a higher one (70, p. 430).

As a result, voco-auditory accompaniments, as well as some other inefficient methods, ". . . tend to drop out because of sheer inability to keep up with fast reading" (70, p. 430). This procedure has been effective with other forms of learning as well. Fulton (28) reported that early emphasis of speed while learning two motor skills frequently gave better results than early emphasis on accuracy.

Mullins, who in one experiment forced a group of average readers to read at least 1000 words per minute, stated:

Even if we granted . . . that comprehension necessarily falls off slightly as speed shoots up, one wonders if it may not be well worth it. Our purpose seldom requires that we get more than fifty or sixty per cent comprehension from any given piece of reading. If we must take three or four times as long to read this material in order to pick up an extra ten or fifteen percent, the slight gain hardly seems justified . . . (42, p. 173).

In the experiment described above, Mullins observed that many of the students had drops in comprehension in the early part of the program, at the same time that their speed was jumping. In almost all cases the comprehension climbed back toward and often beyond the starting comprehension by the termination of the course.

Contrary to this approach, Deal (21) reported experiments with groups

of students with the major emphasis placed on comprehension improvement. His students were drilled in reading efficiency and improved study habits for a period of one semester. This training resulted in an improvement of comprehension scores from an initial average of thirty-three to a terminal average of sixty-seven. The control group in this study, which received no special training, showed no significant improvement. No mention was made of the effect this training had on rate of reading. It is difficult to say whether or not the comprehension gains are a result of training in reading efficiency or training in study habits since Deal did not vary the two methods of training using a control group.

Tinker stressed the importance of comprehension in reading, stating, ". . . 'reading' without comprehension is not reading at all" (67, p. 559). He also says, "The only adequate definition of speed of reading is to consider its rate of comprehension" (67, p. 559). It is questionable whether perfect comprehension without an effective rate of reading is any better or worse than a rapid rate with little or no comprehension.

Relationship of speed and comprehension.---There is disparate opinion relative to the relationship between rate of reading and comprehension. Some individuals have found no relationship between the two (5, 49, 62). Others report a positive relationship between rate and comprehension, (4, 30) and still others have stated that the relationship depends largely upon the material read and the subjects involved (19, 24, 56, 65, etc.).

Stroud and Henderson reported on the basis of their study, ". . . rate and quality [of reading] are virtually unrelated" (62, p. 205). Preston and Botel (49) measured comprehension in timed and untimed reading exercises and obtained a correlation coefficient between rate and timed comprehension of .48 which they called statistically significant. With

the time variable removed the correlation between rate and comprehension yielded an  $r$  of .20, which was not statistically significant at a level acceptable to the above authors. They concluded:

Most reading tests report comprehension scores which are not true measures of an individual's comprehension score at all because speed and comprehension are relatively independent of each other (49, p. 71).

Averill and Mueller in an experiment where increased speed was strongly emphasized stated:

Increase in the speed of reading does not carry with it as a necessary concomitant an increased ability to comprehend. The way to increase comprehension is to give special training in comprehension (5, p. 129).

After summarizing several reports, Gray (30) has concluded that the available evidence indicates that a positive relationship exists between speed and comprehension but that this relationship is not necessarily invariable. He observed that the relationship appeared to be higher with children than with adults. A number of reports (4, 19, 24, 57) warn that if correlations between speed and comprehension are to have meaning the measures must utilize the same or strictly comparable materials. Anderson and Tinker said that when this criterion is met:

The data justify the conclusion that, when an adequate method of measurement is employed, there is an intimate relation between rate of reading and comprehension scores . . . (4, p. 624).

Eurich (24) felt that this relationship was dependent upon the manner in which each was measured. Eurich found that a comparison of scores on several rate measures with scores on comprehension tests yielded an average correlation coefficient of .31. He concluded that this, ". . . indicates a positive but not too close relationship between rate and comprehension" (24, p. 406). Tinker (66) reported finding a very high correlation between rate and comprehension when the material being read was easy but

that this correlation steadily decreased as the difficulty of the material increased. In regard to this, Tinker stated:

The data warrant the conclusion that there is an intimate relationship between speed and comprehension in reading when the textual material is within the reader's educational experience (66, p. 94).

Shores and Husband (56) believe that the purpose for which the material is being read determines to a large extent the relationship. They observed:

With some purposes and some materials, fast readers are the best readers. With other purposes and materials, the best readers will read as slowly or even more slowly than the inefficient readers (56, p. 57).

Agreeing with this, Pressey and Pressey reported:

It appears, then, that ability in silent reading depends very largely upon the nature of the passage read; a good reader in one type of subject matter may very likely be a poor reader with other materials (48, p. 29).

Bloomers and Lindquist, (14) on the other hand, found that it appeared that a person tended to maintain just about the same position in successful reading rate in spite of differences that might be found in the nature and difficulty of the material being read. Stroud and Henderson (62) believed that the individual who read fast or slow under one set of conditions will probably read proportionately fast or slow under other conditions. Weber concluded, "It appears . . . that the comprehension gains are due to more careful reading made possible by the speeding gains" (69, p. 457).

It appears that the purpose for which the material is being read, as well as the nature of the measurement may have some bearing upon the relationship of speed and comprehension. The question of whether the fast and the slow readers maintain their positions in different reading situations cannot be clearly answered. Most of the opinion presented above is little more than conjecture based on the individual's own particular

experiences.

What is retained from a reading improvement course?---Even if gains in reading rate and comprehension are a result of a reading improvement program, there is a question of how much of this improvement is retained for any length of time. Two studies were found which may help answer this question. Deal, (21) working with his training program, found comprehension score increases from thirty-three to sixty-seven. He retested his subjects after a time lapse of one year and found the comprehension score then to be sixty-four. He concluded that the gains which had been made were substantially retained. Mullins and Mowry, (45) in a study of adults at the Monsanto Chemical Company, found that the average speed of reading increased about two hundred per cent as a result of the training program. A retest a year later indicated that these subjects were reading about one hundred per cent faster, on the average, than when they began the course. If we judged from this study, it might be concluded that a little better than half of the improvement obtained in rate may be expected to be fairly permanent. However, Mullins and Mowry (45) did not include a control measure in this retest experiment and it is open to speculation whether or not a control group might improve without training to the same point to which the experimental group regressed.

A brief summary.---It seems possible to secure substantial gains, which have some degree of permanency, as a result of adult reading programs. Ammons and Hieronymus concluded that, "Twenty hours of training can reasonably be expected to produce rate gains of seventy-five to one hundred per cent in 'free' reading" (2, p.468). They feel that one of the greatest dangers to long range effectiveness of reading improvement

programs is the low level of goals set for themselves by the directors of the programs. They reported, "Iowa instructors found that gains in their classes were closely related to their own expectations" (2, p. 466).

#### Research on Techniques of Improvement

It isn't difficult to find in the literature support for, and protests against, the use of the various mechanical instruments designed for facilitating reading improvement. Much of the argument on both sides of this question is more philosophical than empirical. With one or two exceptions most of the literature reported here was experimental in nature. In spite of a lack of critical research justifying the effectiveness of the various devices, Causey, (20) in his survey, found that a vast majority of the schools having a reading improvement program reported using one or more mechanical devices. In the present review an effort will be made to present thinking that is representative of both camps.

The effectiveness of the mechanical approach.---George S. Speer (60) discussed theoretically the development and use of the mechanical devices and the value they may have for a reading program. He believes that in an accelerated reading course, the use of a variety of instruments is essential to the development of more rapid and efficient reading, with retention of effective comprehension. Speer didn't include any report of experimental research in his article to substantiate the usefulness of these devices. His generalizations, which appear to be somewhat less than defensible, are based upon his experience in reading improvement programs. Bernice F. Hamilton (31) discusses one instrument in particular, the flashmeter (or tachistoscope). In support of this instrument as a valid device for improving reading, she stated:

Thus . . . ability to recognize words and to associate them with a specific thought unit will result in more concentration, greater reading speed, and, therefore, better comprehension of reading . . . (31, Pp. 271-272).

Hamilton also neglects to include any experimental evidence to validate her conclusions. It appears that she assumes a concomitant relationship between rapid reading and increased comprehension, an assumption which is open to considerable question (5, 49, 62).

Relative to this same instrument, Renshaw (50) reported some very striking results. He trained three students for three thirty-minute periods for eleven weeks. As a result of this training the mean rate of the students increased from 547 words per minute to 1,137 words per minute on the material that was used. Due to Renshaw's failure to include a control group in his experiment and his using such a small number of subjects his generalizations are subject to some doubt. The relationship between the tachistoscopic span and some measures of reading ability has been investigated by Sommerfeld, and he stated:

. . . training to perceive a larger and larger series of digits in a shorter and shorter period of time cannot, in and of itself, influence the process of normal reading except as certain secondary factors, such as motivation are involved (58, p. 93).

