A STUDY OF THE RELATIONS BETWEEN SCHOOL GRADES

AND READING ABILITY OF ONE HUNDRED SENIORS

WHO HAVE ATTENDED BLACKWELL AND TONKAWA HIGH SCHOOLS

FOR SIX CONSECUTIVE YEARS

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CHAPTER I

INTRODUCTION

It has been demonstrated by several other experiments that the ability to read largely determines the ability of a student to make good grades or to get his lessons.[1] With this idea in mind, this study has been made for the purpose of finding, more specifically, the relation between reading ability in Blackwell and Tonkawa High School Seniors and grades made in history, English, science and mathematics. For the purpose of weighting, intelligence is also included in this study. Intelligence is included partly because of the interest in intelligence and its relation to grades made and reading ability. It is used for a check on other scores used in this study.

The tendency to treat reading as the most important tool in learning has resulted in establishing a close relation between reading and practically every school subject. As a means of gaining information and pleasure it is essential in every content subject, such as history, English, science and mathematics. In fact, scholarship depends on ability to read, supplemented by other qualities, such as high level of intelligence.[2] It follows,

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[1] Elbert Kirtley Fretwell, "A Study in Educational Prognosis," Teachers College Contribution to Education, No. 99, p. 56.

[2] William Scott Gray, "Summary of Investigations Relating to Reading, p. 42.

then, that good teaching must provide for the improvement and refinement of the reading habits and skills that are required in all school and life activities involving reading. By the same logic, it follows, that if this improvement and refinement is to be made effective there must be reliable and accurate devices for the measurement of the desirable abilities and the identification of weaknesses.

The Iowa Silent Reading Test,[3] used in this study, represents an effort to go beyond a mere general survey of a single phase of silent reading ability. It is designed to cover a wide range of skills, listed below, indispensible to effective reading of the work study type. The test measures four major aspects of silent reading ability; namely, (1) Comprehension, (2) Organization, (3) Ability to Locate Information, and (4) Rate of Silent Reading. These fields are covered by means of six different types of questions, requiring a total testing time of thirty-five minutes for the Advanced Test used in this study.

Comprehension must be tested on more than one type of material. Research shows[4] that there is no general

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[3] Iowa Silent Reading Test, published by the World Book Company.

[4] Ibid.

silent reading ability but that one who reads one kind of material well may read another kind poorly and that the ability to read well depends very largely upon the nature of the material to be read. Therefore, in order to be sure that comprehension is adequately measured, this test had the following tests of which it was made:

Test 1 - Paragraph Meaning, Part A. science; Part B, Literature;

Test 2 - Word Meaning, Part A, Social Science; Part B, Science; Part C, Mathematics; Part D, English;

Test 3 - Paragraph Organization, Part A, Selection of Central Idea; Part B, Outlining;

Test 4 - Sentence Meaning;

Test 5 - Part A, Use of Index; Part B, Selection of Key Words;

Test 6 - Rate of Silent Reading.

Norms are for separate tests as well as all of the tests taken together. These norms are based upon results from about six thousand students distributed about equally in grades nine through the first year of college.[5]

The Otis Self-Administering Test of Mental Ability[6] was used in this study to determine the intelligence quotient of the students studied. This test is one that

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[5] Ibid.

[6] Otis Self-Administering Test of Mental Ability, published by the World Book Company.

has been widely used and is scientific in its form. The norms for this test are established on the basis of results from one hundred twenty thousand pupil scores.[7]

The problem of this thesis is to make a study of one hundred high school seniors that have remained in the same school system during their six years of junior and senior high school work. Blackwell and Tonkawa High School senior classes were used as sources of students for this study. Seventy-seven students were used from the Blackwell High School and twenty-three students were used out of the Tonkawa High School. The factors to be taken into consideration in this problem are reading ability of the students in comprehension of content, rate of silent reading of students, intelligence of students, and their achievements measured in terms of teacher scores[8] or grades in history, English, science and mathematics.

The data are accumulated from the following correlations. Comprehension scores[9] in reading were correlated with the scores in intelligence. The comprehension scores in reading and scores made in rate of silent reading were correlated. Comprehension scores in reading

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[7] Ibid.

[8] These teacher scores will be referred to as history scores, English scores, science scores, and mathematics scores.

[9] Scores made on the parts of the Iowa Silent Reading Test that tested comprehension in reading will be referred to as comprehension scores.

were correlated with achievement, teacher scores in each
of history, English, science and mathematics. Also,
rate scores in silent reading were correlated with in-
telligence quotient scores. Rate scores in silent read-
ing were also correlated with each of the history, English,
science and mathematics scores. Likewise, intelligence
quotient scores[10] were correlated with comprehension
scores in reading, rate of silent reading scores and
scores in history, English, science and mathematics.
The data found are the actual existing facts shown to
exist with these one hundred students.

The scholastic records of the students as used in
this study were compiled for the purpose of getting their
achievement records of teacher scores in history, English,
science and mathematics. The Iowa Silent Reading Test
was given in its complete form to these students. For
correlation purposes the total score made in comprehen-
sion, first five parts of test, is used separately from
the score on part six, which tested the rate of silent
reading.[11]

The Pearson Product-Moment Method of correlation
is used in this study to determine the coefficient of

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[10]
Scores made on the Otis Self-Administering Test of
Mental Ability will be referred to as intelligence
quotient scores.

[11]
The scores made by the students on the Iowa Silent
Reading Test that measured rate of silent reading will
be referred to as rate of silent reading scores.

correlation between the different pairs of scores stated above. All of this information is shown in Chapter II of this thesis in the form of tables with a separate discussion of each table. Each table shows the frequency distribution of the two groups of scores used in that particular correlation as well as the calculations that are necessary in computing the coefficient of correlation. The probable error of the coefficient of correlation is shown. The mean score is shown for each group of scores. The standard norm is shown where these have been established. The calculated norm, or the norm that these students should have reached, is shown in cases where sufficient norms are established so that the calculated is known. This calculation is based on the standard norm in intelligence, the norm of this group of students in intelligence, and the established norm in the other subject or field under consideration.

