

A B S T R A C T O F T H E S I S

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THE REMEDIAL READING PROGRAM  
OF  
COLORADO AGRICULTURAL  
AND  
MECHANICAL COLLEGE

Submitted by  
Hugh F. Pierce

Colorado  
Agricultural and Mechanical College  
Fort Collins, Colorado

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## INTRODUCTION

Reading maketh a full man; . . . . and if  
he read little, he hath need of much cunning  
to seem to know what he doth not.

--Francis Bacon

There is no doubt about the importance of reading. In a doctor's dissertation published in 1938, Dr. David Hitchens Morgan showed that the importance of reading was first recognized in the Colonies in 1647 and that as modern life becomes more complex, the place of reading gains in importance. It is not always easy to learn to read, however, and much of educational literature is concerned with the subject of individual differences in reading ability.

These differences are recognized at Colorado Agricultural and Mechanical College and the institution is one of a minority offering remedial reading instruction. The course is not mandatory nor are those students who enter it required to attend all of its sessions.

There is a desire to know the effect of an increase in reading abilities developed in a remedial course on reading in other fields and it is of particular interest to determine the effects of the remedial reading program in this college. The literature on reading often questions the extent to which improvement in one type of reading carries over to other types. This study is primarily concern-

ed with the transfer to another area of reading ability developed in the remedial class room.

### Problem

What are the effects of the remedial reading program on the scores of entrance examinations as re-administered to those students who have taken the remedial reading course?

Problem analysis.---The following sub-questions must be answered in order to answer the problem question.

1. What were the scores of students on the Minnesota Speed of Reading Test before taking the course in remedial reading?

2. What were the scores of students on the Minnesota Speed of Reading Test after taking the remedial course?

3. What were the scores of students on the Iowa Silent Reading Tests before taking the remedial course?

4. What were the scores of students on the Iowa Silent Reading Tests after taking the remedial course?

5. What were the scores of students on the following tests before taking remedial reading?

- a. The American Council on Education  
Psychological Examination for  
Freshmen, 1943 edition.

- b. The American Council on Education  
Cooperative English Test, Form PM.
- c. The Nelson-Denny Reading Test,  
Form A.

6. What were the scores of students on re-administration of the above tests after taking the remedial course?

7. What changes in the scores on the tests should be attributed to normal processes of development?

Delimitations.--This study will be limited to results found in examination of those students who have entered and pursued the course in reading to the point which, in their opinions, satisfied their needs, and those who completed the course. In addition, only those comprising a control group will be included.

Definition of terms.--Scores, as used in the preceding analysis, refers to the raw scores obtained on the tests and has no reference to percentile ratings.

Entrance examinations, as stated in the problem, do not include the chemistry aptitude examination which is regularly administered to entering students.

#### METHODS AND MATERIALS

In the final term of the 1947-48 school year, a meeting was held for the purpose of discussing the evaluation of the remedial reading program. The Dean of the



Graduate School was in charge and others in attendance were the instructor in charge of remedial reading, the psychometrist, a graduate student colleague, and the writer. It was determined to undertake investigations concerning the effect of the remedial reading program in the college. Inasmuch as one of these was the study of transfer, it was necessary to determine methods, procedures, and materials of the investigation. Because of the effect of practice on scores found by re-testing and the ordinary gains made by students during college programs, it was determined that control group techniques were necessary if the effect of the remedial reading program on changes in scores on the entrance tests of the college were to be unbiased.

The entrance tests regularly given to entering students in the college are the American Council on Education Psychological Examination, the American Council on Education Cooperative English Test, the Nelson-Denny Reading Test, and the Iowa Chemistry Aptitude Examination. The chemistry test was not included in the experiment because only certain students take chemistry and the effect of this condition could not be evaluated.

The remedial reading class lists were consulted and those individuals who had taken the course and remained in school were listed. The criteria for equating the experimental and control groups were decided upon as follows: first, the scores on the psychological examination; second,

the scores on the reading tests; third, the scores on the English test; fourth, the year in college of the student; fifth, the sex of the student. Before the equating was finished, it was necessary to forego the plan of matching pairs because of the fact that those students who most perfectly matched the remedial reading students had, in many cases, left school.

A master data sheet was made on which were recorded the scores of the remedial reading students on the initial tests and re-tests of the entrance examinations. The scores of pre-test and post-test administrations of the Minnesota Speed of Reading and the Iowa Silent Reading tests were also listed.

The best way of securing the cooperation of the students for the experiment was a problem. A letter signed by the Head of the Department of Psychology and Education, who is also the Dean of the Graduate School, was sent to all of the 220 students requesting that they attend one of two meetings to be held for the purpose of explaining the nature and purpose of the study. Sixty students attended the first meeting and fifty-eight attended the second meeting. On both occasions the Dean of the Graduate School presented an explanation of the study and students were scheduled for appointments at the testing bureau for re-administration of the entrance examinations. All students in both groups consented to participate. Testing began on the day following

the second meeting and most of it was completed within one and a half weeks. In this way the data for the study were secured.

#### ANALYSIS OF THE DATA

The statistical devices used in the analysis of the data were common to educational statistics. One of the first procedures was a general overview of the progress of the class. On the Minnesota and Iowa tests, both possessing alternate forms which were used in connection with the conduct of the remedial reading class, there was found to be a wide variability of the scores of the individual students.

For example, the scores obtained from the pre-test form of the Minnesota Speed of Reading Test when it was given at the beginning of the course, varied from a high score of thirty to the lowest score of three. On the final form of the Minnesota test given at the end of the course, the scores varied from the highest score of thirty-one to the lowest score of one. Even with a twelve weeks course of development in new reading abilities, the range of the group varied more at the termination of the course than it had at the beginning. On the Minnesota Speed of Reading Test, the gain of the means on the post-test over the pre-test was 3.29. By determining the critical ratio, it was found that this difference was significant. The correlation of the scores of the two tests was .50 with a probable error of .09.

A correlation of pre and post-test scores of remedial students on the Iowa Silent Reading Test produced a coefficient of  $.70 \pm .06$ . The difference in means over its standard error gave a ratio of 7.28 which was over twice the amount necessary to guarantee a significant difference 999 times in 1000.

There was no certain positive relationship found between gains made on the Minnesota or Iowa Reading tests and gains in scores on the entrance examinations.

Correlations of gains produced the following coefficients and probable errors:

Entrance Tests	Reading Tests	
	Minnesota	Iowa
Psychological Examination	$-.03 \pm .12$	$.39 \pm .10$
English Examination	$-.15 \pm .12$	$.17 \pm .12$
Nelson-Denny Reading Test	$.00 \pm .12$	$.00 \pm .12$

The correlations, when considered with the relatively large probable errors are not sufficiently strong to be certain of any relationship.

Scores on initial and final administration of the college entrance tests resulted in data compiled in Table 1. The smallest difference between means of any of the experimental groups and the control was .04. The difference was between the means of the group completing reading and the control group on the initial administration of the psychological examination. The largest difference in the means



of the groups as they were originally equated was 4.08 on the initial scores of those completing the remedial reading course and the controls on the Nelson-Denny Test. On the .04 difference between means the chances are about 50-50 that the true difference is greater than zero. On the 4.08 difference the chances are 91 in 100 of a true difference between the groups. The 4.08 difference is not significant. The critical ratios of the other differences in means are between the extremes of the .04 and 4.08 differences and therefore the groups are equated for the purposes of the experiment.

On the final administration of the tests, the smallest difference in means was .21 between the group not completing the course and the control group on the Nelson-Denny Test. The chances in this case were 52 in 100 that the difference was significant. The largest difference, 3.98, in the final tests was between the English examination scores of the group completing the remedial course and the controls. The difference which most closely approached probable significance, however, was 3.33 between the same groups on the final administration of the psychological examination. The chance in 100 of the difference being significant were 80 in 100. The degree of significance of the other scores on the final administration of the tests were between the lowest and highest just given. The groups were not significantly different, therefore, on the final tests.



Table 1.--COMPARISON OF MEANS OF SCORES OF EXPERIMENTAL AND CONTROL GROUPS WHICH SHOWS EQUIVALANCE OF GROUPS.

	Num- ber	Mean	Stan- dard devi- ation	Diff. of means	Standard Errors Mean    Diff. means	Crit- ical ratio	Chances in 100 that differ- ence is signif- icant	
Psychological Examination								
Initial testing total group	51	112.49	20.56	.65	2.87	3.90	.17	56
controls	50	111.84	18.65		2.64			
Final testing total group	51	122.27	18.64	.97	2.61	3.54	.27	61
controls	50	123.24	16.90		2.39			
Initial testing group complet- ing reading	34	111.88	19.95	.04	3.42	4.32	.01	50
controls	50	111.84	18.65		2.64			
Final testing group complet- ing reading	34	119.91	18.40	3.33	3.16	3.96	.84	80
controls	50	123.24	16.90		2.39			
Initial testing group not com- pleting reading	17	113.70	22.74	1.86	5.69	6.27	.30	62
controls	50	111.84	18.65		2.64			
Final testing group not com- pleting reading	17	127.00	18.22	3.76	4.56	5.15	.73	77
controls	50	123.24	16.90		2.39			
English Examination								
Initial testing total group	54	153.20	39.63	2.42	5.39	7.88	.31	62
controls	50	155.20	40.66		5.75			
Final testing total group	54	173.51	36.80	3.35	5.01	6.86	.49	69
controls	50	176.83	33.06		4.68			
Initial testing group complet- ing reading	34	152.11	36.46	3.51	6.25	8.49	.41	65
controls	50	155.62	40.66		5.75			

Table 1.--continued.

	Num- ber	Mean	Stan- dard devi- ation	Diff. of means	Standard Errors		Crit- ical ratio	Chances in 100 that differ- ence is signif- icant
					Mean	Diff. means		
English Examination continued								
Final testing group complet- ing reading controls	34 50	172.88 176.86	37.02 33.06	3.98	6.34 4.68	7.88	.51	69
Initial testing group not com- pleting reading controls	20 50	155.05 155.62	44.47 40.66	.57	10.27 5.75	11.77	.05	52
Final testing group not com- pleting reading controls	20 50	174.60 176.86	36.40 33.06	2.22	8.35 4.68	9.57	.23	59
Nelson-Denny Test								
Initial testing total group controls	53 49	68.79 71.53	15.29 14.69	2.74	2.10 2.10	2.97	.92	82
Final testing total group controls	53 49	82.26 83.24	21.05 17.50	.98	2.89 2.50	3.82	.26	60
Initial testing group complet- ing reading controls	33 49	67.45 71.53	12.35 14.69	4.08	2.15 2.10	3.01	1.35	91
Final testing group complet- ing reading controls	33 49	80.63 83.24	21.83 17.50	2.61	3.80 2.50	4.55	.57	72
Initial testing group not com- pleting controls	20 49	71.00 71.53	18.94 14.69	.53	4.34 2.10	4.82	.11	54
Final testing group not com- pleting reading controls	20 49	83.45 83.24	19.40 17.50	.21	4.45 2.50	5.10	.04	52

The sum difference of gains in chances in 100 that a mean score was significant was 15, the difference of the totals of 73 and 58 as shown in the Table 2. These data show the basic consistency of the data and essential equality of the groups throughout the experiment.

#### Summary and Implications

The gains in the remedial reading course as measured by the Minnesota and Iowa tests showed that the class had made significant progress. As measured by the Iowa tests the gains may have been rather exceptional. It appears that the group made good progress. There is always the argument by some investigators, however, that the gains made in a remedial course are sometimes the result of practice with test materials of the course. It is believed that this was not the case in this study, however. If familiarity with test materials could have been responsible to a considerable extent for gains shown in class, then it seems reasonable that familiarity should have enabled the same students to make gains which were significant on the Nelson-Denny entrance test. Such was not the case. It is true that the greatest gains, though none were significant, were made by the remedial group on the Nelson-Denny test, but it does not seem that such relatively small gains indicate that the cause was familiarity with test materials any more than the larger gains made on the psychological examination by the control students indicate that they had practiced with psy-

Table 2.--SUMMARY OF PART OF DATA FOUND FROM ADMINISTRATION OF COLLEGE ENTRANCE TESTS.

Group and test given	Diff. of means of exper- imental and control groups	Chances in 100 of a true differ- ence in favor of group	Gains in chances in 100 of a true differ- ence in favor of group	Degree of signif- icance of diff- erence in means
Total group taking reading		<u>Exp.</u>	<u>Cont.</u>	<u>Exp.</u> <u>Cont.</u>
pre-psychological	.65	56		17 none
post-psychological	.97		61	
pre-English	2.42		62	
post-English	3.35		69	7 none
pre-reading	2.74		82	22
post-reading	.98		60	none
Group complet- ing reading				
pre-psychological	.04	50	50	
post-psychological	3.33		80	30 none
pre-English	3.51		65	
post-English	3.98		69	4 none
pre-reading	4.08		91	19
post-reading	2.61		72	none
Group not com- pleting reading				
pre-psychological	1.86	62		15
post-psychological	3.76	77		none
pre-English	.57		52	
post-English	2.22	59		11 none
pre-reading	.53		54	
post-reading	.21	52		6 none
TOTAL				73 58



chological examinations and materials. Therefore, inasmuch as the gains of the remedial class are statistically significant, it is believed that they are real.

If the gains in the reading class were real, then it could be assumed that the abilities gained might be transferred to the reading of materials outside the class, - entrance tests, for example. From the results of this study it appears that the skills gained in class were not conducive of increased scores on the entrance examinations. There was not one of the tests which showed a significant difference between the means of scores of the control and experimental groups. The consistency of the data in favor of no difference in the groups makes the probability even stronger that remedial reading abilities were not transferred from the class room to the taking of the college entrance examinations.

In the literature, an opinion was found which, if true, might account for the lack of transfer. Robinson, of Talladega College, felt that in a remedial course old reading skills were broken down and new ones eventually learned. If this experiment took place at a time when these old reading skills had been broken down and not yet redeveloped, then, of course, it would not be expected that any transfer would appear. If skills were at a low ebb among the experimental students at the time of taking the tests, if they could not read as well as usual, then we would expect that the experimental group would not have scored so well; that



is, equal to the control group. The fact is that they did score as well. Of course, if the skills were returning at the time, on the upswing, then at some precise point they would just equal the controls and possibly surge on beyond them at a later time. The chance that this happened in this study, if it would happen at all, seems very remote. In short, it appears that so far as this particular study is concerned, no transfer of reading ability is shown.