Smith and Tate (57) conducted an experiment to try to determine the amount of improvement in adult reading ability which might accompany the use of a reading rate controller and a tachistoscope. Eighteen college students participated in at least thirty-five training periods of fifty minutes each. Half of each training period was spent flashing digits on a small screen with the tachistoscope. The subject would report the digit observed and the correctness of response would be checked. The remainder of the hour was spent by the subject reading material, from fifth to eighth grade difficulty level, on the controlled reader. Each subject



would read at a speed which he felt was appropriate, adjusting the controller as his speed went up. Smith and Tate (57) report an increase from 364 words per minute, with 80 per cent comprehension, to 433 words per minute, with 72.5 per cent comprehension. They indicate that the drop in comprehension was not statistically significant. The subjects in this experiment often reported that they felt they were making tremendous gains in reading speed as a result of using mechanical devices. However, Smith and Tate stated:

While the various tests employed indicated substantial improvements in reading rate, the improvement as measured by the reading tests was not nearly so great as was shown by the controllers (57, p. 183).

While improvement was found in reading rate by these two it was considerably less than the rate at which the student was reading on the controlled reader. It is possible that the improvement made by Smith's and Tate's subjects was no more than that experienced by untrained students.

Since a control element was not used it is not possible to draw any conclusions regarding this. The question is also raised regarding the transferability of reading skills from the instruments to a "free" reading situation. Relative to the value of these instruments, Smith and Tate said:

. . . too little is known concerning the effect of such equipment on the reading ability of persons of various ages, degrees of intelligence, and varying types of personality patterns to warrant general use of the equipment in remedial reading programs (57, p. 184).

No conclusions regarding the relative effectiveness of the tachistoscope and the controlled reader could be made, as both instruments were used with the experimental group.

Shirley Wedeen (71) using three equivalent groups trained one with the reading rate controller and another with reading without the use of

any mechanical devices. The third group was the control element and was given pre- and post-testing but received no reading training. She reported that the group trained with the reading-rate controller had greater improvement in reading speed than the group trained without any instruments, but that improvement in all other skills was equal for the two groups. She found that both the mechanical and non-mechanical groups were superior to the control group after training. Even though there were terminal differences in reading ability as measured by Wedeen the omission of the level of statistical significance for these differences stimulates speculation as to whether or not they were in excess of chance.

Reading improvement without instruments.---A. L. Bennett, (9,10) directed a program at the University of Texas combining training in study techniques with reading improvement training. He reported gains in reading proficiency resulting from this training in which no mechanical instruments were used. It is difficult to determine, from the information reported by Bennett, whether the improvement was a result of the training with study habits or reading improvement. Another reading program in which no mechanical devices were utilized is described by A. J. Cardwell (18). The regular sessions in this program were devoted to lectures, discussions, practice exercises and tests. Some of the early lectures dealt with summaries of research regarding reading improvement in an effort to assure the student that he also could improve. Such topics as concentration, eye span, skimming and timed reading were discussed, as well as hints for breaking some of the bad reading habits. At the first of the class the average speed was 297 words per minute with 70 per cent comprehension. The final testing showed an average of 417 words per minute with comprehension of 88.75 per cent - an increase of 120 words per minute

and a gain of 18.75 per cent comprehension. These gains were significant at the .01 level of confidence.

Comparing mechanical and non-mechanical methods.—Lauer, et. al., (35) using four groups receiving different types of training, reported significant gains in all four groups. While his groups differed in whether instruments were or were not used, he did not report the between group differences, nor whether his trained groups had significantly greater improvement than an untrained group.

Norman Lewis (36) used two groups in an experiment. The first group was trained exclusively to improve their eye movements by means of a number of mechanical techniques, such as the flashmeter and the metronoscope. They also had eye movement exercises. Group number two read selections of increasing difficulty as the program progressed, and these selections were thoroughly analyzed and discussed each day. No instruments were used with the second group. At the termination of the program the first group improved in speed 24.7 per cent and the second group had an average gain of 69.1 per cent. Lewis stated that:

. . . mature adults . . . can gain the most benefit in a short period of time from a reading course which stresses comprehension, sensitivity to the structure of the writing, and constant practice in rapid reading . . . (36, p. 156).

Warren C. Thompson (64) directed an experiment at the Air University in Alabama, using three groups of equal initial ability. His first group received twenty-one, fifty minute periods over a seven week period of time which was oriented around the reading rate controller. The second group devoted the same length of time to reading and working with a reading manual. The third group was his control measure and received no training at all. Thompson used the Harvard University Reading Course

Test to measure the two major aspects of reading: speed and comprehension. He found that the rate of reading of the two experimental groups had improved significantly more than a control group, and the book-centered group had improved significantly more than the machine-centered group. There were no significant differences in comprehension for the three groups.

Using a group of Marine officers as the experimental population, George Manolakes (38) eliminated the tachistoscope from the training schedule of one of the two experimental groups. The remainder of the training was identical for the two groups. He found that there was a significant difference in the rate of reading at the conclusion of the training which favored the group receiving no tachistoscopic training. From this Manolakes concluded, ". . . the results failed to indicate that the experimental group was penalized through a lack of tachistoscopic training" (38, p. 412).

Kingston (33) administered an attitude questionnaire to students enrolled in a reading program using the reading rate controller, the tachistoscope, special reading films, and a reading workbook. He found that the vast majority of the students enrolled in the program felt that the course had been beneficial in helping them to improve their reading skills. Of the group surveyed 97.07 per cent responded in the affirmative to such an inquiry. Most of the students also thought the improvement in reading skills aided them in their studies. The tachistoscope was the instrument indicated by the students as being of the least value to them.

W. D. Sheldon (54) believes the present research indicates that the improvement in comprehension resulting from the use of instruments is

slight, if any. He maintains the reason the mechanical devices do not facilitate comprehension is intimately related to the thought processes and the purposes for which we read. It is fundamental to emphasize in reading courses the need for development of concepts and background so that what is read may be better understood. Sheldon stated:

The machines don't meet these needs and until they do there is little likelihood that development of comprehension skills will be improved by mechanical techniques (54, p. 46).

Reading material should be read at different rates depending upon the purposes for which it is being read and its level of difficulty. Sheldon feels that mechanical devices don't serve to develop this flexibility of reading rate in the individual.

#### Summary

The experimental evidence presented rather conclusively indicates that improvement in reading rate and comprehension can result from a program designed to develop these skills. There appears to be agreement that a substantial portion of that improvement is retained by the trainee. Such factors as eye movements, concentration, and perceptual span have been emphasized as sources of trouble in cases of poor reading. The motivation of the reader, as well as his educational background, and interests, seems to also have an important bearing on the problem. Some writers are proponents of the use of mechanical devices in the program; others report improvement as good or better without using any instruments. There is no general agreement on the value of utilizing mechanical devices in the training. It is the purpose of this study to attempt to shed some light on the question of the relative effectiveness of these two techniques.

## CHAPTER III

### SUBJECTS, INSTRUMENTS, AND PROCEDURE

Following is a description of the subjects and the instruments, both mechanical and non-mechanical, used in this investigation. The methods and procedures used for testing the hypotheses previously presented will also be elaborated and described. The investigation involved four groups of subjects. The experimental groups, which received reading improvement training using a variety of methods, were three in number and are referred to in the remainder of this thesis as Groups I, II, and III. The training methods used for each of these three groups will be described presently. Group IV was the control group and received no training in reading skills.

#### Subjects

The subjects of this experiment were 159 college students selected from three sections of a reading improvement program offered at Oklahoma A&M College in the spring semester, 1956, and from an introductory psychology class offered the same semester. There were both males and females in each group and they represented all student academic levels from the freshman year through the graduate level. In Table I the distribution of the subjects within the groups is shown by sex and academic level. Their ages range from seventeen to thirty-five. Statistical evidence in the following chapter indicates that these groups are a random selection from the same reading population.

TABLE I  
DISTRIBUTION OF THE SUBJECTS BY SEX AND ACADEMIC LEVEL  
WITHIN GROUPS I, II, III, AND IV.

Group	N	Sex		School Classification					Mean Age Years
		M	F	Fresh	Soph	Jr	Sr	Grad	
I	36	29	7	12	6	6	6	6	22.27
II	36	26	10	9	10	9	7	1	21.49
III	54	41	13	16	8	9	13	8	22.60
IV	33	13	20	19	12	0	2	0	19.97
Total	159	109	50	56	36	24	28	15	-

#### Description of the Instruments Used in the Study

The instruments used in this investigation of the relative effectiveness of the mechanical and the non-mechanical methods in a reading improvement program were of three general types. One: the mechanical devices used to facilitate the improvement of reading skills. Two: non-mechanical practice reading exercises to help improve reading ability. Three: instruments of measurement, used to determine what improvement had taken place during the reading program. Following is a description of the instruments within each of these three categories:

##### 1. Mechanical Instruments.

One mechanical device used as a means of developing proficiency in reading skills was the tachistoscope. The tachistoscope, or the flash-meter as it is sometimes called, is manufactured by the Keystone View Company of Meadville, Pennsylvania. It is a device for projecting groups of digits or verbal phrases on a screen. It comes equipped with an auto-

matic timing device in order that the images can be exposed for differing lengths of time. The time exposures used in this experiment ranged from 100 ms.<sup>1</sup> per exposure to 10 ms. per exposure. The tachistoscopic stimuli used in this experiment were verbal phrases of varying length taken from the Keystone Phrase - Sentence Series of Tachistoslides. Describing a similar type of slide, Eugene S. Wright said, "The motivation guidance group combines perceptual training and instruction in reading. The sentences in the group are designed to motivate reading improvement" (15, p. 16). Describing the content of the slides Wright stated:

Throughout each slide there is a general increase in sentence length, allowing for gradual development of perceptual span. An overlapping of approximately 50 per cent from slide to slide allows adequate practice at each level of difficulty (15, p. 16).