All tests were administered by the writer in the school where the students were in attendance. The directions were followed implicitly and all tests were checked three times by the writer and by two other parties for the purpose of avoiding errors. This study was made during the latter part of the second semester of the senior year of these students, school year 1936-1937.

The research material which forms the basis of this study will be found in Chapter II. The third chapter is an interpretation of the data set up in Chapter II. Chapter IV contains a summary and the conclusions arrived at from this study, as well as some recommendations that this study shows necessary.

CHAPTER II

DESCRIPTION AND ANALYSIS OF DATA

The data in Table I are made up from the scores made in comprehension in reading scores and intelligence quotient scores. According to the intelligence quotient scores, the students ranged from 83 to 125 with a fairly even distribution above and below the standard norm of 100. The mean intelligence score of this group of students was shown by the test to be 103.67, which indicates that they are 3.67 points above normal and upon this basis they should be expected to rate above normal in scholastic achievement. On the Otis Intelligence Test the standard deviation for the group was found to be 10.08, which indicates that 68 per cent or 68 students out of the 100 students scored within 10.08 points of the mean. Ten students scored below 90 and 24 students scored above 110, showing the reason for the mean score being above the standard norm of 100.

The comprehension scores, obtained from the Iowa Silent Reading Test, ranged from 55 to 198, which shows a wide range of variability. The range in variability is reflected in the ability of the student to comprehend material read. By the established norms in this test these scores also show a range in grade level from weak eighth grade students to above college sophomores in comprehension reading ability. The mean score of this

group of comprehension scores is 115.91, while the stand-
ard norm in this test for high school seniors is 123.[1]

The calculated norm for this group of students on
this test or what their mean score should have been is
127.51,[2] as figured on the basis of comparison with
their mean score in intelligence scores and the standard
norm of intelligence scores. From this calculation these
students are 10.98 points below where they should be in
comprehension ability. The standard deviation of the
comprehension reading scores is 34.65. This indicates
that about 68 students of the 100 scored within 34.65
points of the mean.

The coefficient of correlation between the scores
made in intelligence and the comprehension reading scores
is .78, which indicates that a person with ability above
normal in comprehension will be above normal in level of
intelligence. In the scatter diagram made with these
scores there are some noticeable factors that decrease
the coefficient of correlation. Two students who scored
below the mean in intelligence quotient scores, scored
above the mean in comprehension reading scores. Also
four students who scored below the mean in comprehension

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[1]
Iowa Silent Reading Test.
[2]
The calculated norm is figured by multiplying the
mean score of intelligence by the standard norm in com-
prehension scores and dividing by the standard norm in
intelligence scores.

reading scores, likewise scored above the mean in intelligence quotient scores. The probable error[3] of the coefficient of correlation is .026. This indicates that this coefficient of correlation is reliable since the probable error is less than one-fourth of the coefficient of correlation.

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[3] H. O. Rugg, Statistical Methods, p. 272.

TABLE I
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis - Intelligence Quotient

The Y Axis - Comprehension Reading Scores

	83-85	86-88	89-91	92-94	95-97	98-100	101-103	104-106	107-109	110-112	113-115	116-118	119-121	122-124	125-127	f	d	fd	fd²	xy
193-201											1				1	2	8	16	128	80
184-192														1	1	2	7	14	98	91
175-183												1	1			2	6	12	72	54
166-174							1	1	1	1	2		1			7	5	35	175	100
157-165										1	2		1			4	4	16	64	56
148-156									2				1			3	3	9	27	24
139-147								1		1	2					4	2	8	16	16
130-138							1	1	1							3	1	3	3	0
121-129				2		1	1	1	1	2						8	0	(113)		
112-120			1	3	2	3		1	4	1	2					17	-1	-17	17	8
103-111			1	3	3	1		2	1							11	-2	-22	44	38
94-102		3	1	3	3	1		3								14	-3	-42	126	114
85-93					3	1			1							5	-4	-20	80	32
76-84			1		2	1	2		1		1					8	-5	-40	200	50
67-75			1													1	-6	-6	36	30
58-66	3		1	1												5	-7	-35	245	210
49-57	2			1	1											4	-8	-32	256	168
f	5	3	3	5	17	10	11	10	9	8	9	1	3	4	2	(100)		(-214)	1587	(1071)
d	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7					
fd	-35	-18	-15	-20	-51	-20	-11	(-170)	9	16	27	4	15	24	14	(109)				
fd²	245	108	75	80	153	40	11		9	32	81	16	75	144	98	(1167)				

Comprehension Reading Scores
Mean = 116.41
S. D.= 34.65
Standard Norm = 123
Calculated Norm = 127.51

Intelligence Quotient Scores
Mean = 103.67
S. D.= 10.08
Standard Norm = 100

r = .78

P. E. r = .027

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The data in Table II are made up of the rate of silent reading scores and the intelligence scores. On the basis of the intelligence quotient the scores of the individuals in the group ranged from 83 to 125, showing a range of intelligence from subnormal to that of very superior. This range of scores indicates a wide variability in individual differences present in this group. This makes somewhat of a typical group with which to work in this study. The mean of the intelligence quotient scores is found to be 106.67. Since the standard norm on all intelligence tests is 100, this group has a mean score of 3.67 points above the standard norm. This fact should be kept in mind when considering the date presented in these tables, even though it may not be brought out in the discussion of each table.