#### Suggestions for further investi- gation

There is a need for further investigation to strengthen or weaken the implications of this study. Larger samples would be preferable or the experiment could be performed as many times as possible with smaller samples. At this point results of this investigation bear out the somewhat similar opinions of Buswell and Anderson concerning the specific nature of reading skills.

To show eventually that there is no transfer of reading ability might be wasteful and time consuming if transfer actually does exist. It might be quicker to attempt to show that there is transfer by further study along lines such as the following:

1. The study of effects of the increase in reading skills or transfer when credit is given for the course.
2. A study of increases or losses in reading

ability as a result of longer or shorter courses.

3. Shorter, more intensive units in remedial reading on a clinical basis with individual diagnosis and instruction.

4. A study of the teaching of reading in specific fields such as mathematics, art, geology, etc.

5. A study to determine if students taking remedial reading are less inclined to leave school and why.

6. Why do some who achieve the least in a remedial class on speed of reading tests sometimes make the greatest gains on entrance examination re-tests? Has comprehension increased as speed decreased?

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Submitted by  
Hugh F. Pierce

In partial fulfillment of the requirements  
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CREDITS 0

George R. Comstock  
In Charge of Thesis

APPROVED David H Morgan  
Head of Department

Examination Satisfactory

Committee on Final Examination

George R. Comstock H T Guard  
Al B Campbell Benjamin J. Morak  
James F. McClelland

David H Morgan  
Dean of the Graduate School

Permission to publish this thesis or any part of it  
must be obtained from the Dean of the Graduate School.

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## Chapter I

## INTRODUCTION

Reading maketh a full man; speaking a ready man; and writing, an exact man; therefore if a man write little, he hath need of a great memory; if he speak little he hath need of a great wit; and if he read little, he hath need of much cunning to seem to know what he doth not.

--Francis Bacon

It is now generally agreed that an adequate amount of skill in reading is necessary for the happiness of individuals, their efficiency in life, and the progress of our culture and economy. Morgan (15:1), 1938, says that the fundamental importance of the subject in this country was first established in the Colonies in 1647 by the Massachusetts edict which required that reading and writing be taught in all towns of over 50 citizens. He continues:

With the increasing complexity of modern life, however, came the corresponding increase in school subjects to meet the enlarged demands of society. The first of the "three R's" has not only retained its place of importance, therefore, but has taken on an even greater significance. Because reading is an essential tool for the mastery of practically every school subject and every calling or profession in life, it is evident that the scope of reading broadens as the types of studies increase. In short, reading underlies scholastic progress in nearly all subjects in the modern curriculum. (15:1,2)



Skills in reading are not always easily obtained. Educational literature is replete with data which show the wide variations in reading ability. It has been the practice for some time in the lower grades to give remedial work in reading to those who have difficulty, but only comparatively recently has similar remedial work been done at the college level. Though some of the programs appear to have been quite successful, their total effects are not known. Evaluation is not now, and may never be, adequate to the need.

Colorado Agricultural and Mechanical College is one of the minority of institutions of higher education offering remedial reading instruction to those who desire it. All candidates for the work enter the class of their own volition, although all of them are notified when their reading abilities as shown by entrance test scores are not up to the level which would be expected from a consideration of their scores on an entering psychological examination. After enrolling in the course attendance is not mandatory. Students may complete the 12 weeks session or terminate their attendance when they feel they have received the assistance they needed.

In this as in other colleges it is the intention to evaluate the program in the light of benefits which carry over from the remedial work into the other fields. Anderson (2:54), 1928, in a listing of problems for further



investigation, proposed this problem: "To what extent does improvement in one type of reading carry over to other types?" This is the question with which this study is primarily concerned. Evidence will be presented which shows the effect which the remedial work in this college has upon changes in entrance test scores.

### Problem

What are the effects of the remedial reading program on the scores of entrance examinations as re-administered to those students who have taken the remedial reading course?

Problem analysis.--The following sub-questions must be answered in order to answer the problem question.

1. What were the scores of students on the Minnesota Speed of Reading Test before taking the course in remedial reading?
2. What were the scores of students on the Minnesota Speed of Reading Test after taking the remedial reading course?
3. What were the scores of students on the Iowa Silent Reading Tests before taking the remedial course?
4. What were the scores of students on the Iowa Silent Reading Tests after taking the remedial course?

5. What were the scores of students on the following tests before taking remedial reading?

- a. The American Council on Education Psychological Examination for Freshmen, 1943 edition.
- b. The American Council on Education Cooperative English Test, Form PM.
- c. The Nelson-Denny Reading Test, Form A.

6. What were the scores of students on re-administration of the above tests after taking the remedial course?

7. What changes in the scores on the tests should be attributed to normal processes of development?

Delimitations.--This study will be limited to results found in examination of those students who have entered and pursued the course in reading to the point which, in their opinions, satisfied their needs, and those who completed the course. In addition, only those comprising a control group will be included.

Definition of terms.--Scores, as used in the pre-coding analysis, refers to the raw scores obtained on the tests and has no reference to percentile ratings.

Entrance examinations, as stated in the problem, do not include the chemistry aptitude examination which is regularly administered to entering students.

## Chapter II

## REVIEW OF LITERATURE

The investigations completed by others in the past are of great significance in the consideration of the present problem. Especially important are the studies which have been made of college remedial programs, although a background of remedial work in general is also desirable. This chapter will treat the literature under the various headings into which it conveniently falls. These divisions will show the importance of reading, an early history of reading investigations, the individual differences in reading ability, the problem of difficulty and failure in reading, methods used in the reading class, the difference between corrective and remedial reading, and the mechanics of reading. Other topics are rate of reading versus comprehension, gains on psychological examinations during college, reading tests, results of studies of remedial reading, and procedures in measurement of remedial reading. A summary of the chapter will review the important implications as they apply to this study.

The importance  
of reading

Gates (7:1,2), 1935, reported a number of factors



which indicate the importance of reading. The comparatively large time allowed for reading in the schools was one. Others were the great amount of investigation which is being made, and the growing number of findings showing the value of teaching good reading habits.

According to National Society for the Study of Education (16:134), 1937, in its report on the teaching of reading, the various curricular fields are related to reading. It finds that reading motivates and enriches thought and believes that there is insufficient recognition of the dependence which learning puts upon reading. The Society reached the conclusions that reading is an indispensable tool in the study of most parts of the curriculum and that reading deficiencies are probably the greatest source of frustration in study.

#### History of Investigations concerning reading

According to Gray (10), 1925, scientific investigations in reading began in France and Germany in the middle of the 19th century. The studies were concerned for the most part with eye-movements and perception. Between 1850 and 1875, the universities of the two countries made investigations into these problems and results of them were published by Cottell, Erdmann, Dodge, Goldscheider, Mueller, Zeitler, Mesmer, Landolt, La Mare, and Javal.

Cottell brought new light to the previous belief



that each letter of words when read was perceived separately and concluded that reading perception proceeds by words, phrases or sentences.

Coldscheider and Mueller of Berlin, Erdmann and Dodge of the University of Halle, Zeitler and Messmer of the University of Leipzig made investigations which were important because of their contributions toward processes of reading, form and arrangement of perceptual units, and primary reading methods.

Eye movements in reading were studied by Javal about 1879 and he discovered the alternating moving and pausing motion of the eye while reading.

Landolt, Dodge, and Erdmann, while disagreeing with Javal, suggested the possibility of individual differences in reading due to individuals and to the nature and difficulty of material.

Gates (7:5), 1935, reported that even though the greatest strides in the diagnosis of reading difficulties were made since about 1915, intensive research on the subject extends back to around 1885.

During this period of about a half-century many different points of view were expounded through research along different lines. The research usually took the form of investigations into the causes of reading defects, but along different avenues of approach: defective bodily organs and extra-ordinary characteristics, psychological

deficiencies, constitutional or educational immaturity, improper motivation and inefficient reading techniques due to unfortunate accidents of trial-and-error learning or inefficient teaching or a combination of both.

Individual differences  
in reading ability

Evidently the variations in reading ability which are later shown to exist among elementary school children are found, or are carried over, with the student when he attends an institution of higher education. In an investigation of the reading ability of college students made by Anderson (2), 1928, he found that most striking of all the facts of the study is the extreme range of the ability of those students to read. A table showing the data on which he based his conclusion is reproduced here.

Table 1.--SUMMARY OF RANGES OF DISTRIBUTIONS FOR THE  
VARIOUS TESTS

Test	Highest Score	Lowest	Range
Holley Vocabulary Scale	70	31	39
Whipple Reading Test	18	5	13
Van Wageningen, Science	115	67	48
Van Wageningen, Literature	116	71	45

(2:47)

Anderson (2:f1), 1928, also found that the differ-

once between the reading ability of men and women is of little consequence. The difference is too small to be significant. His study shows also that the age of students has little effect on their ability to learn to read. He ascertained that older students are evidently not handicapped. "Age seems to make little difference . . .," he said.

The year in college, he claims, does make a difference, however, in the average ability. He found an increase in ability from the Sophomore to Junior year and from Junior to Senior year of four to six per cent. These differences, he concludes, are not sufficient to make the differentiation in instruction necessary on that basis alone, inasmuch as, even with these average differences, "the average Sophomore reads much better than the poorest Senior". Neither does Anderson believe that differentiation of instruction is justified on the basis of the school or college in which the student is enrolled.

Sangren (20), 1932, published the following data showing variations in the reading ability of elementary school children.



Table 2.--GRADE SCORES OBTAINED BY VII-B PUPILS OF SCHOOL  
E ON GATES SILENT READING TEST--TYPE C

Pupil number	Grade score
1	3.3
2	4.2
3	4.5
4	5.0
5	6.0
6	8.5
7	9.0
8	9.0
9	10.5
10	11.0
-----	
Average	7.1
Standard	7.1

Kottmeyer (12:2,3), 1947, stated the difference in individuals in their reading progress. He found that some children readily learn to read and that others learn only with the greatest difficulty. Those who are adept may make remarkable progress and the less apt may make very little. The result is that in a group of fourth graders the reading ability may spread over eight or more grade levels and if the group is of eighth graders the range in ability may cover twelve or more levels.



Difficulty and failure  
in reading

Gates, (7:2), 1935, reported that a large number of pupils still experience great difficulty in attaining skillful reading ability. This is true, he said, even though there has been much experimentation, many reading materials of interest to children, and considerable time available for instruction.

Gates cites the study of Percival on the causes and subjects of school failures to show that reading was the greatest cause of such failures, particularly in the primary grades where it was practically the only cause. Percival showed that 99.15 per cent of the pupils not promoted were failed because of deficiencies in reading. The percentage was 90 in Grade 2 and about 70 in the Third Grade. Gates believes reading to be the prime source of trouble for the teacher of the primary grades.

As to the causes of difficulty in teaching and learning to read, Gates presented the following:

Aside from the many causes of reading deficiency to be found in individual cases--such cases as low mentality, scholastic immaturity, defective vision, etc.--there is one significant cause, which, when it is recognized, makes evident the reasons for difficulty in teaching and learning to read: This is that reading comprises highly complex abilities that are not easily detected and observed. (7:4)

The lack of proper guidance at the right time, according to Gates, (7:18), is responsible for the failure to acquire the necessary technique and thus there appear

most of the difficulties of reading. He believes that most children above 70 in their intelligence quotients can be taught to read despite the numerous obstacles, if the most is made of the best methods which have been found.

The second report of the National Society for the Study of Education, 1937, in reporting on the teaching of reading, said:

Many students in both high school and college have not yet mastered the mechanics of reading. Such students, in reality still on the elementary school level with respect to reading, must be regarded as remedial or corrective cases. (16:383)

#### Method in remedial reading classes

Instruction in remedial reading should be preceded by investigation and measurement, according to Sangren, 1932.

Measurement and investigation should precede instruction. Efficient teaching is always preceded by some type of testing or examination which will, as completely as possible, describe the pupils and their abilities and locate their strength and weaknesses, the sources of their difficulties, and the causes of their deficiencies. The teacher who expects to give adequate and effective training in silent reading to pupils merely on the bases of their promotion to a certain grade or in terms of the adopted text book for the grade is, in most cases, headed for failure. Efficient teaching and supervision of silent reading will follow and be based upon the most thorough study of the pupils and their abilities that existing measuring devices and means of investigation will permit. (20:5)

In most institutions no credit is given for the work done in the remedial class. Charters (6), 1941, found

by a survey that in most of the colleges where no credit is given for the work that the tendency is to keep the student in the reading class until he is aware of the methods of improving his reading and able to continue on his own volition.

Goldstein and Justman (9), 1942, found that intensive experimentation with the help of expensive apparatus is not necessary in courses intended to improve the rate of reading of college students. They found that the reading rates of students can be improved if the program includes interspersed testing.

They believe that correlations between initial reading ability and achievement should be measured by words per minute and not in terms of the reduced reading time for passages read.

In the measurement of reading achievement, whether in rate or comprehension, it is often found that students receive lower scores on the post-test than on the pre-test.

Robinson (19:105), 1947, reports this condition and explains it by saying that in any course where skills are taught, the first effect is one of disorganization: the skills previously held by the student disintegrate before the new and more efficient skills begin to develop.

At Talledega College, Robinson says, those students whose scores decrease, may be invited to enroll in another section of the course in remedial reading so that



the new skills may be developed.

### Corrective and remedial reading defined

Traxler, 1934, defined remedial reading as that which was necessary for pupils who

are so seriously handicapped in the basic reading skills that they require the use of unusual procedures and techniques and individual attention and guidance in overcoming their deficiencies . . .

(23:6)

Traxler says that "corrective" is the term applied to the teaching of those who will respond to treatment through regular classroom methods within a class group.

### The mechanics of reading

Anderson (2:53), 1928, in a study of the difference in the reading ability of college students, concluded that there is no "general reading ability" which can be applied to all the reading requirements of the college student. He finds that "reading is fairly specific". He also believes that the acquiring of reading skills is continuous. His opinion on this seems qualified to some extent when he reports that good readers are likely to be good readers in various types of materials, but that there are exceptions.

Buswell (4), 1937, claims that reading is psychologically not complicated, and that those who magnify the difficulties fail to understand the process and introduce difficulties greater than the original. He believes that



reading is a process of interpreting conventional symbols on a printed page which have been substituted for the objects in our environment.