The other mechanical instrument used in this study was the controlled reader which was developed by Stanford E. Tyler, Director of Research at Washington Square Reading Center. The controlled reader is a projection device using film strips of verbal material as the stimulus. The film strips contain successive lines of text material, which in this experiment were projected a line at a time on the screen. Each line includes five, six, or seven words, and the film strips were presented at speeds ranging from 250 words per minute to 500 words per minute as progress was made in the program. Each film strip contained a selection of prose which was at the high school or college level of reading difficulty. Comprehension tests were available for each of the film presentations. Developing speed is not the sole purpose of the controlled reader. According to the authors of the manual:

Speed is a consideration because it is an established fact that generally the more efficient the reader is, the higher his reading

---

<sup>1</sup>ms. (millisecond) = 0.001 second



rate is. However, the object of the controlled reader is to make the person a more comfortable and efficient reader by actually modifying his fundamental reading skill (39, p. 48).

In addition to development of speed and comprehension the controlled reading film strips present, at the first of each exercise, a list of vocabulary words which will be encountered in the exercise.

## 2. Non-mechanical Instruments.

The non-mechanical instruments used in this study were two practice reading books. The first was Study Type of Reading Exercises, by Ruth Strang. The second was Reading Skills, by William D. Baker. These two books were used in all sections, the students reading from alternate manuals on alternate days.

Strang's (61) book is a compilation of twenty reading exercises of 1000 words each. The subject matter of the exercises is efficient reading. A comprehension quiz of ten questions pertaining to each exercise was furnished the subjects. Covered in this book are such topics as reading hygiene, eye movements, purpose in reading, and diagnosis of poor reading habits. The students read the 1000 word exercise under timed conditions and then without looking back at the material read, answered the comprehension questions. In this way each subject has a record of his words per minute reading speed as well as his percentage of comprehension.

Reading Skills, by Baker, (6) is a collection of twenty-four practice exercises very similar to those of Strang. Baker also has good reading procedure as the subject matter for his exercises. These articles are 1000 words in length and have a ten question comprehension check accompanying each one. Baker stated:

The first part of this book offers information on how to increase

your reading efficiency, particularly your efficiency in reading study material and textbooks. The second part of this book . . . deals with important reading skills that are too often neglected. The later ones [chapters] are concerned with improving your literary appetite and developing a taste for good reading (6, p. iii).

Baker points out that one of the important features of this book, and this would also obtain with Strang's book, ". . . is that each chapter can be read for two purposes; for information on how to become a better reader and for development of speed" (6, p. 1).

### 3. Instruments of Pre- and Post-test Measurement.

Three measures were made before the training of all four groups began, and three measures were made subsequent to the training, in order to determine the improvement made by the subjects. The two aspects of reading, speed of reading and comprehension of reading, were measured through the use of selected unfamiliar exercises from Baker's, Reading Skills. Three of the early exercises were chosen for the pre-test measures of words per minute reading speed and percentage level of comprehension. The last three exercises in this book, with the comprehension checks, were used for a post-test measure. In this manner the rate and comprehension for the four groups before and after the training could be compared. The comprehension quizzes associated with these practice reading exercises are ten multiple choice questions over the specific material covered in each exercise. Alvin C. Eurich (25) stated that the type of instrument which seems to be most applicable for measuring retention of material read is the multiple choice test. He said:

This [precludes] the measurement of retention by recall and practically assured its measurement by recognition which probably indicates maximum retention rather than minimum (25, p. 203).

The other instrument utilized to measure reading improvement was the Nelson-Denny Reading Test (46). This test served as a measure of

level of general reading ability at the onset of the reading improvement program and an alternate form of the test was used as a measure of achievement at the conclusion of the program.

This test is divided into two parts, a vocabulary test of 100 items, and a paragraph reading test having nine paragraphs with four questions over each paragraph, or a total of thirty-six questions on the second part. In determining the raw score each correct vocabulary item is worth one point and each question answered correctly over the paragraphs is worth two points making a total possible score of 172. The test, therefore, yields three scores, one: a vocabulary score, two: a paragraph reading score, and three: a total or a general reading level score.

It was concluded that it would be well to determine the reliability of the test for students at Oklahoma A&M College. This was done by computing the Pearsonian product moment correlation between the scores for the two alternate forms of the test and by determining whether the differences between the means of the first and alternate forms of the test were statistically significant.

The tests were administered to a class of introductory psychology students. The students, both males and females, were largely freshmen and sophomores. At the first administration every other student in the class was given Form A and the alternate students were given Form B. Two days later the alternate form was administered to the members of the class; those who had previously taken Form A then took Form B, and those having had Form B then took Form A. It is felt that by using both Forms A and B with equal frequency in the two administrations that practice effect might be offset and a more accurate determination of reliability could be made. Those students ( $N = 31$ ) taking Form B and then Form A

composed what may be labeled Group X. Those taking Form A and then Form B make up Group Y, (N = 27). For statistical purposes we will call the combination of these two groups, Group Z (N = 58) in order that results from Form A and Form B may be compared irrespective of the order of administration.

In Table II are shown the Pearsonian product moment correlation coefficients between scores from the alternate Forms A and B of the Nelson-Denny Reading Test. The lowest correlation found was between the alternate forms of the paragraph reading portion of the test, ranging from an  $\underline{r}$  of .715 to an  $\underline{r}$  of .718. The differences between the correlation coefficients on the scores of the paragraph reading test are almost nil.

TABLE II  
CORRELATION OF ALTERNATE FORMS A AND B OF  
THE NELSON-DENNY READING TEST

Group	N	Vocabulary ( $\underline{r}$ )	Paragraph Reading ( $\underline{r}$ )	Total ( $\underline{r}$ )
X	31	.843 ± .052	.718 ± .087	.842 ± .052
Y	27	.861 ± .049	.715 ± .094	.839 ± .057
Z	58	.848 ± .037	.718 ± .064	.833 ± .040

Table III shows a comparison of the means of the scores for the alternate forms of the test for the vocabulary, the paragraph reading, and the total score, when Form B is administered to a population and then Form A is administered to that same population. Also indicated are the differences between the means and the statistical significance, if any, of those differences.

TABLE III

COMPARISON OF MEANS OF THE ADMINISTRATION OF FORM B AND THEN FORM A OF THE NELSON-DENNY READING TEST TO THE SAME POPULATION (N = 31).

Form	$\bar{X}$ Voc	$D_M$	$t$	$\bar{X}$ Par Rdg	$D_M$	$t$	$\bar{X}$ Total	$D_M$	$t$
B	38.81			46.07			84.87		
		1.10	.78		3.17	1.95		5.22	2.15*
A	37.71			42.90			79.65		

\* $P < .05$

In Table III the difference between the mean total score for Form B and the mean total score for Form A is significant at the .05 level of confidence.

Table IV compares the means of the scores of the sub-tests of the Nelson-Denny Reading Test when Form A and then Form B is administered to a group. The differences between these means is shown, along with the Student's  $t$ -value for that difference. As may be observed from Table IV none of these differences approach statistical significance at an acceptable level.

TABLE IV

COMPARISON OF MEANS OF THE ADMINISTRATION OF FORM A AND THEN FORM B OF THE NELSON-DENNY READING TEST TO THE SAME POPULATION (N = 27).

Form	$\bar{X}$ Voc	$D_M$	$t$	$\bar{X}$ Par Rdg	$D_M$	$t$	$\bar{X}$ Total	$D_M$	$t$
A	36.41			40.07			76.48		
		0.41	.31		0.86	.50		0.45	.19
B	37.50			40.93			76.93		

Shown in Table V is a comparison of the means of the scores for the alternate forms of the Nelson-Denny Reading Test. This table compares

the means of the vocabulary, the paragraph reading and the total score for Form A of the test with their counterparts on Form B of the test.

TABLE V

COMPARISON OF MEANS OF FORM A AND FORM B OF THE NELSON-DENNY READING TEST IRRESPECTIVE OF ADMINISTRATION SEQUENCE (N = 58).

Form	$\bar{X}$ Voc	$D_M$	$t$	$\bar{X}$ Par Rdg	$D_M$	$t$	$\bar{X}$ Total	$D_M$	$t$
A	37.10			41.59			78.17		
B	37.50	0.40	.04	43.67	2.08	1.79	81.17	3.00	1.71

As may be observed only one difference (in Table III) was significant at the five per cent level. McNemar's (37, Pp. 84-86) method of determining significance of difference of correlated means was used.

Nelson and Denny (47) in a similar reliability check using 171 college freshmen report a correlation between the total scores of the two forms of the test of  $.914 \pm .013$ . This is slightly higher than the correlation of  $.833 \pm .040$  obtained with a sample of Oklahoma A&M College students and may be due to Nelson and Denny using a larger sample.

Correlation coefficients on the scores of the alternate forms of the tests for the two components have not been reported by the authors. As shown in Table II the correlation in each group was substantially higher for the vocabulary scores of the test than for the paragraph reading. The element of motivation may explain this in part. There is considerably less physical and mental effort involved in the vocabulary part of the test than in the paragraph reading. Unless a testee was positively motivated a larger variability of response might be expected on the part requiring a greater expenditure of effort.