The range of scores on the test in rate of silent reading was from 13 to 47. This was determined by the number of words of material read in two minutes. This test determined mainly the rate or speed of silent reading. There were some minor questions to be answered within the reading material but the main purpose of these questions was to determine whether the student really read the material or not. These scores as compared with norms established for this test show these students to range in rate of silent reading from below eighth grade [4]

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[4] Iowa Silent Reading Test

students to above college sophomores. The mean for this group of scores is 26.11 while the standard norm on this test is 31 for high school seniors. The mean score of this group of students should have established, or their calculated norm, is 32.14. This shows these students as a group to be below normal in rate of silent reading. The standard deviation of the rate of silent reading scores is 7.53. This indicates that 68.26 per cent of the scores were within 7.53 points of the mean.[5]

The coefficient of correlation of these two groups of scores as shown by Table II is .46, which indicates that there is a relation between intelligence and rate of silent reading but in comparison to Table I there is greater relation between comprehension in reading and intelligence. As Table II shows there were several students that scored above the mean in one test and below the mean in the other. This placed their scores in the negative quarters of the scatter diagram and decreased the coefficient of correlation. Four students scored above normal in intelligence that rated as eighth grade students in rate of silent reading. Twenty-eight of these seniors scored as eighth grade students or below in rate of silent reading.

The probable error of the coefficient of correlation in Table II is .05. This indicates that the coefficient of correlation is reliable since the probable error is

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[5] Dennis H. Cook, _Minimum Essentials of Statistics_, p. 68.

less than one-fourth of the coefficient of correlation.[6]

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[6] Probable error explained on page 10.

TABLE II
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis - Intelligence Quotient Scores

The Y Axis - Rate of Silent Reading Scores

	83-85	86-88	89-91	92-94	95-97	98-100	101-103	104-106	107-109	110-112	113-115	116-118	119-121	122-124	125-127	f	d	fd	fd²	xy
46-48											1		2			3	6	18	108	78
43-45																0	5	0	0	0
40-42								1			2				1	4	4	16	64	52
37-39					1				1	1			1			4	3	12	36	18
34-36				1		1	1		1	1						5	2	10	20	-6
31-33							2	1						1		4	1	4	4	4
28-30			1		3				2	2				1	1	10	0	(60)		
25-27		1		3	4		2	2	3	2				1		15	-1	-15	15	7
22-24	1	1		1	4	3	5	4	1	3	3	1				27	-2	-54	108	40
19-21	3		1	2	4	2			1	1			1			15	-3	-45	135	120
16-18						3	1	2								6	-4	-24	96	28
13-15	1	1	1	1	1	1				1						7	-5	-35	175	135
f	5	3	3	5	17	10	11	10	9	8	9	1	3	4	2	(100)		(-173)	761	(476)
d	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7					
fd	-35	-18	-15	-20	-51	-20	-11	(-170)	9	16	27	4	15	24	14	(109)				
fd²	245	108	75	80	153	40	11		9	32	81	16	75	144	98	(1167)				

Rate of Silent Reading Scores
Mean = 26.11
S. D. = 7.53
Standard Norm = 31

Intelligence Quotient Scores
Mean = 103.67
S. D. = 10.08
Standard Norm = 100

Probable Norm = 32.14

r = .46
P.E. r = .05

Table III contains the data from the scores in rate of silent reading and comprehension in reading. The scores in rate of silent reading ranged from 13 to 47 points, making a variation of 35 points which is a greater variation in score than about 85 per cent of the group made. This shows a large difference in ability along this line, but since the standard deviation of this group of scores is 7.53 it shows that the major part of the students studied were located near the mean.[7]

The comprehension reading scores ranged from 55 to 196, which shows a range of 143 points. This range in scores is greater than the individual scores of about 75 per cent of the students studied. This also shows a wide spread in ability in comprehension but the standard deviation of these scores, being 34.65, shows that the greater portion of the group does not have such a large spread in comprehension ability in reading. The principal factor, as the diagram in Table III shows, that decreases the coefficient of correlation, which is .55 in this case, is that several of the students scored rather high in comprehension ability and proved to be slow readers. This caused their scores to be placed in anegative quarter of the diagram.

A very small per cent of the students who made a score below the mean in comprehension in reading made

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[7] Standard deviation explained on page 15.

scores above the mean in the rate of silent reading.

The mean of the comprehension reading scores is 116.41, which is 6.59 points below the standard norm of 123. Reasoning on the basis of the intelligence of the students their norm should have been 127.51. The mean of the rate of silent scores is 26. and the standard norm is 31.[8]

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[8] Iowa Silent Reading Test.

TABLE III
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD
The X Axis - Rate of Silent Reading Scores

The Y Axis - Comprehension Reading Scores

	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36	37-39	40-42	43-45	46-48	f	d	fd	fd^2	xy
193-201						1						1	2	8	16	128	32
184-192				1						1			2	7	14	98	7
175-183			1									1	2	6	12	72	12
166-174			1	2	1		1		1			1	7	5	35	175	-25
157-165						1	1			2			4	4	16	64	20
148-156					1	1		1					3	3	9	27	-6
139-147			1		2				1				4	2	8	16	-12
130-138				1	1					1			3	1	3	3	-2
121-129		1	2	1	4								8	0	(115)		
112-120		2	2	3	1	4	2	1	2				17	-1	-17	17	28
103-111	1	1	1	5		1		2					11	-2	-22	44	58
94-102	1	1	2	9	1								14	-3	-42	126	144
85-93			1	2	2								5	-4	-20	80	56
76-84	1	1		2	1	2		1					8	-5	-40	200	100
67-75	1												1	-6	-6	36	36
58-66	1		3	1									5	-7	-35	245	147
49-57	2		2										4	-8	-32	256	160
f	7	6	15	27	15	10	4	5	4	4	0	3	(100)		(-214	1587	(755)
d	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5					
fd	-42	-30	-60	-81	-45	-10	(-253)	5	8	12	0	15	(40)				
fd^2	252	150	240	243	90	10		5	16	36	0	75	(1087				

Comprehension Reading Scores
Mean = 116.41
S. D. = 34.65
Standard Norm = 123
Calculated Norm = 127.51

Rate of Silent Reading Scores
Mean = 26.11
S. D. = 7.53
Standard Norm = 31
Calculated Norm = 32.14

$$r = .55$$
$$P. E. r = .047$$

The comprehension reading scores and the history scores, are the basis of the data found in Table IV. The comprehension reading scores have a range of from 55 to 198 with a mean score of 116.41. This shows a wide range of ability in comprehension in reading. The standard deviation[9] of these scores being 34.65 indicates that 68 per cent of the group scored within about 70 points of each other while the total range of points is 143 points. These scores indicate that these students ranged from weak eighth grade students to above college sophomores in ability to comprehend what they read and should be kept in mind when considering their scores in history.[10]

The history scores ranged from 70 to 97 points with a difference of 27 points between the extremes. The mean score of this group of history scores is 86.22 with a standard deviation[11] of 6.3. This indicates that 68 per cent of this group has scores that fall principally between 80 and 90, which would indicate the majority of these students are about average in their history scores according to the average method of grading. Since there

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[9] Standard deviation explained on page 13.