Buswell states that he believes he knows how to read and that within these fields of common knowledge he is able to read with a fair degree of speed and understanding because of the lack of background, knowledge of vocabulary of a technical nature and of acquaintance with the basic ideas of the field.

Buswell makes his point very clear when he says:

There is confusion of the ability to read in a familiar field with ability to read in an entirely new field. After a person has mastered the process of reading in those fields common to all people, nothing is gained by applying the term 'learning to read' to the mastery of a new field. Mastering a new field is not learning to read; it is learning a new subject. Calling both by the same name only beclouds the situation.  
(4:114-5)

#### Rate of reading versus comprehension

Buswell (5), 1939, furnished enlightenment to the much questioned degree of importance between rate and comprehension in reading. He finds that rate of reading is always secondary in its importance to comprehension which he claims to be first. He believes that any educator would consider that comprehension should be adequate to the purpose of the reading. The ability to read rapidly is very desirable, of course, if comprehension is not sacrificed.

He says that reading rate is a function of the particular kind of reading being done and as such should be one of the flexible characteristics. Comprehension should come first and rate should vary as comprehension dictates. It is his belief that understanding is of such great importance in certain forms of reading that deliberateness is the most necessary thing and rate of reading is almost insignificant in comparison. He says also that, when enjoyment is the main purpose of the reading, rate of reading may not be important.

Gains on psychological  
examinations during  
college

Because of the changes in scores which may be expected on the tests to be given in this investigation, the work of McConnell (14), 1934, may be of value in a consideration of the results. He reports a study of the gains of seventy members of the student body at Cornell College between 1928 and 1932 on the Psychological Examination of the American Council of Education, a previous form of the same test used in this study. McConnell used the 1927 edition in the original test and the 1928 edition in the latter. After measurement the scores on the tests were made statistically equivalent.

After testing the 70 subjects it was found that there was a difference of 40.42 in the means of the scores

of the two tests. McConnell found by the usual computation of the probable error of the difference between means when correlated that the probable error was 2.23 and the critical ratio more than 18, which showed that a true difference between scores greater than zero was a practical certainty.

A table shown in the study is reproduced here:

Table 3.--INCREASE IN SCORES ON THE PSYCHOLOGICAL EXAMINATION BETWEEN THE FRESHMAN AND SENIOR YEARS.

	Means	SD	PE <sub>m</sub>	PE <sub>sd</sub>	Frequency
Seniors	135.2	48.3	3.89	2.75	70
Freshmen	114.78	46.1	3.71	2.62	70
Difference	40.42	2.2			
PE <sub>difference</sub>	2.23	3.79			

$$\frac{\text{Diff. } M_1 - M_2}{\text{PE}_{\text{diff. } M_1 - M_2}} = 18.12$$

$$\frac{\text{Diff. } SD_1 - SD_2}{\text{PE}_{\text{diff. } SD_1 - SD_2}} = .58$$

(14:67)

McConnell stated that the 2.2 difference of the pre-test and post-test standard deviations is not significant because it is little more than half its own probable error and therefore that there is no evidence to show the variation in the class groups to be significantly greater or less in the four year interval.

A moderately high correlation of .83  $\pm$  .024 was



found between freshman and senior scores and the average gains of the lower half of the freshman test scores was greater than the gains of the upper half by the averages of 43.28 to 37 respectively.

In attempting to explain the reasons for the gains, McConnell listed the following suppositions:

1. Growth in underlying capacity . . . . .
2. Growth in effective use of endowment . .
3. Specific training . . . . .
4. Varying sets, emotional states, motivation, and other like factors, as well as conditions under which the test is administered, may account for some of the change in scores. (14:68-9)

### Reading tests

In the selection of students for remedial reading courses Witty (25:566), 1940, found, in a survey of 131 universities, colleges, and normal schools, that the Iowa Silent Reading Tests were the most used. These tests were used in fifteen of the institutions. The Nelson-Denny Reading Test was the next most used, - in 8 institutions.

Charters (6:117-21), 1941, also made a survey and included 172 colleges. He found that the chief reliance of those contacted is placed on alternate forms of reading tests to check achievement in remedial reading courses. He found, as did Witty, that the Iowa Silent Reading Tests were the ones most frequently used.

Anderson and Dearborn (3:387-96), 1941, in a study made at Harvard administered certain reading tests.

They were: the paragraph meaning part of the Nelson-Denny Reading Test, the paragraph meaning, paragraph organization, and rate of reading parts of the Iowa Silent Reading Tests. The authors said that these tests, at the time, appeared to measure the type of reading required in college. In their conclusions they stated that the Nelson-Denny test appears to be a good one for diagnostic purposes.

Of the tests used, it yielded the most significant results, a fact which may be interpreted to mean that it, better than any of the others, measures the type of reading ability called for by college work.

(3:395)

In analyzing the Nelson-Denny Reading Test, Traxler (22), 1941, said:

The Nelson-Denny Reading Test measures the vocabulary and paragraph reading of senior high school and college students, and also yields a total score. It consists of Forms A and B, each requiring 30 minutes of working time, of which 10 minutes are given to vocabulary and 20 minutes are devoted to paragraph comprehension. The vocabulary part consists of 100 five-choice items arranged in order of increasing difficulty. The paragraph-reading section contains nine paragraphs of increasing difficulty. Four multiple-choice questions are based on each paragraph. The responses are recorded on an answer sheet and scoring is facilitated through the use of the Clapp-Young Self-Marking carbon paper device. There are public-school norms for each grade level from grade 9 through college. Independent-school percentile norms are available for grades 9 to 12, inclusive.

The reliability reported by the authors on the basis of the correlation of the total scores of 171 college freshmen on Forms A and B was satisfactorily high (.914  $\pm$  .013). Reliabilities for the two parts of the test were not given. (22:16)

#### Results of studies of remedial reading

Gerberich (8:36-41), 1934, evaluated the results

of a retraining course in reading and methods of study covering a five year period. For this course scores made by the Freshmen in reading and psychological tests were used in selecting those students who were to take remedial reading. The reading tests were given more weight than the psychological tests in the selection. Students who had very low scores on both tests were not entered in the course because it was presumed that they had little chance of success in the University.

A control group was used in the study. Scores on pre-tests and post-tests showed that in reading the experimental group made twice the gain over the controls. The control group lost .08 grade points during the eighteen weeks of the experiment while the experimentals were gaining 0.32 grade points in the same time. In the next year, though taking an average of 1.2 hours more course work, the experimental group gained an average of 0.29 grade points over the controls; 34 per cent of the experimental and 65 per cent of the control group remained in college at the end of the experiment.

The control group scored higher than the experimental group on the reading and psychological examinations. The differences were all more than four times their probable errors and were therefore significant.

Gerberich showed that even though in scholastic



averages, greater persistence in the University, and fewer scholastic difficulties, the results were in favor of the control group, the differences were comparatively small and without statistical reliability. The control students on the second test did not maintain their original superiority in achievement. Because these control students did not maintain their gains, Gerberich assumes that the lessening of the difference between the two groups is evidence of the instructional efficiency of the experimental technique.

Buswell (4), 1937, in a study which measured the reading ability of adults, reported that when the amount of education was held constant in the case of 212 adults who did not go farther than Grade VII or VIII, the difference in scores among groups of different chronological ages was small. Buswell concludes, therefore, that chronological age is not an important factor in the reading ability of adults.

Buswell measured the reading ability of 25 adults before and after a remedial course. His data, which are reproduced below, show, in addition to improvement on test scores, the gains made in fixations, regressions, and duration of fixations.

Table 4.--IMPROVEMENT IN SILENT READING OF 25 ADULT SUBJECTS  
GIVEN REMEDIAL INSTRUCTION

Test	Scores on special reading test	Compre- hension of eye movement para- graphs	Number of words read per minute	Eye-movement averages		
				Number of fix- ations per line	Number of re- gressive move- ments per line	Number of fix- ations (in thir- tloths of a second)
Initial	47.8	1.5	289	8.4	1.3	7.3
Final	55.1	1.7	301	7.7	1.1	7.4
Gain	7.3	0.2	12	0.7	0.2	-0.1
Percent- age of gain	15.3	13.3	4.2	8.3	15.4	-1.4

(4:130)

The study of Robinson and Hall (18), 1941, on higher reading abilities furnished them data to support their statement that "It is probably more correct to speak of a person's 'reading abilities' than of his 'reading ability'." (18:241) They point to the findings of others which indicate that reading abilities in one area do not predict the ability to read in other fields.

Robinson and Hall intended that their study should reduce some of the variables found in other investigations. Their findings corroborate the concept that there are different reading abilities. They measured the differences of the speed in reading of fiction, art, geology, history and

concluded that:

- (1) There is no high relation between reading in different subject fields even though they were organized under one editorship. Reading in a specific field, however, such as history is quite consistent.
- (2) Through comparison of intercorrelations of the first three minutes with those of the third three minutes they found that differences in the reading performance in different subject matters can be detected from the beginning.

Anderson and Dearborn (3:387-96), 1941 stated that it would appear, because of the prominence of textbooks in college instruction, that reading ability and college achievement are closely related. They said that the problem is more complicated than one would at first suppose inasmuch as intelligence is also related to scholarship; thus the relation of reading ability and achievement depends on these factors as a function of their dependence on intelligence.

They proposed to investigate how the ability to read affected scholarship if intelligence was held constant in the experiment. According to them no such study had as yet been made with college groups, though some evidence had been found that there is a significant relationship between reading ability and achievement in grades 4, 5, 6, and 9 through studies made by Lee and Bond.

The authors suggested that the results might turn out to be negative because of the more select group in



college but that the growing popularity of remedial reading programs in college, established for the purpose of raising scholarship, justifies the experiment.

Sixty eight pairs of Freshmen of Harvard College were matched for intelligence but purposely unmatched in scholarship. Students were selected from History 1, Government 1, Economics A, and English 1, and only those pairs were taken which were a complete rank different in marks, that is A and C, B and D, or C and E. Reading tests, or parts of them, were administered to all students. The three used were the Nelson-Denny, the Iowa Silent Reading Tests and the Whipple Tests.

The scores of the better and poorer students on each of the tests were averaged and compared statistically. Figures were obtained for the pairs within courses and for the pairs regardless of course.

In their analysis of the data the investigators considered two values of 't' to be important for their purpose, the .05 and .01 criteria of significance, where the probabilities are respectively only one in twenty and one in a hundred that the observed differences would be obtained if the true difference between means were zero. Ordinarily, a difference which meets the .05 but not the .01 criterion is considered significant, while results which reach the .01 criterion are referred to as very significant. Differences failing to reach the .05 criterion are considered not sig-

nificant.

Three of the differences found were very significant, by the above standards and five were significant. Two of the differences which were very significant were on figures for all courses combined, and in each case the better readers were the ones with the highest marks. It seemed also, that the better students read more accurately and yet cover more material.

Anderson and Dearborn found that not many pairs could be matched point for point on the Scholastic Aptitude Test. Therefore, a difference was permitted when it favored the student with the lower mark of the pair. The result of this procedure was that the mean of the academically lower students was higher on the Scholastic Aptitude Test than the mean of the academically higher students, by the difference of 3.97 points for all courses. This difference is very significant according to the 't' values.

The authors found that twenty-one of the differences fell into the non-significant category, but eight of the differences showed that the better readers are the better students. The negative character of the nonsignificant differences may have been due to the tests themselves.

The results as a whole showed that twenty-four of the twenty-nine differences were of identical sign. The five small insignificant differences were the exception. Because of their consistency, the results take on a positive

character.

Anderson and Dearborn concluded that even when the factor of intelligence does not influence the results, there is a positive relationship between the ability to read and achievement in college.

One of the conclusions reached by Goldstein and Justman (9), 1942, in a study of the reading rate of college students was that initially better readers tend to make the greater improvement.

Hultin (11:268), 1944, reported that students enrolled in reading efficiency classes at Wayne University increased in reading ability from an average speed of 109 words a minute on entrance to a final average speed of 148 words per minute, an average gain of 359 words per minute.

An investigation by McCaul (13), 1945, revealed that results of the remedial reading program at the University of Chicago show an average gain of 20-percentile ranks in vocabulary, 30-percentile ranks in comprehension, and 110 words a minute in speed. His remarks on the possible reasons for the superiority of certain remedial students are of interest:

Remedial reading students also tend to get higher marks than do the students matched with them by similarity of reading deficiencies but who have not asked for remedial instruction. This superiority could be produced by a host of uncontrolled influences, and we are not disposed to attribute it to remedial reading. It is logical, for example, to postulate that a student who takes the training is more conscientious and industrious



than an equally poor reader who does not choose to avail himself of remedial reading services. Our data do justify a generalization that any student who is willing to apply himself dilligently to the training can improve his reading. (13:40-2)

#### Procedures in measurement of remedial reading

The methods of other investigators of remedial reading are of value in the solution of the problem to be met in this study.

An investigation by Pressey and Pressey (17:206-7), 1930, on the effects of remedial reading, shows the following method used in equating two groups. Four hundred and twenty-two students in the experimental group were matched with students who had entered the University two years previously. The bases for matching were intelligence, reading score on the initial test, sex, age, and college. The reading percentiles of the two individuals were matched also with the four percentile variation. All the students of the groups were paired similarly.

The results of the equating showed the 1926 group to have a median of 17.7 in intelligence and 14.8 in reading. The 1928 group had scores of 18.1 and 14.4. Thus the difference in the median percentile ratings for the two groups on intelligence was .4 of a percentile rank. This was in favor of the 1928 group. In reading a difference of

.4 of a percentile rank favored the 1926 group. They found that the 25th and 75th percentiles of the groups differed by .6 and .1, .9 and 0 for intelligence and reading respectively.