## Procedure

Broadly stated our hypothesis was that no significant differences would be observed in reading improvement as a result of using the mechanical techniques in a reading program as opposed to an equal amount of time spent in vocabulary drill and supervised reading exercises. For purposes of this study "reading improvement" was defined generally as increased reading proficiency, and defined specifically in terms of two factors--one: rate of reading; two: comprehension of material read. The general reading proficiency level was determined by use of the Nelson-Denny Reading Test and the factors of reading speed and comprehension were determined by using the Baker's Words Per Minute Exercises.

This investigation involved three experimental groups and one control group. The subjects of the experimental groups were those members of the Reading Improvement Course at Oklahoma A&M College who completed at least eight weeks of the course with regular attendance. The subjects in the control group were members of an introductory psychology class. Due to scheduling difficulties it was not practicable to manipulate the population in terms of selection and placement within the groups.

The Reading Improvement Course is ten weeks in duration, commencing after the first week of the regular semester. The reading classes meet twice weekly for fifty minutes. The course is neither required nor offered for academic credit, and entails an additional enrollment fee of five dollars. In view of this it seems feasible to assume that most of the enrollees were positively motivated to improve their reading ability. Although the course is ten weeks in length the terminal tests in this

experiment were administered during the eighth week. This was due to the traditionally high attrition that parallels the mid-term testing period.

Mean gains between the pre-tests and the post-tests for the various groups were used as an index to reading improvement. This approach presupposes that reading improvement is a linear function. Analysis of variance of the differences between the means of the four groups on all the initial measurements revealed that in no case did the differences approach statistical significance. Thus, linearity of reading improvement was not a factor of importance in this investigation. Since analysis of variance failed to reveal significant differences between the groups we may assume that these subjects, at least insofar as the measurements employed in this study are concerned, are a random representation of the same population.

The three experimental groups involved in this investigation received different training. The fourth group, the control group, received no training in reading improvement but was given the initial and the terminal tests of reading ability.

During the first week of the reading course all of the three experimental groups received similar treatment. At the first meeting a brief introductory description of the program was presented and Form A of the Nelson-Denny Reading Test was administered. The test was given using the exact instructions furnished in the test manual.

At the following meeting exercises from Baker's manual were given to each group. Numbers representing wpm.<sup>2</sup> were placed on the blackboard in diminishing time increments of five seconds. These instructions were

---

<sup>2</sup> wpm. = words per minute



given to the subjects:

At the signal read the material in the exercise as quickly as you can with understanding. As soon as you finish look at the black-board and I will be pointing to a number which you should write down on the form given you. This number is your rate of reading in words per minutes. As soon as you have done this, turn to the questions that have been furnished with the exercise and answer them without referring back to the text.

Three exercises were administered following this pattern. The means of the three exercise scores for rate and comprehension were then calculated yielding an initial measure of speed of reading and comprehension for each subject. This completed the pre-testing. The post-testing was accomplished in the same fashion during the eighth week. At that time Form B of the Nelson-Denny Reading Test was administered, as were three other unfamiliar exercises from Baker's manual.

After the pre-test a ten minute sound film, Speed Your Reading, (59) was shown. This concluded the orientation phase of the reading program and the remaining six weeks of the course were spent on the methods and techniques for increasing reading proficiency. The structure of the remainder of the training program was unique to each experimental group and following is a description of the technique applied and the instruments used in each of the groups.

#### Group I.

Group I met each Tuesday and Thursday at 8:00 a. m. Each day they received quick-exposure training with the tachistoscope, using tachistoslides of verbal material. At the beginning of the course the purpose of the machine was discussed with the class. The material used consisted of phrases from five words per slide increasing to seven words per slide. Each group of words on the slide would be exposed from 100 ms., decreasing in exposure time, to 10 ms. per slide. The exposure time was

gradually decreased and the length of the phrases was increased throughout the course of the program. From twenty to thirty exposures of stimulus phrases were made and the subjects wrote down as accurately as possible what they had seen at each exposure. The phrases would then be projected without the short exposure timing and the subjects could check the accuracy of their responses. Approximately fifteen minutes each day was spent using this device.

Group I also received training with the controlled reader at each session of the class. Two film strips were shown each day. The first was for warming-up purposes and was usually the strip that had been shown at the previous meeting. Following this a film strip was shown that had not been seen by the class and a short comprehension test was taken afterwards. These film strips were shown at speeds starting at 250 wpm. and increasing to a rate of 600 wpm., as the course went on. Approximately fifteen minutes of each period were devoted to this exercise.

The third phase of training received by this group was practice reading training, using the practice reading books by Strang and Baker. This consisted of timed reading drills, with each student being allowed to finish the reading exercise at his own speed. The groups were all encouraged to read as rapidly as they could with understanding. Each reading exercise yielded a reading rate score (in wpm.) and a comprehension score. These scores were recorded on a mimeographed progress chart which was kept by each student from day to day. In this manner the students could observe their daily progress in terms of rate and comprehension. Only one exercise was read each day and, with the comprehension check, required about fifteen minutes class time. If time per-

mitted the main topic of the daily reading exercise was briefly discussed by the members of the class.

In addition to the training techniques described above a ten word vocabulary list was passed out to the group at the close of each class meeting. The students were encouraged to look up these words and add them to their own daily usage. When there was time the instructor would rapidly go over the words from the previous day, pronouncing them and giving short definitions. This activity ordinarily consumed about five minutes.

#### Group II.

Group II met at 9:00 a. m. each Tuesday and Thursday. These subjects received the same training that was given to Group I except the tachistoscopic exercises. The exclusion of the tachistoscope from their training program provided approximately fifteen minutes each period that was used in expanding some of the other phases of training. Instead of one practice reading exercise from the reading manuals Group II had two exercises each day, with attendant comprehension checks. This increased the time spent on the practice reading function to twenty-five minutes each day as opposed to fifteen minutes for Group I. Also five minutes was added to the time used for vocabulary drill, permitting a somewhat more extensive discussion of the daily vocabulary lists.

#### Group III.

Group III was a combination of two sections of the reading course. One section met each Monday and Wednesday at 10:00 a. m. and the other section met each Tuesday and Thursday at 2:00 p. m. These two sections received identical training. The tachistoscope and the controlled reader were not used with Group III. This permitted increasing the time spent

on the reading exercises to thirty-five minutes each class meeting. These students read three practice reading exercises each day, with a comprehension check over each exercise. At the conclusion of an exercise and its test, a group discussion was held covering the main principles included in the exercise. A vocabulary list of ten words was also furnished this group at the conclusion of each session. The words from the preceding day's list were gone over very carefully in class. The words were written on the blackboard and the members of the class pronounced them with the instructor. Members of the group would then volunteer definitions of the words, with the instructor summarizing the correct definition at the termination of the discussion. This phase usually involved about fifteen minutes each day.

Summarized in Table VI is the way in which the time for each period was used with the various phases of the training activity. This table includes a break-down schedule for the experimental groups I, II, and III. The control group, Group IV, is not shown as they received no training. The times shown in Table VI are necessarily approximate and do not include time spent in passing out the progress charts and daily materials, or setting up the various instruments. As the time used for the various mechanical devices diminishes there is a concomitant increase in the time used in the non-mechanical phases of training.

An effort was made to keep the presentation of the training phases as consistent as possible from group to group. Quantitative evaluation of any differences occurring here was not possible, however, the instructor for all four groups was the same individual. The instructor was experienced in administering the reading program and it is believed that there were no significant differences in the general presentation.

Insofar as possible the only difference in the training received by the groups was in the omission or inclusion of the various mechanical techniques. Therefore, except for these differences the groups received training as nearly identical as possible. All the groups received their training in the same classroom.

TABLE VI

DAILY SCHEDULE OF TIME IN MINUTES DEVOTED TO THE VARIOUS TRAINING TECHNIQUES FOR GROUPS I, II, AND III.

Group	Tachis.	Controlled Rdr.	Rdg. Exc.	Voc.	Total
I	15	15	15	5	50
II	-	15	25	10	50
III	-	-	35	15	50

All of the subjects were furnished with a mimeographed progress chart, on which they recorded their speed of reading and level of comprehension for the daily practice reading exercises. It was felt that such a chart might provide increased motivation to better reading. Regarding this, Dearborn and Wilking stated:

. . . a student's interest is immeasurably improved when he is allowed to follow his progress from day to day on an intelligible and easily read record card (22, p. 675)

The statistical treatment of the data collected in the experiment is presented in the following chapter.

## CHAPTER IV

### TREATMENT OF DATA AND ANALYSIS OF RESULTS

In order that the hypotheses stated in Chapter I may be tested it seemed most appropriate to apply the analysis of variance technique to the data. If the resulting F was statistically significant, the t-test was then used to determine specifically which means differed. The five per cent level of confidence will be accepted as the minimum level of statistical significance in this investigation.

#### The Initial Homogeneity of the Groups

In an investigation involving an effort to determine the relative effect of an independent variable upon several groups it is desirable to know whether or not the members of those groups represent a random selection of the same population. The results of each of the pre-test measures employed were analyzed separately to determine whether or not there were significant differences between the means of the four groups prior to any training.