[10] Iowa Silent Reading Test.

[11] Standard deviation explained on page 13.

are no standard norms established for history scores it
is impossible to state what these students should have
made but according to the scores made on the standardized
tests used these students average about normal.

The mean comprehension reading score of 116.41 in-
dicates on the established norms[12] that these students
rate in grade level at 12.4. This would place the major-
ity of the group near where they are, as classified in
school, as these students were finishing their twelfth
year of school work.

The coefficient of correlation of these two groups
of scores is .61 and the probable error of the coefficient
of correlation is .043.[13] This indicates that the corre-
lation is reliable.

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[12]
Iowa Silent Reading Test.
[13]
Probable error explained on page 10.

TABLE IV
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis - History Scores

The Y Axis - Comprehension in Reading Scores

	69-71	72-74	75-77	78-80	81-85	84-86	87-89	90-92	93-95	96-98	f	d	fd	fd^2	xy
193-201							1			1	2	9	18	162	45
184-192									1	1	2	8	16	128	56
175-183								2			2	7	14	98	14
166-184							2	3	1	1	7	6	42	252	84
157-165							2		1	1	4	5	20	100	45
148-156							1	1	1		3	4	12	48	24
139-147					1	1	1		1		4	3	12	36	9
130-138						1	1	1			3	2	6	12	6
121-129				1	2		2	1	2		8	1	8	8	6
112-120			1		1	3	2	6	3	1	17	0	(148)		
103-111			1	3	2	1	2	2			11	-1	-11	11	5
94-102			2	1	1	2	6	2			14	-2	-28	56	-2
85- 93			1	1	1	1	1			1	5	-3	-15	45	-3
76- 84	1		4			1	1	1			8	-4	-32	128	60
67- 75			1								1	-5	-5	25	15
58- 66		1	1	2	1						5	-6	-30	180	72
49- 57			2	1		1					4	-7	-28	196	56
f	1	1	13	9	12	9	26	16	8	5	(100)		(-149)	1435	492
d	-5	-4	-3	-2	-1	0	1	2	3	4					
fd	-5	-4	-39	-18	-12	(-78)	26	32	24	20	(102)				
fd^2	25	16	117	36	12		26	64	72	80	(448)				

Comprehension in Reading Scores

    Mean = 116.41
    S. D.= 34.65
Standard Norm = 123
Calculated Norm = 127.51

History Scores

Mean = 86.22
S. D.= 6.3

$r = .61$
P. E. $r = .043$

The data of Table V are composed of scores made in English, as recorded by teachers' marks, and comprehension in reading. The comprehension scores as made on the Iowa Silent Reading Test range from 55 to 198. This range of scores shows, according to established norms,[14] that the abilities of the students in comprehension of material read to vary from the ability of eighth grade students to the ability of sophomores in college and higher. The mean score in comprehension in reading of this group is 116.41, which rates their average on the norm scale[15] at mid-year seniors. This indicates that the students that scored near the mean score are near normal in comprehension according to the established norms. Nine of these students rated as eighth grade students or below, and twenty students scored above the standard score of college sophomores. The standard deviation[16] of the comprehension reading scores is 34.65.

The English scores, as determined by teachers' marks, made by these one hundred students range from 60 to 97, which shows a range of 37 points. The mean English score

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[14] Iowa Silent Reading Test.

[15] Ibid.

[16] Standard Deviation explained on page 13.

is 84.62 and the standard deviation[17] of the English

scores is 7.32. This deviation shows that 68 students of

the group scored between 77.30 and 91.98. This shows

them to be less centralized in English than in some groups

of scores but there is a greater variation since the

lowest score was 60. Only one student scored below 70

in English, as Table V shows.

The coefficient of correlation of the comprehension

reading scores and English scores is .66 and the probable

error of this correlation is .038.[18]

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[17] Ibid.

[18] Probable Error explained on page 10.

TABLE V
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis - English Scores

The Y Axis - Comprehension Reading Scores

	59-61	62-64	65-67	68-70	71-73	74-76	77-79	80-82	83-85	86-88	89-91	92-94	95-97	f	d	fd	fd²	xy
193-201											1		1	2	8	16	128	80
184-192												2		2	7	14	98	84
175-183									1	1				2	6	12	72	42
166-174								1	1	1	3		1	7	5	35	175	150
157-165								1			1		2	4	4	16	64	68
148-156									1			1	1	3	3	9	27	39
139-147									1	2			1	4	2	8	16	28
130-138									2			1		3	1	3	3	9
121-129						1	1		3			3		8	0	(113)		
112-120					1		2	3	5	2	3	1		17	-1	-17	17	-34
103-111					1	2	3				1	4		11	-2	-22	44	-30
94-102						1	1	3	3	1	5			14	-3	-42	126	-96
85- 93						1	1	3						5	-4	-20	80	-8
76- 84					2	1	1	3		1				8	-5	-40	200	-15
67- 75								1						1	-6	-6	36	-6
58-66	1				2		2							5	-7	-35	245	70
49- 57			1		1			1	1					4	-8	-32	256	16
f	1	0	0	1	7	6	11	15	17	9	16	9	8	(100)		(-214)	1587	(397)
d	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6					
fd	-6	0	0	-3	-14	-6	(-29)	15	34	27	64	45	48	(233)				
fd²	36	0	0	9	28	6		15	68	81	256	225	288	(1012)				

Comprehension Reading Scores
Mean = 116.41
S. D.= 34.65
Standard Norm = 123
Probable Norm = 127.51

English Scores
Mean = 84.62
S. D.= 7.32

$r = .66$
$P. E. r = .038$

24

The comprehension reading scores and the science scores make up the data shown in Table VI. The comprehension reading scores, that vary from 55 to 198, show a wide range of ability in this particular field that would probably not be expected to be found in a group of high school seniors. It seems unusual to find a group of seniors whose ability in comprehension would vary from the eighth grade to college sophomores in grade level. The mean score of the comprehension reading scores is 116.41 with a standard deviation of 34.65.[19] Basing reasoning on what these students averaged in intelligence they fell below what they should have averaged in comprehension. Their mean score should have been 127.51 or above high school senior on the basis of their average intelligence.