Triggs (24), 1941, pointed out some of the difficulties in procedures for the evaluation of remedial reading. She said:

A final barrier which should be mentioned is the serious difficulty of evaluating a remedial reading program. The difficulties involved in the choice of a pretest have already been mentioned. That gain can be demonstrated on the basis of test-retest evidence, there is no question. However, it is most difficult to demonstrate the fact that gains or losses in grades are due largely to work in remedial reading programs where so many supposedly carefully planned educational experiences are being given the student at the same time. It may well be that the statistical techniques now becoming more common in educational research will help to alleviate this difficulty. Also, it is extremely hard to do a matched study where so complicated a background of experience is involved. For instance, the development of reading skills is known to be greatly affected by the availability of reading materials at the pre-school age, readiness programs, etc. Yet how are the results of all these influences to be taken into account when evaluating the program? In most cases, the record of these details is not now available and no tests have been found sensitive enough to seek out the results of such variations in training. If diagnostic instruments could establish with any degree of certainty the present status of varying skills, the problem would not be solved, but it would be simplified. (24:378-9)

One of the pitfalls of experimenters in remedial reading, according to Ammons and Hieronymus (1), 1947, is that they do not take into account the ordinary gains in ability made without remedial training. The authors say:



Above all, it is necessary in this type of study of reading gains to avoid as much as possible certain common pitfalls. Examination of the pertinent literature shows frequent failure to correct for regression effects either by use of a control group or by statistical manipulation. Without making the correction, one could within wide limits, obtain increasingly larger training gains by selecting people with increasingly lower initial test scores. A similar problem arises when practice during training essentially duplicates the materials and processes used in the evaluation tests themselves. This can give very misleading results and again emphasizes the need for more generally valid college reading tests.

The gains by the control group in this study point to perhaps the most frequent error made in evaluating reading program gains, i. e. practice effects on tests and the general gains to be expected during college attendance are often interpreted as due specifically to reading programs.

### Summary and implications

The review of literature has shown a number of findings which may be corroborated or left unsupported by this study. Of great interest is the seeming agreement in a general way of the specific nature of reading and reading abilities by Anderson (2), Buswell (4), and Robinson and Hall (18). It suggests that this study may not show a transfer of reading ability from class room to a specific field of reading, such as the reading of tests may be considered, a field in which the students have not been trained.

The wide differences in reading ability of both children and adults as shown by Sangren (20), Anderson (2), Kottmeyer (12) and others, though generally known, points to the almost certain probability that wide ranges in abil-



ity will appear in this investigation also.

The findings of Anderson (2) as to the inconsequential difference between the reading ability of men and women indicates that too much stress may have been placed on the identical sex factor in the equating of experimental and control groups,--possibly at the expense of more important factors. Some lessening of the importance of sex equating would seem justified.

A similar revelation by Anderson, that age makes little difference in learning to read implies, it seems, that age may have been over-emphasized in the matching of pairs in control studies. The same is not so true, however, of the years experience in college.

The opinion of Anderson that school or college in which an individual is enrolled is no basis for differentiation of instruction appears to be in conflict with the concept of the specificity of reading abilities and undoubtedly more evidence is needed.

Will the data in this study corroborate the literature in that "the average Sophomore reads better than the poorest Senior"?

Gains in reading ability in this study, if this is the case, would substantiate the findings of Goldstein and Justman (9) that expensive equipment is not necessary inasmuch as the program under observation has no more than ordinary equipment.

If the scores on rate and comprehension in this study tend toward a similarity with the findings of Robinson (19) there is the possibility that a relatively large number of students will lose instead of gain in reading achievement. Analysis should attempt to ascertain, if the losses appear, whether they are due to a breakdown of previous skills prior to learning new ones.

What will be the relationship between gains or losses in speed and comprehension?

Unless a very peculiar set of conditions existed in the work of McConnell (14), at Cornell, large gains will no doubt be made on the Psychological Examination.

The preponderant opinion concerning the value of the Nelson-Denny Reading Test and the Iowa Silent Reading Tests supports the use of these tests in this experiment.

The methods of equating groups and the statistical procedures revealed in the literature are very helpful in a determination of methods in this investigation. The results of other remedial classes also give a basis on which to compare findings.

Not the least important is the contribution of Ammons and Bieronyaus (1), concerning the pitfalls in which investigators become ensnared. Their opinions, where accepted, make control methods or statistical correction of gains by normal processes a major responsibility of the investigator.

There are many other implications, of course; those listed appear at the moment to be of chief importance. They will be noted throughout the study.



### Chapter III

#### METHODS AND MATERIALS

This investigation is concerned with the measurement of the results of the remedial reading program at Colorado Agricultural and Mechanical College. It does not consider the results of the program as measured only by achievement tests which are regularly given in remedial classes. It is interested in the way that changes in reading ability of those who have taken remedial work affects changes in scores of tests which had previously been given those students on entrance into college. In short, is the reading ability gained in a remedial class transferred into other fields? This chapter will present methods and materials found necessary in the conduct of the study. There will be an account of the institution of the investigation, the selection of an experimental and control group and the methods of equating, the conduct of the testing program, the recording of the data, and the problems that were met and solved.

In the final term of the 1947-48 regular school year a meeting was held for the purpose of discussing the evaluation of the remedial reading program. In attendance were the following: the Dean of the Graduate School, who

is also Head of the Department of Psychology and Education, the instructors in charge of the remedial reading course, the psychometrist of the testing bureau, a graduate student colleague, and the writer.

It was determined that at least two investigations would be undertaken immediately: one, the evaluation of the program as it affected grade-point averages and the other, the effect on entrance test scores. This study is not concerned with grade-point averages but will determine the changes in entrance test scores as a result of the remedial reading work.

In a consideration of the problem it was observed and corroborated by the literature that two factors had necessarily to be taken into account; the effect of practice on scores found by retesting, and the very probable assumption, also indicated by the literature, that scores would have changed even though the remedial course had not been taken. The possibility of giving alternate forms of the entrance tests in order to reduce the practice effect was considered but this procedure would have left the matter of gain on scores by normal processes an unknown quantity. Consequently, it was decided that control techniques would be used. This would eliminate the necessity of using alternate forms of the tests, for the main criteria under these techniques would be the changes in scores of the one group as compared to the other.

The entrance tests regularly given to students in the college are The American Council on Education Psychological Examination, 1946 edition, the American Council on Education Cooperative English Test, Form Pa, and Form A of the Nelson-Denny Reading Test, and in addition a chemistry aptitude examination. It was decided that the latter examination would not be given on the re-test inasmuch as some students do and some do not take chemistry and the effect of this condition on the study would not be known.

The first task in entering upon the equating of the experimental and control groups was a listing of all those who had taken all or any part of the remedial course. This list was made from the records of the class. Those who had completed the course were identified as against those who had not finished. A few who had taken this course and left school were found by a search of the records in the personnel office and deleted from the list. Those remaining were the potential members of the experimental group.

The equating criteria had next to be decided upon. A number of possible and desirable factors were easily found: the chronological age of the individual, the mental ability, the sex, the year in college, race, marital status, date of graduation from high school, veteran status, and, the scores of the three entrance tests on which the retests were to be run.

In preliminary work with these possible equating



factors it soon became apparent that to match individuals on even a majority of them was impossible; therefore their rank of importance had to be decided upon.

After considerable deliberation, the scores on the three entrance tests were deemed of greatest importance. It was decided that, of the three, the order should be: the psychological examination--as being the nearest measure to mental ability; the reading test, because it was the ability with which the study was most concerned; and the English examination, for the reason that changes in the final scores should give a good measure of the transfer in which this study is interested. The year in college was ranked next, as the literature reveals some difference in the ability to learn to read according to the year. The sex of the individual was considered next in importance, perhaps mistakenly so, because no evidence has been found which reveals any great difference in the sexes in reading ability.

Equating factors beyond those listed above had to be disregarded in most cases if the designated order of importance was to be held. The conclusion which necessarily had to be made was that factors other than the five decided upon as most important would match only as a matter of chance, if at all.

After the determination of the matching procedures to be used the list of students taking remedial read-

ing was marked with the scores which they had received on their original entrance examination. Entrance records of the same term in which each individual entered were then searched for individuals with similar scores on the tests. Using the same records for the matching of students as the term in which the student to be matched was enrolled insured that the matching pairs had taken the tests at approximately the same time. This was important as, judging from the high rate of gain made by some students in college on the psychological test, there would be an advantage for one or the other if the time spent in college by each was not fairly equal. The requirement of identical sex was, of course, very simply met by recording only individuals of the same sex as the experimental member.

Psychological test scores were fairly easily matched; many coincided within two points. The matching of reading scores was slightly more difficult because of the fact that there was not a sufficiently large number of those with low reading scores who had not taken remedial reading remaining to draw upon. At this point, of course, it was really a matter of finding pairs who were fairly closely equated on two scores, the psychological test and the reading test. The necessity of bringing the English score into the matching offered further complication, for at this point, considering sex and year in school along with the three entrance test scores, the matching was being done

with a consideration of five factors.

Scores for the control students as compared with the experimental tests varied, some higher, some lower, some nearly identical on two of the three scores with the third not close. In any case, all possible scores were recorded opposite the name of the experimental subject. The result was that each experimental student had from one to six "twins". The work thus far showed that there had been recorded, beside the 75 possible members of the experimental group, more than 250 possible members of the control group.

A survey of the lists at this time showed that the possibility of close pairings was very good.

The next step was to secure the acquiescence of the students who had been selected to be re-tested. This problem was approached deliberately for there was no assurance at this stage that the cooperation of the students would be forthcoming. The Heads of the Psychology and Education Department and the Testing Bureau were consulted. The sending of an official letter requesting that the selected students report for testing was decided against as being unethical for the reason that these particular students should not be required to do what other students were not. The alternative procedure which was discussed and finally followed was this: a letter was to be written over the signature of the Head of the Department of Psych-



ology and Education and sent to all students in both the tentative control and experimental groups 1/. The letter would endeavor to give the students an appreciation of the importance of their participation and ask that they attend, of their own volition, one of two meetings on a consecutive Tuesday and Wednesday of the following week. In the letter, students were impressed with the fact that their requested participation or lack of it would have absolutely no effect on their status in the college.

It was now necessary to get the correct addresses of the total of the combined groups of about 325 students in order to send them the letter.

Here occurred a very interesting, yet momentarily, a very disturbing situation. When the records of the personnel bureau were searched, as they previously had been for members of the experimental group, it was found that a large number of the possible control group, about 90 of the 250 in fact, had left school. With them had gone, it seemed, those who matched the most exactly on the entrance reading test scores. With the proper foresight the names of those who had left school would have been deleted before the pairings were made. Since the students were gone in any event the matched pairs could not have been used but a deletion of the names would have saved time and the disappointment.

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I/ Appendix A. Letter requesting participation of experimental and control group students.

In another conference with the Head of the Department, it was decided that the study would be continued.

The letters described heretofore were sent to the remaining members of the two groups. Names and addresses were found to be the same in the personnel office as in the student directory so the directory was used.

Sixty students attended the first meeting. The Head of the Department explained very clearly the purpose of the study and the procedures to be followed. Every student volunteered to become a subject.

After the assent of the students had been given, an effort was made to schedule the times when they could meet in groups in the testing bureau for their tests. Though the writer had made a careful sampling of free periods of the students involved, there appeared to be no common time when students could meet in groups. The scheduling began to bog down. The Department Head suggested that students write the hours they had available on slips of paper which had been passed out to them and informed them that they would be notified as to the particular time they could report for testing.

Before the meeting of the next day, the difficulties of scheduling groups for tests were considered. The head of the testing bureau and the psychometrist cooperatively and graciously suggested that students be referred at any time convenient. With this assurance the meeting

of the following day went smoothly. The purpose of the study was again explained by the Department Head, again all of the fifty-eight students agreed to participate, and they were asked to write on the paper slips a time when they could be tested and requested to report to the testing bureau at that time.

Students at the first days's meeting were notified by post card that they might report at any of the times which they had listed. The psychometrist was notified of the free periods as listed by students so that she could plan the tremendous amount of extra work entailed over and above regular duties.

Testing began the following day, progressed by single individuals at a time or small groups until finished. All but a few completed within the next seven school days. Students were given the tests singly, at different times, or consecutively if they had sufficient time to take them all at once.

All but a few of the students reported for tests as scheduled. These few students arranged for new testing dates. Fewer still experienced conflicts so serious that they chose to forego the examinations. In cases in which students failed to report at scheduled dates without making arrangements for re-scheduling, the writer found those students by consulting



their weekly class schedules and was able to assist most of them to plan time for testing.

Test answer sheets were checked by student assistants of the testing bureau who had considerable former experience with this work in the same bureau and with the same tests. Their work was closely supervised by the psychometrist who also made spot checks of the correcting process. All test answer sheets were checked twice also by the writer who had considerable former experience with similar tests. Where a few differences were found, the test answer sheets were again checked by the psychometrist. The result of the cross checking was complete agreement among the different checkers on the scores assigned to the various tests.

Test scores were recorded on testing bureau cumulative cards and on the Master Data Sheet 2/. They were then checked three times for errors in transcription. Gains were figured on pre-test and re-test scores and recorded on the data sheet. Also recorded were the pre-test and post-test achievement scores of the tests given in connection with the remedial reading course.

The tests used in the remedial reading course were: The Minnesota Speed of Reading Test and the Iowa Silent Reading Tests. The Minnesota Test has alternate forms A and B. Form A was the pre-test.

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2/ See Appendix B, Master Data Sheet

The Iowa Silent Reading Tests are nine in number and there are alternate forms of each also. The nine tests are intended to measure various abilities, as follows:

1. Rate
2. Comprehension
3. Directed reading
4. Poetry Comprehension
5. Word Meaning
6. Sentence Meaning
7. Paragraph Comprehension
8. Location of information. Index
9. Location of information. Key Words

## Chapter IV

### ANALYSIS OF DATA

In the first chapter, the problem, the effect of the remedial reading program on the changes in scores on the entrance tests at Colorado Agricultural and Mechanical College, was outlined. Chapter II gave the findings of others, especially the implications as they touched upon the transfer of increased reading ability from the remedial classroom into other fields, and the third chapter reviewed the methods used in conducting the study.

This chapter will present the data bearing on the solution of the problem much in the same order in which the problem was analysed in the first chapter. Thus, it will deal first with the effects of the remedial reading work on reading as measured in the reading course. This effect was determined by the scores of students completing the course on two tests, the pre-course and post-course forms of the Minnesota Speed of Reading and The Iowa Silent Reading Tests.

The data gathered from an analysis of the records of scores of students on the entrance examinations made on their entrance into college will next be presented; following these, the scores of the same students on readain-



istration of the entrance tests after taking the remedial reading course. The entrance tests included in the experiment are the American Council on Education Psychological Examination for College Freshmen, 1946 edition, the Cooperative English Test, Form PM of the American Council on Education, and Form A of the Nelson-Denny Reading Test.