The American Council on Education Psychological Examination is a part of the battery of tests given to students entering Oklahoma A&M College for the first time. The "L" scores made by the Subjects in this study on this test were obtained from the College Testing Bureau. Differences in linguistic aptitude in the groups which might not be reflected in initial reading ability should be taken into account. For this reason the variance of the "L" scores of the ACE test was analyzed. Scores on

this test were available for only 128 of the 159 subjects involved in this experiment. The missing scores were not found to be restricted to any one of the groups or to any particular type of student involved in the experiment. Therefore, it is assumed that the available scores will not diminish representativeness of the sample, and that the obtained F will be valid. In Table VII the variance of the "L" scores of the ACE test is analyzed for the four groups.

TABLE VII  
ANALYSIS OF VARIANCE OF THE "L" SCORES OF THE ACE TEST  
FOR GROUPS I, II, III, AND IV.

Source	Sum of Squares	df	Mean Square	F	P
Between	496.91	3	165.64	.882	-
Within	23293.52	124	187.85		
Total	23790.43	127			

As may be seen from Table VII the F of .882 does not approach statistical significance at the five per cent level of confidence, and the assumption that the groups do not differ in linguistic ability as measured by the "L" part of the ACE test, may not be rejected. Any difference between the groups in gain in reading ability cannot be assumed to result from differences in verbal aptitude.

Table VIII shows the analysis of variance of the Form A, Nelson-Denny Reading Test scores for the groups, prior to receiving any training.

The F of .546 indicated in Table VIII is not statistically significant at an acceptable level. Reading ability, as measured by the Nelson-Denny Reading Test, does not differ between the groups prior to their

participating in the reading improvement program.

TABLE VIII

ANALYSIS OF VARIANCE OF PRE-TRAINING, NELSON-DENNY READING TEST,  
(FORM A) SCORES FOR GROUPS I, II, III, AND IV.

Source	Sum of Squares	df	Mean Square	F	P
Between	1098.20	3	366.07	.546	-
Within	104145.57	155	671.90		
Total	105243.77	158			

Table IX shows the analysis of variance of the reading speed scores of the Baker's Words Per Minute Exercises before the beginning of the reading program for the four groups.

TABLE IX

ANALYSIS OF VARIANCE OF BAKER'S WORDS PER MINUTE PRE-TRAINING  
READING SPEED SCORES FOR GROUPS I, II, III, AND IV.

Source	Sum of Squares	df	Mean Square	F	P
Between	30293.55	3	10097.85	1.59	-
Within	980555.61	155	63261.65		
Total	1010849.16	158			

The F of 1.59 in Table IX indicates that the differences between the reading speed score means for the four groups, at the onset of the reading program, as measured by Baker's Words Per Minute Exercise, are not statistically significant at an acceptable level. The groups are homo-



geneous in terms of this particular reading ability, as thus measured.

Table X presents analysis of variance of pre-training comprehension scores for the Baker's Words Per Minute Exercise for the groups.

TABLE X

ANALYSIS OF VARIANCE OF BAKER'S WORDS PER MINUTE PRE-TRAINING  
COMPREHENSION SCORES FOR GROUPS I, II, III, AND IV.

Source	Sum of Squares	df	Mean Square	F	P
Between	74.72	3	24.91	.033	-
Within	11638.88	155	75.08		
Total	11713.60	158			

The F of .033 in Table X does not approach statistical significance at the five percent level of confidence and we must assume that no significant differences exist between the means of the four groups on these four groups on these scores, prior to training in reading proficiency.

Verbal aptitude, reading speed, reading comprehension, and general reading ability were measured and in no case did the groups differ significantly. Thus, it is reasonable to assume that the members of these groups are a random sample of the same population prior to the training received in the reading improvement program.

The question of whether improving reading proficiency is a linear or a growth function is not of importance to this investigation since the groups are of equal initial reading ability.

#### The Change in Reading Ability

Shown in Table XI are the pre-training means with the standard dev-

iations and the post-training means with the standard deviations of Form A and Form B of the Nelson-Denny Reading Test for the groups. As was shown in Table VIII the pre-training means on Form A of the Nelson-Denny Reading Test were not significantly different for the four groups.

TABLE XI

SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE PRE-TRAINING TEST SCORES (FORM A) AND THE POST-TRAINING TEST SCORES (FORM B) OF THE NELSON-DENNY READING TEST FOR GROUPS I, II, III, AND IV.

Group	N	Pre-tng $\bar{X}$ and SD	Post-tng $\bar{X}$ and SD	$D_M$	t-value	P
I	36	81.78 27.36	87.31 29.74	5.53	.821	-
II	36	85.17 22.33	90.64 21.85	5.47	1.050	-
III	54	78.22 26.03	87.91 26.62	9.69	1.914	.10
IV	33	79.97 26.21	87.27 24.83	7.30	1.160	-

It may be noted from Table XI that on the Nelson-Denny Reading Test, which combines a measure of vocabulary, reading speed, and comprehension, each group gained in score. Group III, which did not receive training with the mechanical devices, made the greatest gain. However, this gain of 9.69 points by Group III is statistically significant at only the ten per cent level of confidence. It is interesting to note that after six weeks of reading training, Groups I and II made gains in scores, as measured by this instrument, which were not as great as the gain made by Group IV, the control group, which had no special reading training at all. None of the differences between the pre- and the post-training means for Groups I, II, and IV are statistically significant at an acceptable level.

The variability of two of the groups increased slightly, and two decreased slightly in variability, on the post-training means of the Nelson-Denny Reading Test. The pre- and post-training standard deviations for the groups do not differ to any great degree. Wedeen (71) reports that training in reading often produces an increase in the heterogeneity of the population, causing a greater variability in reading skill. This was not observed in the current investigation with the instrument that was used with this particular population.

Table XII shows the significance of differences between the pre-training and the post-training mean reading speed scores, as measured by Baker's Words Per Minute Exercise, for the four groups.

TABLE XII

SIGNIFICANCE OF DIFFERENCES BETWEEN THE PRE-TRAINING READING SPEED SCORES AND THE POST-TRAINING READING SPEED SCORES FOR THE BAKER WORDS PER MINUTE EXERCISE FOR GROUPS I, II, III, AND IV.

Group	N	Pre-tng $\bar{X}$ and SD	Post-tng $\bar{X}$ and SD	DM	t-value	P
I	36	310.47 105.36	490.42 236.17	179.95	4.175	.001
II	36	295.44 71.95	490.69 281.84	195.25	4.028	.001
III	54	274.83 70.71	609.41 346.92	334.58	6.950	.001
IV	33	299.15 62.81	292.33 66.48	6.82	.428	-

Groups I, II, and III, the experimental groups, all increased substantially in reading speed, as measured by the Baker's Words Per Minute Exercise. Group III had the greatest improvement between the pre- and

the post-training scores, making an average gain of 334.58 words per minute. This compares to increases of 179.95 wpm. for Group I and 195.25 wpm. for Group II. Group IV did not improve in reading speed during this six weeks period, in fact, the post-training mean for this group was 6.82 wpm less than the pre-test means. This decrease in speed did not approach statistical significance at an acceptable level, however. The differences between the pre- and post-training means for Groups I, II, and III were all statistically significant at the .001 level of confidence.

The variability of the scores increased considerably from the pre- to the post-training measurement for all the groups except Group IV, and the increase here was slight.

Presented in Table XIII are the means of the pre- and post-training comprehension scores, as measured by Baker's Words Per Minute Exercise for the four groups. Also shown are the differences between these means and the level of statistical significance of each.

TABLE XIII

SIGNIFICANCE OF DIFFERENCES BETWEEN THE PRE-TRAINING COMPREHENSION SCORES AND THE POST-TRAINING COMPREHENSION SCORES FOR THE BAKER WORDS PER MINUTE EXERCISE FOR GROUPS I, II, III, AND IV.

Group	N	Pre-tng $\bar{X}$ and SD	Post-tng $\bar{X}$ and SD	$D_M$	t-value	P
I	36	76.25 7.96	60.89 11.71	15.36	6.51	.001
II	36	75.03 7.84	58.03 10.04	17.00	8.01	.001
III	54	75.02 8.96	55.70 10.31	19.32	10.39	.001
IV	33	76.55 9.23	69.46 12.26	7.09	2.66	.02

Table XIII indicates that all of the four groups decreased in comprehension after the six weeks period. Groups I, II, and III had mean losses in comprehension that were significant at the .001 level of confidence. The mean loss of 7.09 points by Group IV was significant at the two per cent level. The comprehension scores yielded by the Baker Words Per Minute Exercise had a greater variability for the post-test scores than for the pre-test scores.

#### The Relative Effect of the Various Techniques

To measure the relative effect of the various methods of presenting a reading improvement program a comparison was made by analysis of variance of the mean differences between the pre-test and the post-test scores of the instruments used for the groups involved.

Table XIV shows the analysis of variance of the mean differences between the pre-training scores and the post-training scores of the Nelson-Denny Reading Test for the four groups.

TABLE XIV

ANALYSIS OF VARIANCE OF THE MEAN DIFFERENCES BETWEEN THE PRE-TRAINING SCORES (FORM A) AND THE POST-TRAINING SCORES (FORM B) OF THE NELSON-DENNY READING TEST FOR GROUPS I, II, III, AND IV.