The science scores have a variation of 27 points, from 70 to 97 with a mean average score of 85.97. The standard deviation is 6.06[20] showing that 68 of these students scored within a range of 12.16 points of the mean. Two students who scored above the mean in comprehension scored below the mean in science. Sixteen students who scored above the mean in science scored below the mean in comprehension. The group of sixteen students who scored above the mean in science and below the mean in

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[19] Standard Deviation explained on page 13.
[20] Ibid.

comprehension. The group of sixteen students who scored above the mean in science and below the mean in comprehension formed the principal factor that decreased the coefficient of correlation.

The coefficient of correlation of the comprehension and science scores is .57 and the probable error of this correlation is .046.[21]

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[21] Probable error explained on page 10.

TABLE VI
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis - Science Scores

The Y Axis - Comprehension Reading Scores

	68-70	71-73	74-76	77-79	81-82	83-85	86-88	89-91	92-94	95-97	f	d	fd	fd²	xy
193-201									2		2	8	16	128	48
184-192								1	1		2	7	14	98	35
175-183							1	1			2	6	12	72	18
166-174						1		3	1	2	7	5	35	175	85
157-165				1			1	1	1		4	4	16	64	24
148-156				1					1	1	3	3	9	27	21
139-147						1	2			1	4	2	8	16	12
130-138						1	1	1			3	1	3	3	3
121-129					2		2	1	2	1	8	0			
112-120			2		1	4	5	3	2		17	-1	-17	17	-10
103-111	1		1	1	1	1	3	3		1	11	-2	-22	44	-2
94-102			1	1	3	2	5	2			14	-3	-42	126	-3
85- 93				2	1	1	1				5	-4	-20	80	16
76- 84			1	1	3	1		1			8	-5	-40	200	25
67- 75						1					1	-6	-6	36	0
58-66				2	3						5	-7	-35	245	49
49- 57		2		1		1					4	-8	-32	256	80
f	1	2	5	8	16	14	21	17	10	6	(100)		(-214)	1587	(397)
d	-5	-4	-3	-2	-1	0	1	2	3	4					
fd	-5	-8	-15	-16	-16	(-60)	21	34	30	24	(109)				
fd²	25	32	45	32	16		21	68	90	96	(425)				

Comprehension Reading Scores
Mean = 116.41
S. D = 34.65
Standard Norm = 123
Calculated Norm = 127.51

Science Scores
Mean = 85.97
S. D.= 6.06

$r = .57$
P. E. $r = .046$

27

Table VII is made up of the data from the mathematics scores and the comprehension reading scores. The comprehension reading scores as made on the Iowa Silent Reading Test range from 55 to 98. This range of scores, according to the established norms,[22] indicates that the abilities of these students vary in comprehension ability from eighth grade students to college sophomores, and higher. The mean score in comprehension in reading of this group is 116.41, which shows their average to equal that of mid-year seniors by the established norms.[23] This indicated that the students that scored near the mean are near normal in comprehension reading ability. The standard deviation[24] in this group of scores is 34.65 in a range of 144 points, which indicates that the majority of these students are near normal in comprehension in reading. The standard norm established[25] for the comprehension reading scores is 123, which shows that these students are 6.59 points below normal.

The scores in mathematics as shown in this table range from 68 to 97. This is a range in difference of

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[22] Iowa Silent Reading Test.

[23] Ibid.

[24] Standard deviation explained on page 13.

[25] Iowa Silent Reading Test.

scores of 29 points. The mean mathematics score is 85.07 with a standard deviation[26] of 6.96. This mean score and standard deviation shows that 68 per cent of this group of students scored between 79.11 and 92.03. Two students who scored above the mean in comprehension scored below the mean in mathematics. Fifteen students who scored below the mean in comprehension scored above the mean in mathematics.

The two above mentioned facts are the main factors that decreased the correlation from a perfect point of 1 to .55. The probable error of this correlation is .047.[27]

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[26] Standard deviation explained on page 13.

[27] Probable error explained on page 10.

TABLE VII

THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X axis - Mathematics Scores

	68-70	71-73	74-76	77-79	80-82	83-85	86-88	89-91	92-94	95-97	f		d		fd		fd²		xy
195-201						1				1	2		8		16		128		52
184-192								1		1	2		7		14		98		42
175-183				1				1		1	2		6		12		72		33
166-174						1	2	1		1	7		5		35		175		30
157-165							2		2	1	4		4		16		64		36
148-156						1	1	1		1	3		3		9		27		21
139-147		1				1	2	1	1		4		2		8		16		14
130-138			2		1		1				3		1		3		3		3
121-129	1	1			2	1	3	1	3		8		0						
112-120			1	4	1	2	5	3	1	1	17		-1		-17		17		-4
103-111	1	2		1	2	3	1	1		1	11		-2		-22		44		22
94-102				4	1	3	4	3		1	14		-3		-42		126		-3
85-93			1								5		-4		-20		80		24
76-84		1	1	2				1			8		-5		-40		200		50
67-75					1						1		-6		-6		36		-12
58-66		1	2		1		1				5		-7		-35		245		63
49-57	1		1	1	1	1	1				4		-8		-32		256		38
f	3	6	6	15	11	12	6	11	3	6	100				(-214)		1587		(472)
d	-5	-4	-3	-2	-1	0	1	2	3	4									
fd	-10	-24	-18	-26	-11		6	24	9	24					(108)				
fd²	50	96	54	52	11		6	55	55	96					645				