Inasmuch as a control group was used in the conduct of the experiment, their scores will be reviewed also in the order in which they will present the clearest comparison with the experimental group. The total data found, all of which are used in the study, are recorded on the Master Data Sheet 1/ in the Appendix.

#### Statistical procedures

All statistical devices used are common to the worker in educational statistics. The elements found necessary throughout the analysis in the various computations were the determination of the mean, standard deviation, difference between means, coefficient of correlation between two distributions, standard errors for the mean, standard deviation, and difference of means in correlated and uncorrelated distributions, and for the standard deviations when correlated or uncorrelated. The customary tables were referred to for values indicating significance in differences

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1/ Appendix B. Master Data Sheet.

and for the well known "t" values. One procedure more than necessary was followed in the calculation of differences of means because of some difference in authoritative opinion on the computation of standard errors. Some authorities consider a standard error to be more consistent when the statistic for which the standard error is to be found is divided by the square root of  $N-1$ , while others consider this necessary for small samples of, say, less than thirty only. The standard errors computed in the data to follow in the case of the difference of means of the pre-remedial and post-remedial administration of the entrance tests are found by both methods except in the few cases where the samples were less than thirty. In these cases, the small distribution statistics were divided by the square root of  $N-1$  to find the standard error as advocated by practically all authorities.

The difference in the two computations was very small in each case, the largest amounting to only a little over three-hundredths of a point in the final ratio of difference to standard error of the difference. These slight deviations, probably due to the dropping of figures in decimals to some extent, has<sup>ve</sup> no bearing on the results. The double calculations on these standard errors was an excellent means of checking the accuracy of the computations by comparing one with the other, besides being performed as a matter of personal interest.

Measurement of achievement  
in the remedial reading  
course

The remedial reading course covered a period of twelve weeks. Students were not required to complete it but were allowed to drop at any time. Table shows that of those enrolling in the course, over 63 per cent completed and that the others terminated at some time before the end of the course. Thus, a sample of over thirty was found which had completed the instruction.

Table 5.--NUMBER OF STUDENTS ENROLLING, COMPLETING, AND NOT COMPLETING REMEDIAL READING COURSE AND PERCENTAGES OF EACH.

	Number	Per cent
Enrolled in course	54	100
Completing course	34	63
Not completing course	20	37

At the beginning of the course, students were pre-tested on one of alternate forms of both the Minnesota Speed of Reading Test and the Iowa Silent Reading Test. As shown in Table 6, the highest score of the 34 students who completed the course was 30 and the lowest score was 3.

The scores showed that the reading ability possessed by the highest scoring student as measured by the test was ten times greater than the ability of the lowest scoring student. The average student as indicated by the mean



score read over four times as well as the lowest scoring student and less than half as well as the highest scoring student, if weighing of the scores is not considered.

Table 6.--VARIABILITY OF PRE-TEST SCORES OF 32 REMEDIAL READING STUDENTS ON MINNESOTA SPEED OF READING TEST, FORM A.

	Frequency	Raw score
Highest score	1	30.00
Lowest score	1	3.00
Range	-	27.00
Mean	-	14.59

At the end of the course, students were tested on Form B of the Minnesota test. The spread of scores is shown in Table 7. On this test, the lowest score was one and the highest was thirty-one. The mean was 17.88.

From the scores it was found that the student with the best score did thirty-one times better than the poorest score. The best score was again about twice that of the average score but the lowest score was, in this case, only about one eighteenth of the mean score.

Table 7.--VARIABILITY OF POST-TEST SCORES OF 32 REMEDIAL READING STUDENTS ON MINNESOTA SPEED OF READING TEST, FORM B.

	Frequency	Raw score
Highest score	1	31.00
Lowest score	1	1.00
Range	-	30.00
Mean	-	17.88

Comparison of the data of the two tests as shown in Table 8 revealed that there was a difference of the mean scores, 14.59 and 17.88, for the two tests of 3.29 in favor of the scores on the post-test, Form B.

The standard error of the mean of Form A of the test was 1.05 and indicated that there are 68 chances in 100 that the true mean would not be further away from the obtained mean than plus or minus 1.05. In other words, the chances are approximately two to one that the true mean lies between 13.54 and 15.64. It is practically certain, 99 chances in 100, that the true mean does not lie outside plus or minus  $3 \times 1.05$  or 3.15. For almost certainly the true mean lies between 11.44 and 17.74.

The mean of Form B scores was found to be 17.88, with a standard error of 1.11. There are 68 chances in 100 that the true mean is not greater than 18.99 nor less than 16.77 and it is almost guaranteed that it could not be

larger than 21.21 nor smaller than 14.55.

The correlation coefficient of .50 with a probable error of .04 shows that there is a substantial relationship between the two tests.

The standard error of the difference between the means is 1.08. The difference being 3.29, it was found that there is practically no chance that the difference between means was not more than zero. Therefore, the gain of the class in the reading ability measured by the tests is significant.

Table 3.--COMPARISON OF DATA ON MINNESOTA SPEED OF READING TESTS, PRE-TEST AND POST-TEST, FORM A AND FORM B.

	Number of cases	Mean	Standard Deviation	Standard error of the mean
Form A Pre-test	32	14.59	5.99	1.05
Form B Post-test	32	17.89	6.31	1.11
-----				
Difference of the means				3.29
Standard Error of the difference of means				1.08
Ratio of difference of means to standard error of difference when correlated. (Difference of means/standard error of difference)				3.05
Correlation coefficient of both tests				.50
Probable error of correlation coefficient				.09

Besides the Minnesota Speed of Reading Test, the



Iowa Silent Reading Tests were also given as pre-tests and post-tests to those completing the course. No data are available for the difference on scores of students who did not complete the course as they were not tested at the termination of the class.

Table 9 shows the highest score made was 201 and the lowest 153, and thus the range was 48. There is not the variability found in the scores of the Minnesota test; the average of scores of the students was about seven-eighths as high as the best score and the lowest score about three-fourths as good.

Table 9.--VARIABILITY OF SCORES OF 34 STUDENTS OF REMEDIAL READING ON PRE-TESTS, FORM Aa OF THE IOWA SILENT READING TESTS.

Highest score	201.00
Lowest score	153.00
Range	48.00
Mean score	171. 79

It was found that the range between scores was less on Forms Bm of the Iowa Tests given at the end of the course. The variation shown in Table 10 was 36 points as compared with a variation of 48 on the initial forms of the test. The mean of the scores was only about twenty points below the best score or about nine-tenths as large and the lowest score was about four-fifths of the highest

scores.

Table 10.--VARIABILITY OF POST-TEST SCORES OF 32 REMEDIAL READING STUDENTS ON THE IOWA SILENT READING TESTS.

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Highest score	202.00
Lowest score	166.00
Range	36.00
Mean	181.91

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It was found that students made significant progress in the remedial class as measured by the gains made between alternate forms of the Iowa Silent Reading Tests.

An analysis of the data of Table 11 shows that, considering the standard error of the difference, gains of over twice the amount necessary were made to be certain (99 chances in 100) that the true difference in the means was greater than zero. The correlation of .70 showed a possible high relationship between the two tests and indicated that the two forms of the test may measure identical elements better than the Minnesota Test. A decrease in the variability as measured by the smaller standard deviation makes the gains even more certain.

Table 11.--COMPARISON OF DATA ON IOWA SILENT READING TESTS, PRE-TEST AND POST-TEST, FORMS Am AND Bm.

	Number of cases	Mean	Standard Deviation	Standard error of the mean
Form A Pre-test	34	171.79	11.20	1.92
Form B Post-test	34	181.91	9.17	1.57
-----				
Difference of the means				10.12
Standard error of the difference of the means				1.39
Ratio of difference of means to standard error of difference when correlated				7.28
Correlation coefficient of both tests				.70
Probable error of correlation coefficient				.06

Relationship of gains on reading tests to gains on entrance examinations

Remedial reading students, in addition to being tested in the conduct of the course, were given re-tests on the entrance examinations to determine if there was a transfer of reading abilities. The data necessary to compare the gains made in the course with gains made when re-tested on the entrance examinations are now presented.

The findings, Table 12, were that the relationship of gains on the Minnesota Reading Test to the entrance examinations was very slight. One correlation was zero, indicating no relationship. The probable error of the



correlation indicates that the true relationship may lie either positively or negatively from zero with equal chances for either.

The obtained relation between gains on the Minnesota test and the Psychological examination was negative, but only .03. The probable error shows that the true correlation, 50 times in 100, falls between plus .09 and minus .15. The true relationship may in reality be positive or more negative than indicated.

The correlation obtained between the Minnesota reading test and the Cooperative English test was also negative, minus .15. The probable error of .12 allows the true correlation to fall negative fifty per cent of the time. The true relationship, though unlikely, may be as low as minus .63 or plus .33.

As the table shows, the deviation of scores about the mean is greater than the mean itself five out of six times and the deviation is almost equal to the mean in the other case. The clear indication is that there is little relationship between gains on the achievement tests and gains on entrance examinations but that what little there is, is negative.

Table 12.--COMPARISON OF GAINS MADE BY REMEDIAL READING STUDENTS ON THE MINNESOTA SPEED OF READING TEST WITH GAINS MADE ON ENTRANCE EXAMINATIONS.

Name of test	Number of cases	Mean of gains	Standard devi- ation	Corre- lation coef- ficient of gains	Probable error of corre- lation coef- ficient
Minnesota Speed of Reading Test	32	3.28	6.17		
American Council on Education Psy- chological Exam- ination	32	6.17	13.07	-.03	.12
Minnesota Speed of Reading Test	32	3.28	6.17		
American Council on Education Co- operative English Examination	32	20.10	20.03	-.15	.12
Minnesota Speed of Reading Test	31	3.68	5.98		
Nelson-Denny Reading Test	31	15.19	15.40	.00	.12

Correlations, Table 13, of the Iowa Silent Reading Test gains with gains on the entrance examinations were low but relatively higher in two cases than for the Minnesota test. There was a zero correlation with the Nelson-Denny Reading Test just as the correlation was zero between the Iowa and Nelson-Denny tests. The highest correlation of the series so far, one that is almost significant, was found for the relationship between the Iowa and Psychological

tests.

In the series so far, the Minnesota and Iowa tests, as each was correlated with the entrance examinations, has shown practically no relationship between gains on one with gains on the other. Only one of the six coefficients of correlations found approached a figure which would warrant the assumption that there was even a slight correlation, and this figure, in the light of its probable error, was not significant.

Table 13.--COMPARISON OF GAINS MADE BY REMEDIAL READING STUDENTS ON THE IOWA SILENT READING TESTS WITH GAINS MADE ON ENTRANCE EXAMINATIONS.

Name of test	Number of cases	Mean of gains	Standard devi- ation	Corre- lation coef- ficient of gains	Probable error of corre- lation coef- ficient
Iowa Silent Read- ing Tests	34	10.11	8.13		
American Council on Education Psy- chological Exam- ination	34	8.0	13.95	.39	.10
Iowa Silent Read- ing Tests	34	10.11	8.13		
American Council on Education Co- operative English Examination	34	20.76	20.08	.17	.12
Iowa Silent Read- ing Test	33	9.9	8.10		
Nelson-Denny Reading Tests	33	13.2	17.90	.00	.12



Changes in scores of  
remedial reading stu-  
dents on entrance exam-  
inations as compared  
with a control group

The data to follow were all derived from experiments using a control group. In the selection of the control group an attempt was made to find matched pairs but this was not completely successful. On the other hand, control students were not members of the student body at large but were selected because of a similarity of entrance test scores to some member of the experimental group. In this sense, the groups are matched even though the individuals themselves were not perfectly paired. Without the endeavor spent in selecting control group students with scores similar if not identical, it is doubtful that such a close matching of groups could have been achieved.

The Master Data Sheet 1/ shows the scores for the two groups. In the experimental group the students numbered one to thirty-four completed the remedial course. Those numbered thirty-five to fifty-four did not complete the course. The data treats these two groups together and separately.

In some instances a member of either group did not take one of the tests. In these instances, the numbers will be less than fifty-four.

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1/ Appendix B. Master Data Sheet.

The psychological examination.--The close matching of the control and experimental groups is recorded in Table 14. The slight difference of the means, .65, the relatively equal size of the standard deviations, and the standard errors of the means indicates that the groups are closely equated. In fact, the ratio, .17, of the difference showed, on reference to a table that the chances of the true difference being greater than zero are only 56 in 100. For the purposes of this experiment, the groups may be considered as equated.

Table 14.--COMPARISON OF MEAN SCORES OF EXPERIMENTAL AND CONTROL STUDENTS ON ORIGINAL ADMINISTRATION OF AMERICAN COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION.

Group	Number	Mean	Standard deviation	Diff. of means	Standard errors of means	Diff. means
Experimental	51	112.49	20.56	.65	2.87	3.90
Control	50	111.84	18.65		2.64	
Difference of means over standard error of difference. $D/SE_{diff.}$						.17
Chances in 100 that the true difference of means is greater than zero						56

After the remedial reading students had completed their course they were retested on the psychological examination as was the control group which had not taken remedial reading.

Table 15 shows the findings on the retesting.

The difference between means was found now to be slightly larger than on the pretest. The difference now is in favor of the control group rather than the experimental as was the case on the initial testing. There are only about 61 chances in 100 that the true difference is more than zero and therefore the difference does not even approach the realm of significance. The scores of groups are still equivalent.

Table 15.--COMPARISON OF MEANS OF SCORES OF ALL EXPERIMENTAL AND CONTROL STUDENTS ON FINAL ADMINISTRATION OF AMERICAN COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION.

Group	Number	Mean	Standard devi- ation	Diff. of means	Standard errors Mean Diff.means
Experimental	51	122.27	18.64	.97	2.61
Control	50	123.24	16.90		2.39
Difference of means over standard error of difference. $D/SE_{diff.}$					.27
Chances in 100 that true difference of means is greater than zero					61

The previous analysis compared the means of the controls and all of the group enrolling in the remedial course. An analysis was then made of the mean score of only those students who completed the twelve weeks work in the course as compared with the entire control group. It was found, Table 16, that the difference of the means of scores on the initial testing was near zero, only .04. It



was found that practically, the chances of the difference in favor of the experimental group being more than zero were even. These groups are therefore equivalent for the purposes of the experiment.