Source	Sum of Squares	df	Mean Square	F	P
Between	540.55	3	180.18	1.636	-
Within	17074.56	155	110.16		
Total	17615.11	158			

As shown in Table XIV the mean differences between the pre-training and the post-training scores for the Nelson-Denny Reading Test are not

significantly different, at an acceptable level. Insofar as whatever is measured by this instrument, the differences in the training technique do not significantly effect the terminal results. In fact, six weeks of training in reading skills did not cause the groups receiving that training, to have terminal reading ability scores that were, in terms of statistical significance, any different than the scores made by the control group, which had received no training.

Presented in Table XV are the results of analysis of variance of the mean differences between the pre- and post-training reading speed scores of the Baker Words Per Minute Exercise for the groups.

TABLE XV

ANALYSIS OF VARIANCE OF THE MEAN DIFFERENCES BETWEEN THE PRE-TRAINING READING SPEED SCORES AND THE POST-TRAINING READING SPEED SCORES OF THE BAKER WORDS PER MINUTE EXERCISE FOR GROUPS I, II, III, AND IV.

Source	Sum of Squares	df	Mean Square	F	P
Between	11571143.69	3	3857040.48	6.89	.001
Within	8678566.22	155	55990.75		
Total	20249709.91	158			

The F of 6.89 indicated in Table XV is highly significant, statistically. With three and 155 degrees of freedom an F as great as 6.89 is significant at the .001 level of confidence. It is appropriate to apply the t-test to the data to determine specifically which of the means differ.

Table XVI lists the mean differences between the pre-training reading speed scores and the post-training reading speed scores of the Baker Words Per Minute Exercise for the four groups. The t-values are indicated for the difference between the differences for each combination of

mean differences.

TABLE XVI

SIGNIFICANCE OF DIFFERENCES BETWEEN THE MEAN DIFFERENCES OF THE READING SPEED SCORES OF THE BAKER WORDS PER MINUTE EXERCISE FOR GROUPS I, II, III, AND IV.

Group		I	II	III	IV
N		36	36	54	33
M <sub>D</sub>		179.95	195.25	334.58	6.82
		<u>t</u>	<u>t</u>	<u>t</u>	<u>t</u>
I	36	179.95	-.28	3.04*	3.27**
II	36	195.25	-	2.74*	3.54**
III	54	334.58	-	-	6.53**
IV	33	6.82	-	-	-

\*P < .01

\*\*P < .001

As indicated in Table XVI the differences between the mean differences of the pre-training and post-training reading speed scores, as measured by the Baker's Words Per Minute Exercise, for Groups I and II yielded a t-value of .28 which does not approach statistical significance at an acceptable level. These two groups (I and II) were composed of subjects who received training with the mechanical devices in addition to the regular reading practice. Group III had a mean gain in reading speed that was greater than that of either Group I or II. The differences between Groups I and III and Groups II and III were significant at the .01 level of confidence. All of the experimental groups had mean speed gains superior to Group IV. The t-value for the differences between Groups I and IV, II and IV, and III and IV were all significant at the .001 level of

confidence. There can be little doubt that students in a reading improvement program of the type described in this study will have gains in speed of reading in excess of the gains that might be experienced by the average non-trained college student.

Shown in Table XVII is the analysis of variance of the mean differences between the pre-training comprehension scores and the post-training comprehension scores of the Baker's Words Per Minute Exercises for the four groups.

TABLE XVII

ANALYSIS OF VARIANCE OF THE MEAN DIFFERENCES BETWEEN THE PRE-TRAINING COMPREHENSION SCORES AND THE POST-TRAINING COMPREHENSION SCORES OF THE BAKER WORDS PER MINUTE EXERCISE FOR GROUPS I, II, III, AND IV.

Source	Sum of Squares	df	Mean Square	F	P
Between	3197.88	3	1065.96	8.332	.001
Within	19828.69	155	127.93		
Total	23026.57	158			

As shown in Table XVII the F of 8.332 has high statistical significance, indicating that the differences in the mean pre- and post-training comprehension scores, as measured by the Baker's Words Per Minute Exercise, greatly exceed those that might be expected by chance. The F of 8.332 reaches the .001 level of confidence. To determine which particular set of means differ significantly the t-test was applied to the data.

In Table XVIII are shown the mean differences for each of the four groups between the pre-training measurement of comprehension and the



post-training measurement of comprehension. Also listed in Table XVIII are the  $t$ -values for the differences between the differences for each combination of mean differences.

TABLE XVIII

SIGNIFICANCE OF DIFFERENCES BETWEEN THE MEAN DIFFERENCES OF THE READING SPEED SCORES OF THE BAKER WORDS PER MINUTE EXERCISE FOR GROUPS I, II, III, AND IV.

Group		I	II	III	IV	
	N	36	36	54	33	
	$M_D$	15.36	17.00	19.32	7.09	
		$\underline{t}$	$\underline{t}$	$\underline{t}$	$\underline{t}$	
I	36	15.36	-	.617	1.628	3.040*
II	36	17.00	-	-	.872	3.643*
III	54	19.32	-	-	-	4.892*
IV	33	7.09	-	-	-	-

\* $P < .01$

As may be seen from Table XVIII the difference between the mean differences for Groups I and II results in a  $\underline{t}$ -value of .617 which is not statistically significant at an acceptable level. The differences between the mean differences of Groups I and III and Groups II and III also are not statistically significant at an acceptable level. Group IV has a mean difference on comprehension scores that is significantly smaller than mean differences of the three experimental groups. It should be kept in mind that the mean differences of all four groups represent a loss in comprehension over the six weeks period. The  $\underline{t}$ -value for the differences between Groups I and IV, II and IV, and III and IV are all

significant at the .001 level of confidence. It would appear that six weeks of reading improvement training as presented by this particular program has as a consequence a decrease in comprehension in reading, as measured by the Baker test.

### Discussion

It is reasonable to assume that the four groups involved in this investigation were equivalent in terms of reading ability at the onset of the program. At the conclusion of the program differences in reading ability, as measured by the rate and comprehension exercises taken from Baker's manual, were found to exist between the groups. These differences far exceeded chance expectancy.

The other instrument, the Nelson-Denny Reading Test, in terms of improvement in reading ability, failed to differentiate between the trained groups and the non-trained group. Although some improvement was indicated by the differences in pre- and post-training measurement on the Nelson-Denny test, it was not sufficient in any of the groups to reach the five per cent level of confidence. The improvement here was about the same for all four groups, irrespective of training methods, or for that matter, of whether any training was received at all.

On the other hand the post-training measurement, using Baker's Words Per Minute Exercises, indicated substantial and highly significant gains in reading speed for the three experimental groups. The control group in the same six weeks period had no significant change in the rate of reading.

Also observed from this measurement of reading speed was a difference between the groups receiving training with mechanical instruments and the group that was trained with the reading exercise manuals and

vocabulary drill. From the point of view of speed of reading, it appears that time devoted, in a reading program, to work with the mechanical devices could more profitably be spent in practice reading. There was no significant difference in the terminal gains made by Groups I and II. The tachistoscope, as used in a program of this length, apparently does not measurably affect an increase in rate of reading.

Concomitant to this increase in reading speed in the experimental groups is a considerable lessening in comprehension of the material read. However, it should be noted that the control group, which did not increase in speed also dropped in comprehension. From this we might conclude that the initial and terminal measurement of comprehension are not of equal difficulty. Even so, the loss in comprehension suffered by the experimental groups was significantly greater than the loss experienced by the control group. This difference far exceeded that which might be expected to occur by chance.

It has been suggested that an absolute measure of the amount of reading with understanding that is accomplished by a reader can be determined (65, 66, 67). Tinker calls this "rate of comprehension" (67, p. 560). This rate of comprehension is computed by multiplying the number of words read per minute by the percentage of comprehension. For example 200 wpm. with 100 per cent comprehension would yield a rate of comprehension of 200 wpm.; 400 wpm. with 50 per cent comprehension would also yield a rate of comprehension of 200 wpm. Unless the measure of comprehension was known to have a high degree of validity this would seem to be a somewhat tenuous result. While this method may be legitimate, the research regarding the relationship between speed of reading and comprehension is so inconclusive as to subject it to considerable

doubt. For this reason the "rate of comprehension" was not computed in this study.

It should be noted that the experimental groups would read more material in a given period of time than the control group. Of this material read the percentage of comprehension would be somewhat lower for the experimental groups than the control group. In view of the ambiguity of the available information regarding the relationship of comprehension and speed of reading it is uncertain what the net amount of reading with understanding would be for the various groups.

Subject to the limitations imposed by the design of this experiment, it doesn't seem reasonable to doubt that students trained by the techniques employed in the Oklahoma A&M College reading program will improve in reading speed. The data seem to justify the conclusion that attendant to this increase in rate is a decline in comprehension. However, the loss in comprehension is not necessarily proportionate to the gain in rate. Group III was significantly superior to Groups II and III in terms of rate of reading, but in terms of comprehension loss there was no significant difference between the three groups.

Some interesting questions are posed by the Nelson-Denny test's failure to differentiate between the four groups, which are so obviously disparate regarding speed and comprehension.

It would seem that either Baker's Words Per Minute Exercise doesn't yield a meaningful measure of reading speed and level of comprehension or there are other factors involved in reading ability as measured by the Nelson-Denny test. A number of possible explanations exist for this instrument's failure to yield comparable results. One possibility might be that the Nelson-Denny test is not a measure of reading ability, being

rather a measure of reading aptitude or verbal intelligence, which might be relatively constant. It is almost untenable that six weeks of concentration on reading improvement would not yield some measurable increase in proficiency.