Mathematics Scores
Mean = 85.07
S.D. = 6.96

Comprehension Reading Scores
Mean = 116.41
S. D. = 34.65
Standard Norm = 123
Probable Norm = 127.51

r = .55
P. E. r = .047

The data in Table VIII is made up of the intelligence
quotient scores and history scores. The intelligence
scores range from 83 to 125, making a variation of 42
points. The table shows the distribution and shows that
the number of students near the extremes are near the
same in number with fairly even decrease in number from
the mode to the two extremes. Taking the normal group
of intelligence[28] to fall between 90 and 110 there are
10 students who scored below 90 and 24 scored above 110,
leaving 66 students who scored within the normal group.
The mean score of the intelligence scores is 103.67,
while the standard norm is 100,[29] which indicates that
this group of students is 3.67 points above the standard
norm. The standard deviation[30] of the intelligence scores
is 10.08, which indicates that 68 students of this group
scored between 93.59 and 113.75.

The history scores ranged from 70 to 97, which shows
a range of 27 points. The mean of the history scores is
86.22 with a standard deviation[31] of 6.3. The mode of the
history scores does not occur at the mean but the major
part of the scores occur near the mean. Seven students

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[28] Otis Self-Administering Test of Mental Ability.

[29] Ibid.

[30] Standard deviation explained on page 13.

[31] Ibid.

TABLE IX
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis - English Scores

The Y Axis - Intelligence Quotient Scores

IQ Scores	59-61	62-64	65-67	68-70	71-73	74-76	77-79	80-82	83-85	86-88	89-91	92-94	95-97	f	d	fd	fd²	xy
125-127										1			1	2	7	14	98	70
122-124											1	1	2	4	6	24	144	26
119-121									2				1	3	5	15	75	60
116-118										1				1	4	4	16	16
113-115						1		1	1	3	1		2	9	3	27	81	74
110-112								3	4				1	8	2	16	32	34
107-109						1	2	1		2	3			9	1	9	9	24
104-106					1	1		4		2	1	1	1	10	0	(109)		
101-103				2			1	1	2	1	2	2		11	-1	-11	11	-22
98-100						1	1	1	2	1	3	1		10	-2	-20	40	-48
95- 97					1	2	3	4	2	1	3	1		17	-3	-51	153	-72
92- 94	1		1			1	1			1				5	-4	-20	80	28
89- 91					1			2						3	-5	-15	75	0
86- 88								2	1					3	-6	-18	108	-24
83- 85				2		2	2	1						5	-7	-35	245	21
f	1	0	0	1	7	6	11	15	17	9	16	9	8	(100)		(-170)	1167	(297)
d	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6					
fd	-6	0	0	-3	-14	-6	(-29)	15	34	27	64	45	48	(233)				
fd²	36	0	0	9	28	6		15	68	81	256	225	288	(1012)				

Intelligence Quotient Scores
Mean = 103.67
S. D. = 10.08
Standard Norm - 100

English Scores
Mean = 84.62
S. D. = 7.32

$$r = .51$$
$$P.\ E.\ r = .05$$

The science scores and intelligence quotient scores make up the data found in Table X. In intelligence quotient scores the students ranged from 83 to 125 with a fairly even distribution above and below the standard norm[38] of 100. The mean score of the intelligence scores is 103.67, which means that the average score is 3.67 points above the standard norm. On the basis of the mean score these students should make scores above the average in all things where there is a positive correlation between intelligence and the work scored. The standard deviation[39] of the intelligence quotient scores is 10.08. Ten students scored below 90 and twenty-four students scored above 110, which shows the reason for the mean score being above the standard norm[40] of 100.

The scores made in science ranged from 70 to 97, which is a range of 27 points. The mean score of this group is 85.97 and the standard deviation is 6.06. This standard deviation indicates that a majority of these scores lie principally between 80 and 90. Five students who scored below the mean in science scores scored above the mean in intelligence scores. Ten students who scored below the mean in intelligence scored above the mean in

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[38] Otis Self-Administering Test of Mental Ability.

[39] Standard deviation explained on page 13.

[40] Otis Self-Administering Test of Mental Ability.

science. These ten students, who scored below the mean in intelligence and above the mean in science, form the principal factor that decreased the coefficient of correlation, which is in this case .51. The probable error of this correlation is .05. The probable error in this case shows the correlation to be reliable since it is less than one-fourth of the correlation.

TABLE X
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis - Science Scores

The Y Axis Intelligence Quotient Scores

	68-70	71-73	74-76	77-79	80-82	83-85	86-88	89-91	92-94	95-97	f	d	fd	fd²	xy
125-127								1	1		2	7	14	98	35
122-124							1		2	1	4	6	24	144	66
119-121								2		1	3	5	15	75	40
116-118							1				1	4	4	16	4
113-115				2		1	3	2	1		9	3	27	81	24
110-112				2		2	2	1	1		8	2	16	32	10
107-109				1		1	2	2	2	1	9	1	9	9	15
104-106			1		1	3		2	1	2	10	0	(109)		
101-103			1		1	2	2	5			11	-1	-11	11	-9
98-100					2		5	2		1	10	-2	-20	40	-22
95- 97	1		2	5	3	1	3		2		17	-3	-51	153	45
92-94		1	1	1	1		1				5	-4	-20	80	36
89- 91					1	2					5	-5	-15	75	5
86- 88			1			1	1				3	-6	-18	108	15
83- 85		1		1	2	1					5	-7	-35	245	56
f	1	2	5	8	16	14	21	17	10	6	(100)		(-170)	1167	(317)
d	-5	-4	-3	-2	-1	0	1	2	3	4					
fd	-5	-8	-15	-16	-16	(-60)	21	34	30	24	(109)				
fd²	25	32	45	32	16		21	68	90	96	(425)				