Table 16.--COMPARISON OF MEANS OF SCORES OF 34 STUDENTS COMPLETING REMEDIAL READING WITH CONTROL STUDENTS ON INITIAL SCORES OF AMERICAN COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION.

Group	Number	Mean	Standard deviation	Diff. of means	Standard error of Mean diff. means
Experimental	34	111.88	19.95		3.42
Control	50	111.84	18.65	.04	2.64
Difference of means over standard error of difference. $D/SE_{diff.}$					.01
Chances in 100 that true difference of means is greater than zero					50

The comparison of means of the 34 students completing remedial reading with the control group on the post-testing of the psychological examination, Table 17, showed the possibility of a gain of the control group over the experimental group. The difference in means was 3.33. It was determined from a table of values, using the figure of the difference in means divided by the standard error of the difference that the chances were about 80 in 100 that the true difference was greater than zero. A critical ratio of 3.0 is usually required to guarantee a significant

difference, however, and, though the gain appears to be in favor of the controls, it is not certain. The groups are deemed to be without a significant difference, therefore.

Table 17.--COMPARISON OF MEANS OF SCORES OF 34 STUDENTS COMPLETING REMEDIAL READING WITH SCORES OF CONTROL STUDENTS ON FINAL ADMINISTRATION OF AMERICAN COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION.

Group	Number	Mean	Standard deviation	Diff. of means	Standard error of Mean Diff. means	
Experimental	34	119.91	18.40	3.33	3.16	3.96
Control	50	123.24	16.90		2.39	
Difference of means over standard error of difference. $D/SE_{diff.}$						.84
Chances in 100 that true difference of means is greater than zero						80

A sample of around 20 is insufficient to be of certain value in statistical evaluation but a consideration of the sample may sometimes lead to the consistency of other data or introduce an inconsistency which it might be well to take into consideration. For these reasons a comparison of the scores of the 17 students who could be measured and who had not completed the remedial reading course is considered Table 18.

It was found that the obtained mean of the scores of this group was larger than the control group by 1.86. This is not large enough as it works out to show a signi-



ficant difference between the groups as the chances are only 62 in 100 that the real difference would be greater than zero. These two groups are also statistically without a variation great enough to guarantee that they are not equal.

Table 18.--COMPARISON OF MEAN SCORES OF 17 STUDENTS NOT COMPLETING REMEDIAL READING WITH MEAN OF CONTROL GROUP ON INITIAL AMERICAN COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION.

Group	Number	Mean	Standard deviation	Diff. of means	Standard errors of Mean Diff. means	
Experimental	17	113.70	22.74		5.69	
Control	50	111.84	18.65	1.86	2.64	6.27
Difference of means over standard error of difference. $D/SE_{diff.}$						.30
Chances in 100 that true difference of means is greater than zero.						62

The final testing of the small section of the experimental group on the psychological examination showed, Table 19, a larger obtained difference in their favor. The difference was not significant even with the gain, there being only 77 chances in 100 that it was greater than zero. There is no certainty, then, that the obtained score really shows that the groups are now unequal.



Table 19.--COMPARISON OF MEAN SCORE OF 17 STUDENTS NOT COMPLETING REMEDIAL READING WITH MEAN OF CONTROL GROUP ON FINAL AMERICAN COUNCIL EDUCATION PSYCHOLOGICAL EXAMINATION.

Group	Number	Mean	Standard devi- ation	Diff. of means	Standard errors MeanDiff.means	
Experimental	17	127.00	18.22		4.56	
Control	50	123.24	16.90	3.76	2.39	5.15
Difference of means over standard error of difference. $D/SE_{diff.}$						.73
Chances in 100 that true differences of means is greater than zero.						77

This concluded this section of the analysis of scores of the two groups on the Psychological Examination. No significant difference was found in any of the comparisons of the groups. It appears the Psychological Examination is impervious to any registration of gains in reading ability of those taking the test.

The Cooperative English Examination.--The next data to be presented are those gained from tests and re-tests of the Cooperative English Examination of The American Council on Education. As in the previous section comparisons will be shown as found from initial testing and re-testing of the control group and of the experimental group at the same times but with a remedial reading course in the meantime for the latter group. The data will be

presented in similar form.

Table 20 shows that the initial testing of all the experimental group revealed a mean obtained score lower than that for the controls. The difference is not significant, and there is only a little better than an even chance that the true difference is more than zero.

Table 20.--COMPARISON OF MEANS OF SCORES OF ALL EXPERIMENTAL AND CONTROL STUDENTS ON INITIAL ADMINISTRATION OF THE AMERICAN COUNCIL ON EDUCATION COOPERATIVE ENGLISH EXAMINATION.

Group	Number	Mean	Standard devi- ations	Diff. of means	Standard errors Mean Diff. means
Experimental	54	153.20	39.63	2.42	5.39 7.88
Control	50	155.20	40.66		5.75
Difference of means over standard error of difference. $D/SE_{diff.}$					.31
Chances in 100 that true difference of means is greater than zero.					62

The post-administration of the English Examination showed a slightly larger obtained difference in favor of the control group, Table 21. The chances in 100 that the obtained difference was significant increased also in their favor. On the initial test they were 62 in 100 and on the final testing they were about 69. The difference between the means of the scores is, again, not large enough to insure significance.



Table 21.--COMPARISON OF MEANS OF SCORES OF ALL EXPERIMENTAL AND CONTROL STUDENTS ON FINAL ADMINISTRATION OF THE AMERICAN COUNCIL ON EDUCATION COOPERATIVE ENGLISH EXAMINATION.

Group	Number	Mean	Standard deviation	Diff. of means	Standard errors of Mean Diff. means
Experimental	51	173.51	36.00		5.01
Control	50	176.86	33.06	3.35	4.68
Difference of means over standard error of difference. $D/SE_{diff.}$					.19
Chances in 100 that true difference of means is greater than zero.					69

The analysis turns again to the scores of those 34 students who completed the remedial course.

It was found, Table 22, that the initial test scores on the English Examination on the average were higher for the controls than for this section of the experimental group. The difference was not great, 3.51, and the critical ratio of difference in means over its standard error showed by reference to the table of possibilities that there were about 65 chances in 100 that the difference was significant. There is only a probable chance these groups are unequal, therefore, and it is not certain.



Table 22.--COMPARISON OF MEANS OF SCORES ON PRE-TEST OF AMERICAN COUNCIL ON EDUCATION ENGLISH EXAMINATION: CONTROL GROUP AND 34 STUDENTS COMPLETING REMEDIAL READING COURSE.

Group	Number	Mean	Standard deviation	Diff. of means	Standard errors of Mean Diff. means	
Experimental	34	152.11	36.46		6.25	
Control	50	155.62	40.66	3.51	5.75	8.49
Difference of means over standard error of difference. $D/SE_{diff.}$						.41
Chances in 100 that true difference of means is greater than zero.						65

The data of Table 23 showed that chances in favor of the control group mean being significantly greater than that of the experimental on the final test of the English Examination were only 69 in 100. Therefore, it cannot be regarded as certain that the gains of the control group are greater than the 34 reading students who completed the course though the greatest probability is in that direction.

Table 23.--COMPARISON OF MEANS OF SCORES ON POST-TESTING OF THE AMERICAN COUNCIL ON EDUCATION ENGLISH EXAMINATION: CONTROL GROUP AND 34 STUDENTS COMPLETING THE REMEDIAL READING COURSE.

Group	Number	Mean	Standard deviation	Diff. of means	Standard errors of Mean Diff. means
Experimental	34	172.88	37.02	3.98	6.34
Control	50	176.86	33.06		4.68
Difference of means over standard error of difference. $D/SE_{diff.}$					.51
Chances in 100 that true difference of means is greater than zero.					69

The analysis now moves from the consideration of the scores of the experimental group section which completed reading as against the control group to the comparison of those who did not complete the remedial course. Here the means of the two groups are evenly matched, Table 24. The difference of .57 and a computation of its difference showed that it is only a very little more likely that the real difference is greater than zero than less. Half of these data are based on a sample of 20, but are used for reasons given before. Keeping in mind the pitfalls of attaching more importance than warranted to this small group, there does not appear to be any difference in the calculations between this and the larger group to indicate that the observed difference is significant.



Table 24.--COMPARISON OF THE MEANS OF THE CONTROL GROUP AND 20 STUDENTS NOT COMPLETING THE REMEDIAL READING COURSE ON THE SCORES OF THE INITIAL AMERICAN COUNCIL ON EDUCATION COOPERATIVE ENGLISH EXAMINATION.

Group	Number	Mean	Standard deviation	Diff. of means	Standard errors of Mean Diff. means
Experimental	20	155.05	44.47		10.27
Control	50	155.62	40.66	.57	11.77
Difference of means over standard error of difference. $D/SE_{diff.}$					.048
Chances in 100 that true difference of means is greater than zero.					52

On post-testing of the same group it was found, Table 25, that the errors of the means and of the difference of the means had been reduced. Thus a difference of 2.22 and its error of 9.57 show 6 chances in 10 that the difference is real. Again this is insufficient to be of certain significance.



Table 25.--COMPARISON OF THE MEANS OF THE CONTROL GROUP AND 20 STUDENTS NOT COMPLETING THE REMEDIAL READING COURSE ON FINAL TESTING WITH THE AMERICAN COUNCIL ON EDUCATION COOPERATIVE ENGLISH EXAMINATION.

Group	Number	Mean	Standard devi- ation	Diff. of means	<u>Standard errors</u> Mean Diff. means	
Experimental	20	174.60	36.40	2.22	8.35	9.57
Control	50	176.86	33.06		4.68	
Difference of means over standard error of difference. $D/SE_{diff.}$						.23
Chances in 100 that true difference of means is greater than here.						59

The Nelson-Denny Test.--The effects of the remedial reading course will now be considered in connection with re-administration of the Nelson-Denny Reading Test.

The first groups to be considered are all those entering the remedial course, and the controls. Table 26 shows the data which were found. The mean was larger on the initial testing in favor of the control group. The results are consistent with those found previously; there is no significant difference in the mean scores.

Table 26.--COMPARISON OF TOTAL EXPERIMENTAL AND CONTROL GROUP MEAN SCORES ON FIRST ADMINISTRATION OF NELSON-DENNY TEST, FORM A.

Group	Number	Mean	Standard deviation	Diff. of means	Standard error of Mean Diff. means	
Experimental	53	68.79	15.29	2.74	2.10	2.97
Control	49	71.53	14.69		2.10	
Difference of means over standard error of differences. $D/SE_{diff.}$						.92
Chances in 100 that true difference of means is greater than zero.						82

Another case of very slight difference in the means is shown in Table 27. With a difference in means of .98 and its standard error of 3.82 the critical ratio of .26 indicates that the true difference is less than zero, 49 out of 100 times which shows that the scores are not significantly different.

Table 27.--COMPARISON OF POST-TEST MEAN SCORES OF EXPERIMENTAL AND CONTROL GROUPS ON THE WILSON-DEWY READING TEST, FORM A.

Group	Number	Mean	Standard devi- ation	Diff. of means	Standard errors Mean: Diff. means	
Experimental	53	82.26	21.05	.98	2.89	3.82
Control	49	83.24	17.50		2.90	
Difference of means over standard error of differences. $D/SE_{diff.}$						.26
Chances in 100 that true difference of means is greater than zero.						60

Having presented the data on the scores of the whole experimental group, the findings concerning the scores of the group which completed remedial reading as compared with those of the controls will be given.

The first administration of the tests on entrance into college showed that the control group was almost but not quite significantly superior on the test to those who were later to take remedial reading. The computations given in Table 28 show the largest difference encountered so far, 4.08. The critical ratio is also the largest, 1.355. The groups are almost at the limit of the range in which there is a chance that they are not different.



Table 28.--COMPARISON OF MEANS OF 33 STUDENTS WHO COMPLETED THE READING COURSE AND THE CONTROL GROUP ON THE FIRST ADMINISTRATION OF THE NELSON-DERRY READING TEST.

Group	Number	Mean	Standard devi- ation	Diff. of means	Standard errors Mean Diff. means
Experimental	33	67.45	12.35	4.08	2.15
Control	49	71.53	14.69		22.10
Difference of means over standard error of differences. $D/SE_{diff.}$					1.35
Chances in 100 that true difference of means is greater than zero.					91

On the final testing of the experimental students who had completed remedial reading it was found that they had decreased the difference in the means in favor of the control group by 1.47 points. The 91 chances in 100 that the obtained difference was significant possessed by the control group on the original testing was reduced to 72 chances in 100 on the second test. The results of the second tests, shown in Table 29, show there is no certainty of a true difference larger than zero.

Table 29.--COMPARISON OF MEANS OF 33 STUDENTS WHO COMPLETED THE REMEDIAL READING COURSE AND THE CONTROL GROUP ON THE FINAL ADMINISTRATION OF THE NELSON-DENNY TEST, FORM A.

Group	Number	Mean	Standard deviation	Diff. of means	Standard errors of Mean Diff. means	
Experimental	33	80.63	21.83		3.80	
Control	49	83.24	17.50	2.61	2.50	4.55
Difference of means over standard error of differences. $D/SE_{diff.}$						.57
Chances in 100 that true difference of means is greater than zero.						72

The results of the tests with the small sample on the Nelson-Denny entrance test as compared with the control group will now be treated.

On the original tests, Table 30, the difference between means was very slight, only .53, in fact. According to the data, this showed 54 chances in 100 that the difference was real. The data follow the pattern consistently. There was no significance in the difference.



Table 30.--COMPARISON OF MEANS OF SCORES OF CONTROL GROUP  
AND 20 STUDENTS NOT COMPLETING REMEDIAL READING ON  
ORIGINAL ADMINISTRATION OF NELSON-DENNY TEST, FORM A.

Group	Number	Mean	Standard devi- ation	Diff. of mean	Standard errors	
					Mean	Diff. means
Experimental	20	71.00	18.94		1.34	
Control	49	71.53	14.69	.53	2.10	4.82
Difference of means over standard error of differences. $D/SE_{diff}$ .						.11
Chances in 100 that true difference of means is greater than zero.						54

The last comparison to be reviewed did not differ from the findings on the others as to the difference of the means, Table 31. There was no significance in the variation of .21. The readers decreased the lead of the control group from 54 chances in 100 of a difference against them to 52 chances in 100 that their advantage on the final test was a true difference.