Another possibility in view of the negative relationship observed between rate and comprehension is that perhaps a balance has been achieved; as speed of reading increased the level of comprehension decreased until the net result was a level comparable to the original level of reading ability.

These two possibilities are presented as theoretical conjecture and are made defensible in no way by the results of this experiment.

One other possible explanation for the relationship observed between speed and comprehension is that at the start of the program the subject's speed was relatively low but the comprehension was fairly high. The importance of rapid reading was impressed upon the groups so that in their effort to obtain maximal rate perhaps the level of comprehension temporarily fell. At this less than optimum level it was measured. An interesting extension of this study would be to increase the length of the program and make periodic measures of rate and comprehension to determine if the comprehension would return to or above its initial level.

## CHAPTER V

### SUMMARY AND CONCLUSIONS

#### General Summary of the Investigation

Development of the hypotheses.---This study was designed to investigate the relative effect of a machine centered approach as opposed to a non-mechanical or book centered approach in a reading improvement program. In general terms the hypothesis tested was: there will be no differences in the reading improvement experienced by subjects who receive, as a part of their practice, training with mechanical instruments and subjects who receive training in reading improvement that includes no mechanical devices. This study was made by formulating four null hypotheses and conducting an experiment that would provide tests for these hypotheses. The null hypotheses were stated in Chapter I as follows:

First Hypothesis: In a reading improvement program there will be no differences in the mean gains in reading ability between a group receiving regular training with tachistoscopic exercises and equivalent groups which do not receive such practice.

Second Hypothesis: In a reading improvement program there will be no differences in the mean gains in reading ability between a group receiving regular training with the controlled reader and equivalent

groups which do not receive such training.

**Third Hypothesis:** A book centered reading program, not using mechanical instruments to facilitate improvement, will not result in a mean gain in reading ability at the termination of that program, different from the level reached by equivalent groups trained with mechanical devices.

**Fourth Hypothesis:** The reading program, whether using mechanical or non-mechanical methods, will not result in gains in reading ability different than the gains observed in an equivalent group receiving no reading training.

Subjects.---The experimental subjects, which were divided into three groups, were members of four sections of the Oklahoma A&M College reading improvement program. The control subjects were members of an introductory psychology class at the same institution.

Procedure.---The methods of training for the three experimental groups were similar in that all received the same fundamental reading practice and vocabulary work. The training methods differed in that Group I had supplementary tachistoscopic training and Group II had training with the tachistoscope and the controlled reader. The equivalent amount of time devoted to mechanical practice with these two groups was used to broaden the time spent in reading practice and vocabulary work for Group III. Group III received no training with the mechanical instruments. Group IV, was the control group and received no training in reading improvement.

Results.---It was found that in terms of reading ability, as meas-

ured by the instruments employed, the four groups were initially equivalent.

In terms of general reading ability, as measured by the Nelson-Denny Reading Test, no differences, statistically significant at the five per cent level of confidence, were found in mean gains of reading ability between the four groups.

Measuring the speed of reading in words per minute, there were significant inter-group differences between all of the groups except between the two groups trained with mechanical instruments. Groups I and II did not differ significantly, at an acceptable level of confidence, from each other. In mean gains in reading rate Group III, receiving no mechanical training, was significantly superior to the other two experimental groups at the .01 level of confidence, and superior to the control group at the .001 level of confidence. Groups I and II had gains which were significantly greater than Group IV at the .001 level of confidence.

In terms of comprehension of material read all groups comprehended less on the terminal measurement than on the initial measurement. Groups I, II, and III had a mean drop in comprehension which was significantly greater than the loss observed in the control group, at the .001 level of confidence. The three experimental groups did not differ, at an acceptable level of confidence, on mean loss in comprehension.

### Conclusions

The results of this investigation are not nearly as consistent as might have been desired, and for that reason clear-cut, unambiguous conclusions may not readily be drawn. If the Nelson-Denny test is accepted as a valid measure of reading ability then we must conclude that six



weeks of reading training failed to result in reading improvement in excess of that which might be achieved in the normal course of college activities. On the other hand, data from the Baker Words Per Minute Exercise clearly indicate that the non-mechanically trained group had gains in speed that were superior to the gains in the mechanically trained groups or in the control group. The mechanically trained groups did not differ significantly from each other but were substantially superior to the control group in mean gains of reading speed. The three experimental groups were not different in terms of comprehension loss but all experienced losses greater than those sustained by the control group.

It is believed the obtained data justify the following conclusions:

1. The mean gains made by Group I (trained with the tachistoscope) in comprehension and general reading ability were not different than the mean gains made by Groups II and III. However, Group III was superior to Group I in terms of gain in rate of reading. We must, therefore, reject the first null hypothesis.
2. Group II and Group III did not significantly differ in mean gains in general reading ability or comprehension but Group III was superior in mean gains of reading speed, making the second null hypothesis untenable.
3. Group III, which received no training with mechanical instruments, had a mean gain in reading speed that surpassed the mean gains of either Group I or II. The three groups did not significantly differ on the other aspects measured. The third null hypothesis is then not acceptable.
4. The three groups receiving training in reading improvement were superior to the control group which received no special reading training, in terms of mean gains of reading rate. The control group, however, had a

decrease in mean comprehension scores that was not as great as the decrease in the three experimental groups. The four groups did not differ on gains of general reading ability as measured by the Nelson-Denny test. Since in reading the relative importance of comprehension and speed is not known, sufficient evidence has not been obtained to justify the rejection of the fourth null hypothesis.

One general conclusion that seems appropriate is that time spent, in a reading improvement program, on practice reading exercises and vocabulary drill is more profitable to the student than the same amount of time devoted to training with mechanical devices. This generalization, of course is confined to the instruments that were used in this investigation, and subject to the limitations and conditions imposed by the experimental design.

## BIBLIOGRAPHY

1. Allen, Robert M. "Adult Reading Improvement at an Army Service School." School and Society, LXXIV, (August, 1951), 72-76.
2. Ammons, R. B., and Hieronymus, A. M. "Critical Evaluation of a College Program for Reading Improvement." Journal of Educational Psychology, XXXVII, (December, 1947), 449-470.
3. Anderson, Irving H., and Dearborn, W. F. The Psychology of Teaching Reading, New York: Ronald Press Company, 1952.
4. Anderson, V. L., and Tinker, M. A. "The Speed Factor in Reading Performance." Journal of Educational Psychology, XXVII, (November, 1936), 621-624.
5. Averill, L. A., and Mueller, L. A. "The Effect of Practice on the Improvement of Silent Reading in Adults." Journal of Educational Research, XVII, (February, 1928), 125-129.
6. Baker, William D. Reading Skills, New York: Prentice-Hall Inc., 1953.
7. Barbe, Walter R. "Reading Improvement and Group Intelligence Test Scores." School and Society, LXXXII, (September, 1955), 72-73.
8. Barry, R. F., and Smith, P. E. "An Experiment in Ninth Grade Reading Improvement." Journal of Educational Psychology, XLV, (November, 1954), 406-414.
9. Bear, Robert M., and Imus, H. A. "Changes in Reading Performance During the Freshman Year of College." Journal of Educational Psychology, XXX, (December, 1939), 667-673.
10. Bennett, A. L. "An Experiment in Reading." Michigan Educational Journal, XXX, (January, 1953), 302-303.
11. \_\_\_\_\_. "Two Experimental Groups in Reading." College English, XV, (January, 1954), 233-235.
12. Berman, Isabelle, and Bird, Charles. "Sex Differences in Speed of Reading." Journal of Applied Psychology, XVII, (June, 1933), 221-226.
13. Black, E. L. "The Difficulties of Training College Students in Understanding What They Read." British Journal of Educational Psychology, XXIV, (February, 1954), 17-31.

14. Bloomers, Paul, and Lindquist, E. F. "Rate of Comprehension of Reading: Its Measurement and Its Relation to Comprehension." Journal of Educational Psychology, XXXV, (November, 1944), 449-473.
15. Brown, J. I., and Wright, E. S. Manual of Instructions for Use With the Minnesota Efficient Reading Series of Tachistoslides, Keystone View Company, Meadville, Pennsylvania, 1951.
16. Burke, Armand. "Building a Remedial Reading Program." Peabody Journal of Education, XXXI, (March, 1954), 285-288.
17. Buswell, Guy T. "The Relationship Between Rate of Thinking and Rate of Reading." School Review, LIX, (September, 1951), 339-346.
18. Cardwell, A. J. "Adult Reading Improvement Without Machines." School and Society, LXXXII, (September, 1950), 71-72.
19. Carlson, Thorston R. "Effect of Certain Test Factors on Measurement of Speed of Reading." Journal of Educational Research, XLIV, (March, 1951), 543-549.
20. Causey, Oscar S. "College Reading Programs in the Nation." Fifth Yearbook of the Southwest Reading Conference for Colleges and Universities, Fort Worth: Texas Christian University Press, 1956, 135-137.
21. Deal, R. W. "The Development of Reading and Study Habits in College Students." Journal of Educational Psychology, XXV, (April, 1934), 258-273.
22. Dearborn, W. F. "Motivation versus 'control' in Remedial Reading." Education, LIX, (September, 1938), 1-6.
23. \_\_\_\_\_, and Wilking, S. V. "Improving the Reading of College Freshmen." School Review, XLIX, (November, 1941), 668-678.
24. Eurich, A. C. "The Relation of Speed of Reading to Comprehension." School and Society, XXXII, (September, 1930), 404-406.
25. \_\_\_\_\_. "A Method for Measuring Retention in Reading." Journal of Educational Research, XXIV, (October, 1931), 202-208.
26. \_\_\_\_\_. Reading Abilities of College Students, Minneapolis: University of Minnesota Press, 1931.
27. Freeburne, C. M. "The Influence of Training in Perceptual Span and Perceptual Speed Upon Reading Ability." Journal of Educational Psychology, XL, (October, 1949), 321-352.
28. Fulton, R. E. "Speed and Accuracy in Learning Movements." Archives of Psychology, 1945, No. 300, 53.