Intelligence Quotient Scores
Mean = 103.67
S. D.= 10.08
Standard Norm = 100

Science Scores
Mean = 85.97
S. D.= 6.06

$$r = .51$$
$$\text{P. E. } r = .05$$

39

Table XI is made up of the mathematics and intelligence quotient scores. The intelligence quotient scores made by these students varied from 83 to 125, which gives a difference of 42 points between the two extremes. As shown by the frequency distribution in the table, there is fairly even decrease of frequency from the mean to the two extremes. The mean score of this group of scores is 103.67 or 3.67 points above the standard norm[41] for intelligence scores. The standard deviation[42] for the intelligence scores is 10.08, which indicates that 68 of the students scored within 20.16 points of each other or within 10.08 points of the mean. Ten students of this group scored within the dull group in intelligence; 66 students scored within the normal group; 17 students scored within the superior group, and seven students rated as very superior.[43]

The scores in mathematics, as shown by this table, ranged from 68 to 97. This is a range in scores of 29 points. The mean score in mathematics is 85.07 with a standard deviation[44] of 6.96. This mean score and

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[41] Otis Self-Administering Test of Mental Ability.

[42] Standard deviation explained on page 13.

[43] Otis Self-Administering Test of Mental Ability.

[44] Standard deviation explained on page 13.

standard deviation shows that 68 of these students scored between 78.11 and 92.03. Six students who scored below the mean in mathematics scored above the mean in intelligence. Twelve students who scored below the mean in intelligence scored above the mean in mathematics.

The coefficient of correlation of the mathematics and intelligence scores is .5 and the probable error[45] of this correlation is .05.

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[45] Probable error explained on page 10.

TABLE XI
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis - Mathematics Scores

The Y Axis - Intelligence Quotient Scores

	68-70	71-73	74-76	77-79	80-82	83-85	86-88	89-91	92-94	95-97	f	d	fd	fd²	xy
125-127						1				1	2	7	14	98	28
122-124								2		2	4	6	24	144	72
119-121							1	1		1	3	5	15	75	35
116-118								1			1	4	4	16	8
113-115					1		2	3	2	1	9	3	27	81	51
110-112				1	1	2	2	1		1	8	2	16	32	10
107-109		1		1	1	1		2	3		9	1	9	9	6
104-106	1	1		1			3	1	3		10	0	(109)		
101-103		1	2		2	1	3	2			11	-1	-11	11	5
98-100		1		1	1	3	1	1	2		10	-2	-20	40	-4
95- 97		1	1	5	3	2	2	2	1		17	-3	-51	153	33
92-94			2	2		1					5	-4	-20	80	40
89- 91				1	1			1			3	-5	15	75	5
86-88				1		1	1				3	-6	-18	108	76
83- 85	1	1	1		1			1			5	-7	-35	245	77
f	2	6	6	13	11	12	15	18	11	6	(100)		(-170)	1167	(372)
d	-5	-4	-3	-2	-1	0	1	2	3	4					
fd	-10	-24	-18	-26	-11	(-89)	15	36	33	24	(108)				
fd²	50	96	54	52	11		15	72	99	96	(545)				

Intelligence Quotient Scores
Mean = 103.67
S. D.= 10.08
Standard Norm = 100

Mathematics Scores
Mean = 85.07
S. D.= 6.96

$r = .5$

$P. E. r = .05$

Table XII shows the scores made in history and rate of silent reading. The rate of silent reading scores ranged from 13 to 47, which is a range of 34 points. This range in scores is equal to as much or more than 85 per cent of the group of students made in rate of silent reading. The mean score of the rate of silent reading is 26.11. This is .25 below the standard norm[46] for ninth grade students. The standard norm for seniors in this test is 31.[47] The probable norm, as shown on the table to be 32.14 is figured on the basis of the mean score made by these students on the intelligence test. According to grade levels corresponding to test scores five students scored below eighth grade; thirty-four as eighth grade; twenty-two as ninth grade; nineteen as tenth grade; one as eleventh grade; two as twelfth grade; two as thirteenth grade, and sixteen as fourteenth grade and above in rate of silent reading.[48]

The history scores ranged from 70 to 97 with a mean score of 86.22 and a standard deviation[49] of 6.3. The mode of the history scores does not occur at the mean but the major part of the scores fall near the mean. Six students

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[46]
   Iowa Silent Reading Test.
[47]
   Ibid.
[48]
   Ibid.
[49]
   Standard Deviation explained on page 13.

who scored below the mean in history scored above the mean in rate of silent reading. Twenty-five students who scored above the mean in rate of silent reading scored below the mean in history. These two groups of students mentioned above decreased the correlation. The twenty-five students mentioned made scores in history above the mean in spite of the fact that they were slow readers, and six of the more rapid readers scored low in history.

The coefficient of correlation of these two groups of scores is .38 and the probable error[50] of the coefficient of correlation is .058.

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[50] Probable error explained on page 10.

TABLE XII
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis - History Scores

	69-71	72-74	75-77	78-80	81-83	84-86	87-89	90-92	93-95	96-98	f	d	fd	fd²	xy
46-48							1			2	3	6	18	108	60
43-45											0	5	0	0	0
40-42						1	1			2	4	4	16	64	36
37-39							2	2			4	3	12	36	18
34-36			1	1			1	2			5	2	10	20	0
31-33						1	2	1			4	1	4	4	4
28-30			2	1	1		3	2			10	0	(60)		
25-27			2	1	3	1	3	4	1		15	-1	-15	15	-8
22-24	1		2	2	5	2	10	5			27	-2	-54	108	0
19-21			3	3	2	2	1	2	2		15	-3	-45	135	18
16-18				1	1	1	1	2			6	-4	-24	96	-8
13-15		1	3			1	2				7	-5	-35	195	55
f	1	1	13	9	12	9	26	16	8	5	(100)		(-173)	761	(175)
d	-5	-4	-3	-2	-1	0	1	2	3	4					
fd	-5	-4	-39	-18	-12	(-78)	26	32	24	20	(102)				
fd²	25	16	117	36	12		26	64	72	80	(448)				

Rate of Silent Reading Scores
    Mean = 26.11
    S. D.= 7.53
Standard Norm = 31
Calculated Norm = 32.14

History Scores
    Mean =86.22
    S. D.= 6.3

$$r = .38$$
$$P. E. \; r = .058$$

The Y Axis - Rate of Silent Reading Scores

The data found in Table XIII are made up of the
scores made in English and rate of silent reading. The
scores made in rate of silent reading ranged from 13 to 47.
This range of scores indicates on the grade level norms[51]
that these students vary in rate of silent reading from
below the eighth grade level to above college sophomores.
Seventy-five of this group of seniors rated as eighth,
ninth, and tenth grade students in rate of silent read-
ing. The mean of the rate of silent reading scores is
26.11 and the standard deviation[52] is 7.53. The standard
norm for seniors on this test of rate of silent reading
is 31.[53] This shows that these students range on the
average of 4.89 points below where they should score.