Table 31.--COMPARISON OF MEANS OF SCORES OF CONTROL GROUP AND 20 STUDENTS NOT COMPLETING REMEDIAL READING ON FINAL ADMINISTRATION OF NELSON-DENNY READING TEST, FORM A.

Group	Number	Mean	Standard devi- ation	Diff. of mean	Mean	Diff. means
Experimental	20	83.45	19.40		4.45	
Control	49	83.24	17.50	.21	2.50	5.10
Difference of means over standard error of difference. $D/SE_{diff.}$						.04
Chances in 100 that true difference of means is greater than zero.						52

This ends the presentation of the data. The findings will be summarized and implications noted.

#### Summary and Implications

This chapter will be reviewed here. The form will follow the chapter organization.

#### Achievement in the remedial reading course.--

It was found that, even with a comparatively wide range of abilities in the way of individual differences suggested by the range of scores on the pre-tests of the Minnesota and Iowa Reading tests, the remedial reading class made significant gains. The gains as measured on the alternate forms of the Minnesota Test were significant and the gains as shown by the Iowa Silent Reading Tests were more than twice the amount necessary to guarantee significant progress.

Gains of remedial students on entrance examinations as compared with gains on the Minnesota Test.--

Correlation of gains on the Minnesota Test with gains of the same students on the Psychological, English, and Nelson-Denny entrance tests were:  $-.03 \pm .12$ ,  $-.15 \pm .12$ , and  $.00 \pm .12$  respectively. No positive correlation was found.

Correlation of the scores of the Iowa Silent Reading Tests with scores on the same entrance tests were:  $.39 \pm .10$  for the Psychological,  $.17 \pm .12$  for the English test, and  $.00 \pm .12$  for the Nelson-Denny Test. Two indications of very slight relationship are suggested by the  $.17$  and  $.39$  coefficients but the probable errors are too large to make them reliable. No positive relationship can be construed from the data, therefore.

Difference in gains of experimental and control groups on entrance examinations.--inasmuch as no significant difference was shown between any of the groups of experimental and control students tested on any of the entrance tests, another way of evaluating the experiment is now shown in Table 32.

The table shows the difference in the means of the scores of each group paired for the study. Even though no particular group gained significantly, the critical ratio of the observed difference of means gave a figure (chances in 100) of the true gain being greater than zero. With these chances in 100 as the criteria, it was found

Table 32.--GAINS OF VARIOUS EXPERIMENTAL GROUPS AS COMPARED WITH THE CONTROL GROUP ON THE BASIS OF CHANCES IN 100 THAT THE TRUE DIFFERENCE IN THE OBTAINED MEANS IS GREATER THAN ZERO.

Group and test given	Diff. of means of exper- imental and control groups	Chances in 100 of a true differ- ence in favor of group		Gains in chances in 100 of a true differ- ence in favor of group		Degree of signif- icance of differ- ence in means
		Exp.	Cont.	Exp.	Cont.	
Total group taking reading						
Pre-Psychological	.65	56		17	none	
Post-Psychological	.97		61			
Pre-English	2.42		62			
Post-English	3.35		69	7	none	
Pre-Reading	2.74		82			
Post-Reading	.98		60	22	none	
Group completing reading						
Pre-Psychological	.04	50	50			
Post-Psychological	3.33		80	30	none	
Pre-English	3.51		65			
Post-English	3.98		69	4	none	
Pre-Reading	4.08		91			
Post-Reading	2.61		72	19	none	
Group not completing reading						
Pre-Psychological	1.86	62				
Post-Psychological	3.76	77		15	none	
Pre-English	.57		52			
Post-English	2.22	59		11	none	
Pre-Reading	.53		54			
Post-Reading	.21	52		6	none	
				73	50	



that the greatest gains in chances of a true difference in mean scores was made on the Psychological Test by the control group as compared with the section of the experimental group which completed the reading course. The two largest gains by the control group were on the Psychological Test and the two smallest of its gains was on the English examination. In the one case, an experimental group section, those not completing the course made more gain than the controls on the English examination. This same group made the lowest of the gains on the Psychological examination also.

Where the experimental group gained consistently was on the reading tests. Even though the data showed that there was no correlation in gains on the Minnesota or Iowa Reading test with the Nelson-Denny Reading test, the three experimental sections gained in each case. Before drawing conclusions from this it should be remembered that none of the gains of the groups was significant and that any of the difference in scores just reviewed may have been due wholly to chance.

The total gains of chances in 100 of a true difference in scores was in favor of the experimental group, 73 to 58, and this difference of a total of 15 points is probably the best indication of the basic consistency of the data and essential equality between the groups throughout the experiment.

## Chapter V

## DISCUSSION

Studies of reading rates and comprehension, and investigations in remedial reading have increased enormously. The past few years have shown that the attention of more and more people has been focused on ways of improving reading abilities. Even the popular magazines publish articles with titles such as "How to Improve Your Reading in One Lesson". Perhaps the trend is good. Public schools, colleges, psychologists, and other educators are now interested more than ever before as evidenced by the increasing number of studies on reading and wider use of remedial reading programs.

Colorado Agricultural and Mechanical College has followed the trend in increased realization of the need for better reading skills. In this study, 54 students out of a larger group who enrolled in the remedial reading course this last year, 1947-48, furnish data in answer to the question, What are the effects of the remedial reading program on the scores of entrance examinations as re-administered to those students who have taken the remedial reading course? As it may readily be seen, this question is basically very similar to a problem proposed by Anderson

(2:53), 1928, when he said, "To what extent does improvement in one type of reading carry over to other types." Both problems appear to be, really, the question of transfer of reading abilities. Do the reading skills acquired in remedial class work make it possible for individuals to achieve more in other areas?

This investigation proposed to furnish some evidence toward the ultimate solution of both problems through a study of the changes in college entrance test scores of students taking remedial reading by re-testing them on the entrance tests after they had completed the remedial course. If the results of the investigation were to be valid, it was realized that the warning of Ammons and Hieronymus (1), 1947, must be heeded. Control techniques were used in order to avoid the mistakes which the authors mentioned above indicate are made in studies which do not take into account regression effects, either by a control group or statistical manipulation. The controls were necessary also because it has been well demonstrated in the literature that gains on tests are made without specific training in the abilities the tests were designed to measure. The truth of these gains was shown by McConnell (14:67), 1934, in the increase of Psychological Examination scores over a four year period, and alluded to by Triggs (24), 1941, when she pointed out that the varied educational experiences the student receives at the same time he is enrolled in a



remedial course makes the evaluation of a remedial reading program very difficult.

The matching of the experimental and control groups seemed to be very successful, though it appeared discouraging at one point. When the exact matching of individuals became an impossibility, because of the termination of college work by those non-remedial students who were deficient in reading abilities, those who had the closest scores were retained and incorporated into the control group. The method is believed to be a good one, though of course it may be known to many already. At any rate, the eventuality which caused the change in the method of selection of the controls confirms the data of Gerberich (8:36-41), 1934, who found that 84 per cent of his students in an experimental group of remedial readers remained in college but only 65 per cent of a control group remained at the end of the experiment.

The accuracy of measurement of the gains in reading ability in a remedial class is sometimes doubted. Triggs (24), 1941, stated that there was no question about the demonstration of gain by test-retest evidence and so the achievement of the reading group in the class was considered as pertinent to the study. It is well to recall the extensive use shown in the literature of the Iowa Silent Reading Tests as a measure of achievement in college reading classes. Witty (25:566), 1940, found that they

were most used in 131 higher education institutions, and Charters (6:117-21), 1941, found they were most used in a survey of 172 colleges. In addition, they were used by Anderson and Dearborn (3:387-96), 1941, in a Harvard study. There is a good reason to believe, therefore, that they measure achievement as well as any tests now available.

Results of the remedial  
program as measured by  
reading tests

The pre-test scores, as expected from the findings of Anderson (2), 1928, and Sangren (20:6), 1932, varied widely, as did the post-test scores. The difference in the mean scores of 10.12 between pre-test and post-test suggested that the class made considerable progress over the course. A correlation of  $.70 \pm .06$  between the two tests with a ratio of the difference of the means to the standard error of the difference when correlated of 7.28 indicated that there was hardly any chance but that there had been substantial progress made in the course. There does not seem to be any reason to doubt this statistical evidence of progress, unless the tests were not measuring a real gain but the effects of practice on materials peculiar to the class room. This was possible, of course, as Ammons and Hieronymus (1), 1947, pointed out. They said that a "problem arises when practice during training essentially duplicates the materials and processes used in the evaluation tests themselves". The large critical ratio,

twice as much as needed to be virtually certain (999 times in 1000) that the true difference is greater than zero seems in favor of accepting the progress of the class as real.

The belief that real progress was made is supported also by the results of the Minnesota Speed of Reading Test on which the ratio of the difference of the means to the standard error when correlated was 3.05. This figure also showed a significant difference greater than zero. The correlation of .50  $\pm$  .09 of pre-test and post-test strengthens the belief that real progress in reading was made in the class room.

Comparison of gains on  
Iowa and Minnesota Read-  
ing tests to gains on  
entrance examinations

Correlations of gains on the Minnesota Speed of Reading Test and each of the entrance examinations produced some surprising data. The writer has been assured that it is not unscientific to anticipate certain results but those obtained were at the extreme opposite end of those anticipated. In this case, it was presumed that students making the highest gains in the remedial reading class might make the best gains on the entrance examinations. This was not true. The coefficient of correlation between the Minnesota Speed of Reading Tests and The American Council on Education Psychological Examination showed no positive relationship.



The coefficient and its probable error were  $-.03 \pm .12$ .

About the same results were obtained on correlation of the Minnesota Test and The American Council on Education Cooperative English Examination. The coefficient and probable error were  $-.15 \pm .12$ . The correlation of  $-.15$  was not construed to be any particular relationship because it was less than four times its probable error and could be negative by chance.

The correlation between the Minnesota Test and the Nelson-Denny Test followed the pattern set by the other two except that it was  $.00 \pm .12$ .

The implications of these data are not clear, possibly because they were so unexpected. If gains made in the reading class had a substantial relationship to gains on the entrance tests, then it might be inferred that those who increased their reading abilities increased their abilities to score on the entrance tests, but since this is not the case, the implication seems to be that there is no effect of increased reading ability on the other tests. In other words, there is no transfer. The data are consistent it will be noticed.

Another possibility emerges, one which in an indirect manner argues for the assumption that the gains in the reading class were not the result of practice with materials similar to the tests. If reading tests have elements in common and they probably do, and if students had

become "test wise" in class, which accounted for their progress, then it seems that gains on the Nelson-Denny Test would also be expected. The fact that there is no relationship between gains in class and gains on the Nelson-Denny Test seems to be against the possibility of "test-awareness" in the class.

On the correlations of the Iowa Silent Reading Tests gains and the entrance test gains, the same unexpected data are found. The largest correlation for the Psychological Test had a coefficient of  $.39 \pm .10$  which just approaches significance because it is about four times the probable error. Even so, the relationship is not high at the figure found and the true value may lay anywhere between it and  $-.01$ .

The coefficient of correlation was  $.17 \pm .12$  for the Iowa Tests and the English Examination which shows no significant relationship.

Surprisingly enough, the correlation between the Iowa Tests and the Nelson-Denny is  $.00 \pm .12$  as in the case of the Minnesota Test. This element of consistency seems to make the implications previously drawn more valid, if the inferences themselves were valid.

All the six coefficients are consistently small. The probability that there is no transfer of abilities is thus more strongly supported.

Comparison of experimental  
and control group scores  
on college entrance examina-  
tions

All experimental and control students were re-tested on the college entrance examinations. Their mean scores on the tests as groups when they originally entered school were taken as the figures by which they were equated and the means as groups are compared after the experimentals had taken a remedial course for the purpose of finding whatever differences might exist due to an increase in ability. This method is found often in the literature. Similar procedures were used by Pressey and Pressey (17: 206-7), 1930, by McConnell (14), 1934, and by various others.

Because some of the experimentals had completed the reading course and others had not, there was a question as to whether those who completed or had not completed made the greatest gains. Consequently, data were found on all three tests for comparison of all these as a group who took remedial reading, all those who completed the course, and those who did not complete.

The Psychological Examination.--A statistical comparison of the total experimental group on the Psychological Examination on entrance into college showed that the group was equated with the controls on this examination within a difference of means of .65 of a point. After the remedial program, the difference was only .97 but in favor



of the controls, whereas the first difference shown was in favor of the experimentals. The gain in chances in 100 that the difference was truly greater than zero was 17 in favor of the control group. There was no significant difference here, hence no evidence of gains due to transfer of reading abilities. The probability of true gain was in favor of the control group.

On the Psychological Examination, the group completing the remedial course was equated within .04 of a point. On the post-testing a change in scores showed a difference of 3.33 between the means. The controls had gained 30 chances in one hundred that the true difference was in their favor. Again the difference was not significant. There was no indication of transfer of reading ability on this test.

The group not completing the course had a mean 1.86 lower than the controls on the initial tests. On the final tests, the difference had increased in favor of the experimental group but was not significantly greater. Measured in chances in 100 of a true difference, the gain was 7 chances. Statistically, this shows little gain, and therefore the transfer of reading ability into gains on the tests is not shown.

The Cooperative English Examination.--The total experimental group on the initial English Examination came within 2.42 points of the control. The difference was not

significant. On the final testing, the control group had an advantage of 3.35 and had gained 9 chances in 100 that the true difference was in its favor. No evidence is shown here of any increase on scores of the experimental group because of having taken the reading course.

The students completing the course were lower than the control group on the initial English examination by a mean difference of 3.51 points which was not significant and lower than the controls by 3.98 points on the final tests. The gain of 4 chances in 100 that the true difference was in their favor was on the side of the control group. The difference in the mean scores were again without significance, and again there is no evidence for or against the transfer of reading ability.

The group which did not complete the course and the controls were equal within .57 on the initial testing with the difference of means in favor of the controls. On the final test, a difference of 2.22 was again in favor of the controls. The difference in means was not significant on either test but the 7 chances in 100 that the true difference was in their favor was on the side of the controls. No effect of transfer of reading skills is shown here.

The Nelson-Denny Reading Test.--The mean of the total experimental group was not significantly different from the controls on the entrance scores for the Nelson-Denny Test, although the difference was in favor of the

latter.

On the final testing the experimental group had made some gain on the controls. The difference in means had decreased from 2.74 on the initial test to .98 on the final test and the reading group had gained 22 points out of 100 that the difference was in its favor.