29. Gates, A. I. The Improvement of Reading, New York: Macmillan Company, 1935.
30. Gray, W. S. "Summary of Investigations Relating to Reading." Supplementary Educational Monographs, No. 28, 1925.
31. Hamilton, Bernice F. "The Flashmeter: An Instrument for Teaching Reading." Elementary English Review, XXIII, (October, 1946), 272-275.
32. Harris, Albert J. How to Increase Reading Ability, New York: Longmans, Green and Company, 1949.
33. Kingston, A. J. Jr. "Student Reaction to a College Reading Improvement Program." Junior College Journal, XXIII, (October, 1952), 98-101.
34. Lauer, A. R. "An Experimental Study of the Improvement of Reading by College Students." Journal of Educational Psychology, XXVII, (November, 1936), 655-662.
35. \_\_\_\_\_, Henry, L. K., and Fritz, J. F. "Improving the Reading Ability of College Students." Psychological Bulletin, XXXV, (November, 1938), 670.
36. Lewis, Norman. "An Investigation into Comparable Results Obtained From Two Methods of Increasing Speed Among Adults." College English, XI, (December, 1949), 152-156.
37. McNemar, Quinn. Psychological Statistics, 2nd Ed., New York: John Wiley and Sons, Inc., 1955.
38. Manolakes, George. "The Effects of Tachistoscopic Training in an Adult Reading Program." Journal of Applied Psychology, XXXVI, (December, 1952), 410-412.
39. Manual, Controlled Reader, Viewlex Company.
40. Moore, Herbart. "Training College Freshmen to Read." Journal of Applied Psychology, XV, (October, 1934), 630-634.
41. Moore, Joseph E. "Sex Difference in Speed of Reading." Journal of Experimental Education, VIII, (September, 1939), 110-114.
42. Mullins, C. J. "Reading Improvement Course Aimed to Increase Speed." Personnel Journal, XXXIII, (October, 1954), 172-174.
43. \_\_\_\_\_. "The Effect of Reading Ability on Two Standardized Classification Tests." Journal of Educational Psychology, XLVI, (March, 1955), 189-192.
44. \_\_\_\_\_. "Use for the Tachistoscope in Reading." Junior College Journal, XXVI, (March, 1956), 390-394.

45. \_\_\_\_\_, and Mowry, H. W. "How Long Does Reading Improvement Last?" Personnel Journal, XXXII, (April, 1954), 416-417.
46. Nelson, M. J., and Denny, E. C. The Nelson-Denny Reading Test, Dallas: Houghton-Mifflin Company, 1929.
47. Nelson, M. J., and Denny, E. C. Manual of Directions, Dallas: Houghton-Mifflin Company, 1937.
48. Pressey, L. W., and Pressey, S. L. "A Critical Study of the Concept of Silent Reading." Journal of Educational Psychology, XII, (January, 1921), 25-31.
49. Preston, R. C., and Botel, Morton. "Reading Comprehension Tested Under Timed and Untimed Conditions." School and Society, LXXIV, (August, 1951), 71.
50. Renshaw, Samuel. "The Visual Perception and Reproduction of Forms by Tachistoscopic Methods." Journal of Psychology, XX, (October, 1945), 217-232.
51. Remmers, H. H., and Stalnaker, J. M. "An Experiment in Remedial Reading Exercises at the College Level." School and Society, XXVIII, (December, 1928), 797-800.
52. Robinson, F. P. "Speed Versus Comprehension in Reading--A Discussion." Journal of Educational Psychology, XXXI, (October, 1940), 554-558.
53. Robinson, H. M. "Qualifications for Teachers of Remedial Reading." School Review, LXIII, (May, 1955), 334-347.
54. Sheldon, W. D. "Can We Improve Reading by Using Mechanical Devices." Educational Digest, XXI, (September, 1955), 45-47.
55. \_\_\_\_\_. "Reading Courses in College." NEA Journal, XLIV, (April, 1955), 227-228.
56. Shores, Harlan, and Husband, K. L. "Are Fast Readers the Best Readers?" Elementary English, XXVII, (January, 1950), 52-57.
57. Smith, H. P. and Tate, T. R. "Improvement of Reading Rate and Comprehension of Subjects Training With the Tachistoscope." Journal of Educational Psychology, XLIV, (March, 1953), 176-184.
58. Sommerfeld, Roy E. "The Relationship of Reading Ability to Measures of Perceptual Span With Special Reference to Tachistoscopic Span for Digits." Doctors Dissertation, University of Michigan, 1952.
59. Speed Your Reading, Ten minute sound film, black and white. Teaching Aids Exchange, Modesto, California.

60. Speer, G. S. "Using Mechanical Devices Can Increase Speed of Reading." Nation's Schools, XLVIII, (October, 1951), 45-48.
61. Strang, Ruth. Study Type of Reading Exercises, New York: Bureau of Publications, Teachers College, Columbia University, 1935.
62. Stroud, J. B., and Henderson, M. "Rate of Reading and Learning by Reading." Journal of Educational Psychology, XXXIV, (April, 1943), 193-205.
63. Taylor, S. E., and Frachenpohl, Helen. "The Timex and Controlled Reader Teach Fundamental Reading Skills." Audio-Visual Guide, XXI, (May, 1955), 5-8.
64. Thompson, W. C. "A Book Versus Machine Experiment in Adult Reading Improvement." College English, XV, (May, 1954), 471-472.
65. Tinker, M. A. "The Relation of Speed to Comprehension." School and Society, XXXVI, (July, 1932), 158-160.
66. \_\_\_\_\_. "Speed Versus Comprehension in Reading as Affected by Level of Difficulty." Journal of Educational Psychology, XXX, (February, 1939), 81-94.
67. \_\_\_\_\_. "Dr. Robinson on Speed Versus Comprehension." Journal of Educational Psychology, XXXI, (October, 1940), 559-560.
68. Traxler, A. E. "Sex Differences in Rate of Reading in the High School." Journal of Applied Psychology, XIX, (June, 1935), 351-352.
69. Weber, C. O. "The Acquisition and Retention of Reading Skills by College Freshmen." Journal of Educational Psychology, XXX, (May, 1939), 453-460.
70. \_\_\_\_\_. "Reading Inadequacy as Habit." Journal of Educational Psychology, XL, (November, 1949), 427-433.
71. Wedeen, Shirley U. "Mechanical Versus Non-Mechanical Reading Techniques for College Freshmen." School and Society, LXXIX, (April, 1954), 121-123.
72. Witty, P. A. "Practice in Corrective Reading in Colleges and Universities." School and Society, LII, (November, 1940), 564-565.
73. \_\_\_\_\_, Stolarz, Theodore, and Cooper, William. "Some Results of a Remedial Reading Program for College Students." School and Society, LXXVI, (December, 1952), 376-380.
74. Wooster, G. F. "An Experimental Study of the Reading Rate Controller." Journal of Educational Psychology, XLV, (November, 1945), 421-426.

## VITA

Robert M. Morgan

Candidate for the Degree of

Master of Science

Thesis: THE RELATIVE EFFECTIVENESS OF MECHANICAL AND NON-MECHANICAL  
METHODS IN A READING IMPROVEMENT PROGRAM

Major Field: Psychology

Biographical:

Personal data: Born in Ponca City, Oklahoma, February 5, 1930,  
the son of Perry H. and Velma B. Morgan.

Education: Attended grade school in Bartlesville and Ponca City,  
Oklahoma; graduated from Ponca City Senior High School in  
1948; received the Bachelor of Science degree from the Okla-  
homa Agricultural and Mechanical College, with a major in  
Psychology in August of 1955.

Experiences: Entered the United States Army in 1949, serving in  
the Far East Command until 1952; graduate teaching assistant,  
Oklahoma Agricultural and Mechanical College, 1955-56.

Member of Psi Chi, National Honorary Psychological Association; the Psych-  
ology Club; the Society of Personnel Management.

Date of Final Examination: July, 1956.



THESIS TITLE: THE RELATIVE EFFECTIVENESS OF MECHANICAL AND NON-MECH-  
ANICAL METHODS IN A READING IMPROVEMENT PROGRAM

AUTHOR: Robert M. Morgan

THESIS ADVISER: Dr. Roy E. Sommerfeld

The content and form have been checked and approved by the author and thesis adviser. The Graduate School Office assumes no responsibility for errors either in form or content. The copies are sent to the bindery just as they are approved by the author and faculty adviser.

TYPIST: Robert M. Morgan