The question now presents itself: could this gain in favor of the readers show some effect of the transfer of reading ability? We know that the difference is not significant, statistically, and that scores in one direction or another may be due entirely to chance when the difference in means is so small, so it seems that not much importance can be attached to the gain.

The group that completed the remedial course were different from the controls on the mean scores by 4.08 points, the largest difference so far. The chances were 91 in 100 that the true difference was in favor of the controls but the difference was not significant, even so. On the final test, the experimental group had reduced the difference in means to 2.61 and the chances of a true difference in favor of the controls to 72 in 100, a difference of 19 chances. Again, the possibility that there is some transfer may be considered but such transfer is unlikely.

The group not completing remedial reading matched the controls on the initial Helson-Denny Test by a .53 difference of means which was not in their favor. The differ-



ence is not significant. On the final test, the difference of means was .21 but the advantage had changed from the control to the experimental group. The gain in chances in 100 of the true difference being in favor of the latter was 6.

Implications.--In all of the Nelson-Denny tests, the gains have been in favor of the experimental group. These gains were made with a difference of means which in the case of every test has not been significant. It is probable that there are comparatively few times when data are so consistent as compared with the times when a statistical inconsistency appears. There is consistency in the gains of the experimental over the controls on the reading tests, but there is also consistency in the very low or zero correlations between the Iowa and Minnesota reading tests and the battery of entrance tests. The possibility again arises that the gains of the experimentals on the Nelson-Denny Test was a result of the "test-awareness" of the group with that type of test. Whether or not this would be a true transfer of reading ability is questioned, if it were so. It would seem more likely to be merely a transfer of "test-awareness" which, apparently, is not the same as reading ability. On the other hand, the consistency of the control group, in having the higher gains on the other tests, is a case quite similar, it appears, to the experimental reading test gains.

What must be taken into consideration is that

the gains were relatively small and it does not seem that such relatively small gains indicate that their cause was familiarity with test materials, or "test-awareness", any more than the equal gains by the control students on the Psychological and English tests indicates that they had practiced with psychological test materials.

The much broader consistency of the data of the experiment as a whole probably should have the most weight of any assigned. Not a significant difference between any of the control and experimental groups was found. Even the chances of a true difference in means in favor of one group or another averaged out rather closely. The final totals were 73 chances in 100 that some difference favored the reading group, and 58 chances in 100 that certain differences favored the control group. This is a total difference of only 15 in favor of the experimental group.

It seems that this close tally indicates in yet another way the essential similarity and absence of significant progress of either group over the other.

Therefore, the indications are that it may be inferred with adequate evidence to support the inference, that there is no transfer of reading ability as shown by this study and that the remedial reading program has very little or no effect on changes in the entrance test scores of remedial reading students.

These implications, apparently, help to confirm

some of the opinions in the literature of remedial reading, especially those of Anderson (2:53), 1928, who said there is no "general reading ability" and that "reading is fairly specific".

#### Suggestions for Further Investi- gation

What is needed to prove or disprove the implication of no transfer found in this study is more investigation. Lacking larger samples, this experiment or similar ones should be performed over as many times as possible with the smaller samples available.

It might be quicker to attempt to determine if there is transfer by further study along lines such as the following:

1. Relationship between college failures and poor reading ability.
2. Relation of reading ability of pupils in schools having guidance program in elementary grades to pupils of elementary schools who do not have a planned guidance program.
3. Determination of critical score or "cutting score" in college entrance reading examinations.
4. The possibility of predicting grade point averages in college by measures of reading ability.
5. Study of methods of various colleges in measurement and investigation of reading abilities.



6. Reasons for lower scores on final tests of speed of reading. Does speed decrease as a result of increased reading for comprehension?

7. Study of proper speeds for various types of reading.

8. Study of "percentage of comprehension" or "content assimilation", by reading opening and closing lines of paragraphs, opening paragraphs and closing summaries of chapters, etc.

9. Forms of arrangement of ideas and concepts in writing, format, etc. on students' ability to read such writing with speed and comprehension.

10. Investigation to determine extent to which reading skills disintegrate and reintegrate during remedial programs.

11. Study of additional and different reading skills needed on transfer to college from high school with view to teaching those skills before graduation from high school.

12. Amount of increase or decrease in reading speed by teaching comprehension to the exclusion of speed.

## Chapter VI

## SUMMARY

The purpose of this investigation was to determine if the effects of the remedial reading program at Colorado Agricultural and Mechanical College were carried over into another field. The problem was: What are the effects of the remedial reading program on the scores of entrance examinations as re-administered to those students who have taken the remedial course?

The problem was analyzed as follows: What were the scores of students on the tests listed below before and after taking the remedial reading course: The Minnesota Speed of Reading Test, The Iowa Silent Reading Tests, The American Council on Education Psychological Examination, 1946 edition, The American Council on Education Cooperative English Examination, The Nelson-Denny Reading Test, Form A.

The study was delimited to those students who entered the course in remedial reading and a control group. Raw scores were used in compiling the data.

The study was made in the final term of the 1947-48 school year after a meeting was held under the chairmanship of the Dean of the Graduate School who is also the Head of the Department of Psychology and Education. Control group techniques were decided upon to eliminate regression

effects.

The equating of experimental and control groups was made on the basis of matching individuals as closely as possible on the scores of their original entrance tests. The following equating factors are listed in the order assigned to them: scores on Psychological Examination and Nelson-Denny Reading Test, the year in college, and sex.

Letters were sent to 225 prospective members of control and experimental groups requesting attendance at meetings where the purpose of the study was explained by the Dean of the Graduate School. Appointments were scheduled with the testing bureau for re-testing of the groups. Re-test scores were checked and the data recorded on a master sheet.

Common statistical devices were used in the analysis of the data.

The experimental group made significant gains during the remedial course as measured by the Minnesota Test and the Iowa Tests. The gain in means on the Minnesota Test was 3.29 with a critical ratio of 3.05 which showed significant progress. The correlation of scores of the two tests was .50 with a probable error of .09. The gain in means on the Iowa Tests was 10.12 with a critical ratio of 7.28, over twice enough to be practically certain of significance.

Correlation coefficients and their probable



errors of gains on the Minnesota Test and the entrance examinations were as follows: Minnesota and Psychological,  $-.03 \pm .12$ ; Minnesota and English,  $-.15 \pm .12$ ; Minnesota and Nelson-Denny,  $.00 \pm .12$ . Correlation coefficients and probable errors of gains on the Iowa Tests and the entrance examinations are as follows: Iowa and Psychological,  $.39 \pm .10$ ; Iowa and English,  $.17 \pm .12$ , Iowa and Nelson-Denny,  $.00 \pm .12$ .

Comparisons of means of initial entrance test scores of the experimental and control groups showed no significant differences. The largest difference in means was 4.08 on the Nelson-Denny Test between the group completing the remedial course and the controls. The smallest difference was .04 on the Psychological Test between the same groups. The comparison of means on the final administration of the entrance tests also showed no significant differences. The largest difference in means was 3.98 between the group completing remedial reading and the controls. The smallest difference was .21 between the group not completing remedial reading and the controls.

It appears that real progress in reading was made as a result of the remedial work. Because of the lack of significant differences in the scores of the groups on both the initial and final administration of the entrance tests, there apparently was no transfer of reading ability to gains on the tests. Apparently the remedial reading course had no effect on the scores of re-administered entrance tests.

A P P E N D I X

	Minnesota Speed of Reading			Iowa Silent Reading		
	Pre	Post	Gain	Pre	Post	Gain
1.	15	15	0	164	168	4
2.	25	29	4	184	190	6
3.	12	22	10	158	177	19
4.	12	17	5	169	171	2
5.	14	18	4	163	181	18
6.	19	18	- 1	183	182	- 1
7.	3	17	14	176	183	7
8.	18	18	0	175	184	9
9.	12	15	3	181	189	8
10.	20	26	6	180	201	21
11.	11	16	5	181	175	- 6
12.	14	14	0	187	196	9
13.	6	8	2	157	166	9
14.	13	22	9	184	188	4
15.	25	20	- 5	169	184	15
16.	15	12	- 3	159	175	16
17.	30	21	- 9	178	184	6
18.	11	26	15	181	191	10
19.	12	17	5	165	184	19
20.	15	16	1	171	173	2
21.	12	19	7	171	184	13
22.	--	--	-	153	174	21
23.	16	31	15	201	202	1
24.	23	29	6	185	199	14
25.	16	17	1	154	176	22
26.	10	1	- 9	163	181	18
27.	14	13	- 1	166	178	12
28.	8	15	7	173	174	1
29.	26	21	- 5	184	193	9
30.	12	20	8	162	176	14
31.	--	--	-	155	181	26
32.	11	13	2	177	171	- 6
33.	9	6	- 3	163	183	20
34.	8	20	12	169	171	2

Numbers 1-34 completed remedial reading course.



	ACE Psychological			ACE Coop. English			Nelson-Denny Read.		
	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
1.	103	94	- 9	127	169	42	55	81	26
2.	120	129	9	200	212	12	67	101	34
3.	103	120	17	133	142	9	56	67	11
4.	110	125	15	124	145	21	57	47	-10
5.	119	124	5	173	174	1	64	81	17
6.	138	147	9	177	173	- 4	82	97	15
7.	106	114	8	95	100	5	49	57	8
8.	101	121	20	154	160	6	74	71	- 3
9.	136	145	9	139	159	20	74	94	20
10.	140	139	- 1	255	248	- 7	88	133	45
11.	117	111	- 6	183	190	7	67	70	3
12.	121	140	19	180	178	- 2	72	68	- 4
13.	89	97	8	110	106	- 4	63	64	1
14.	86	80	- 6	149	195	46	76	108	32
15.	111	131	20	162	188	26	66	94	28
16.	115	103	-12	149	192	43	72	81	9
17.	113	112	- 1	132	182	50	72	89	17
18.	115	122	7	189	223	34	63	89	26
19.	102	115	13	140	167	27	52	64	12
20.	86	89	3	139	150	11	68	69	1
21.	112	105	- 7	176	171	- 5	57	67	10
22.	53	98	45	98	117	19	95	53	-42
23.	145	156	11	164	172	8	82	108	26
24.	124	138	14	170	251	81	88	130	42
25.	120	125	5	154	197	43	60	74	14
26.	109	135	26	106	161	55	--	--	--
27.	94	97	3	166	188	22	90	92	2
28.	120	135	15	108	127	19	63	69	6
29.	123	150	27	240	243	3	66	124	58
30.	90	103	13	162	175	13	44	58	14
31.	117	130	13	167	210	43	72	78	6
32.	165	123	-42	120	151	31	69	69	0
33.	99	104	5	102	117	15	49	53	4
34.	102	120	18	129	145	16	54	61	7
35.	115	119		155	193		62	98	
36.	126	135		162	169		80	85	
37.	143	157		225	238		84	106	
38.	123	132		161	177		57	71	
39.	99	113		146	179		67	73	
40.	90	104		56	134		64	88	
41.	--	--		157	202		52	58	
42.	130	125		191	204		79	80	
43.	139	134		145	157		69	69	
44.	--	--		127	131		72	80	
45.	121	134		106	121		79	83	
46.	89	109		128	124		56	70	
47.	96	108		147	162		46	62	
48.	107	118		146	133		48	73	
49.	60	106		165	177		57	87	
50.	135	152		248	249		115	139	
51.	129	160		183	196		82	100	
52.	--	--		128	183		59	79	
53.	142	147		229	221		119	122	
54.	89	106		96	142		73	76	

Nos. 1-34 completed remedial reading. Nos. 35-54 did not complete.

	AGE Psychological		AGE Coop. English		Nelson-Denny Read.	
	Pre	Post	Pre	Post	Pre	Post
1.	106	124	157	157	49	70
2.	123	128	192	186	78	91
3.	104	111	127	156	57	69
4.	109	127	130	165	58	80
5.	123	136	160	168	69	86
6.	138	148	169	210	94	113
7.	102	117	152	181	47	70
8.	102	98	190	183	77	88
9.	135	136	139	180	78	88
10.	140	146	242	250	96	110
11.	115	132	160	179	67	73
12.	118	127	164	191	71	87
13.	89	100	115	130	60	62
14.	76	99	136	158	77	84
15.	107	113	160	149	67	71
16.	117	109	155	197	--	--
17.	113	96	140	161	68	81
18.	112	125	196	199	67	78
19.	103	125	145	150	59	74
20.	87	109	134	164	63	71
21.	108	130	157	181	60	72
22.	144	165	227	234	93	92
23.	132	153	167	206	79	84
24.	107	116	203	203	86	103
25.	111	117	155	162	67	79
26.	107	98	131	158	64	63
27.	107	136	131	172	64	69
28.	89	105	24	145	78	94
29.	98	107	68	104	53	60
30.	115	114	150	167	78	106
31.	138	139	147	173	76	82
32.	117	122	192	199	66	84
33.	120	135	148	166	71	82
34.	143	140	265	268	117	125
35.	72	84	109	117	47	51
36.	117	133	205	249	88	136
37.	87	107	90	118	69	77
38.	106	118	165	175	70	66
39.	122	133	168	181	84	91
40.	92	121	134	171	65	74
41.	89	115	112	165	57	76
42.	58	104	110	150	57	73
43.	129	125	205	211	86	112
44.	113	109	147	141	64	70
45.	106	130	149	163	58	69
46.	129	145	183	156	80	90
47.	123	125	166	195	75	70
48.	137	147	183	198	108	111
49.	136	150	187	236	87	107
50.	121	133	140	165	56	65

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May 22, 1948

Mr. Carl G. Owens  
312 West Laurel  
Fort Collins, Colorado

Dear Mr. Owens:

Much of the progress in educational research is made possible through the cooperation of students such as you.

You have been chosen as one of a selected group to participate in a research project to be conducted on this campus. Participation requires only that you make available about four hours of your time to the testing bureau on a date which can be set to suit your convenience.

It is impossible to explain fully in this letter just what the purpose and procedures are. Therefore, will you be kind enough to attend one or the other of two meetings to be held at 3:00 P. M., May 25 and 26, in Room 200 of the Civil Engineering Building. A further explanation will be made at those times.

Thank you very much.

Very truly yours,

David H. Morgan, Head  
Department of Psychology  
and Education

P. S. Your compliance with this request will have no effect whatsoever on your standing in this college.



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AS CONTENT

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