The English scores vary from 60 to 97, a range of
37 points. The mean of the English scores is 84.62 with
a standard deviation of 7.32. The principal thing that
causes this scatter diagram to appear off balance is the
one score of 60 when the next score occurs three intervals
above that point. Seven students who scored below the
mean in English scored above the mean in rate of silent
reading. Eighteen students who scored above the mean in

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[51]
  Iowa Silent Reading Test.
[52]
  Standard deviation explained on page 13.
[53]
  Iowa Silent Reading Test.

English scored below the mean in rate of silent reading.

These two groups of students whose scores fall within the negative quarters of the scatter diagram are the factors that caused the coefficient of correlation to be reduced. The coefficient of correlation of these two groups of scores is .27. The probable error[54] of this correlation is .063.

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[54] Probable error explained on page 10.

TABLE XIII
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis – English Scores

	59-61	62-64	65-67	68-70	71-73	74-76	77-79	80-82	83-85	86-88	89-91	92-94	95-96	f	d	fd	fd²	xy
46-48											1		2	3	6	18	108	96
43-45														0	5	0	0	0
40-42								1	1				2	4	4	16	64	60
37-39										2	2			4	3	12	36	42
34-36						1		1		2		1		5	2	10	20	22
31-33									2		1	1		4	1	4	4	13
28-30					1			3	1	1	2			10	0	(60)		
25-27						1	1	3	5			3	2	15	-1	-15	15	-39
22-24				3	3		5	3	5	1	7			27	-2	-54	108	-70
19-21			1	2	1		4	1	1	2		3		15	-3	-45	135	-57
16-18					1		1		1	2		1		5	-4	-24	96	-44
13-15	1							3	2		1			7	-5	-35	175	-55
f	1	0	0	1	7	6	11	15	17	9	16	9	8	(100)		(-173)	761	(-32)
d	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6					
fd	-6	0	0	-3	-14	-6	(-29)	15	39	27	64	45	48	(233)				
fd²	36	0	0	9	28	6		15	68	81	256	225	288	(1012)				

Rate of Silent Reading Scores
Mean = 26.11
S. D.= 7.53

Standard Norm = 31
Probable Norm = 32.14

English Scores
Mean = 84.62
S. D.= 7.52

r = .27
P. E. r = .063

Table XIV is a scatter diagram containing science and rate of silent reading scores from which the coefficient of correlation of these two groups of scores is calculated.

The rate of silent reading scores have a range of 34 points between 13 and 47, which are the two extreme scores. The mean score of the rate of silent reading is 26.11 with a standard deviation of 7.53. The standard norm for seniors in rate of silent reading is 31. These students are 4.89 points below the mean that their scores should have established. According to the grade levels corresponding to these rates of silent reading scores, five students scored below eighth grade; thirty-four as eighth grade; twenty-two as ninth grade; nineteen as tenth grade; one as eleventh grade; two as twelfth grade; two as thirteenth grade, and sixteen as fourteenth grade and above in rate of silent reading.[54]

The scores in science are as low as 70 and as high as 97 with the mean score at 85.97 and a standard deviation[55] of 6.06. This standard deviation indicates that 68.26 per cent of these science scores occur between 79.91 and 92.03. Ten students who scored above the mean

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[54]
  Otis Self-Administering Test of Mental Ability.
[55]
  Standard deviation explained on page 13.

in rate of silent reading scored below the mean in science. Thirteen students who scored below the mean in rate of silent reading scored above the mean in science. This put the scores of twenty-three of this group of students in the negative quarters of the table.

The coefficient of correlation of these two groups of scores shown in this table is .58 and the probable error[56] of this correlation is .058.

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[56] Probable error explained on page 10.

TABLE XIV
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis - Science Scores

The Y Axis - Rate of Silent Reading Scores

	68-70	71-73	74-76	77-79	80-82	83-85	86-88	89-91	92-94	95-97	f	d	fd	fd²	xy
46-48							1	1	1		3	6	18	108	54
43-45											0	5	0	0	0
40-42					1	1		2			4	4	16	64	12
37-39							1	1	2		4	3	12	36	27
34-36					2	1	1		1		5	2	10	20	4
31-33						1	2	1			4	1	4	4	4
28-30			1	1		2	1	1	2	2	10	0	(60)		
25-27			2	2	4		2	2	1	2	15	-1	-15	15	-3
22-24	1		1	2	4	5	8	5	1		27	-2	-54	108	-10
19-21		2	1	1	3	1	3	1	2	1	15	-3	-45	135	3
16-18					1	1	1	3			8	-4	-24	96	24
13-15				2	1	2	2				7	-5	-35	175	15
f	1	2	5	8	16	14	21	17	10	6	(100)		(-173)	761	(140)
d	-5	-4	-3	-2	-1	0	1	2	3	4					
fd	-5	-8	-15	-16	-16	(-60)	21	34	30	24	(109)				
fd²	25	32	45	32	16		21	68	90	96	(425)				

Rate of Silent Reading Scores
Mean = 26.11
S. D.= 7.53

Science Scores
Mean = 85.97
S. D.= 6.06

Standard Norm = 31
Probable Norm = 32.14

$$r = .38$$
$$P. E. \quad r = .058$$

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Table XV shows the scores made by one hundred seniors in mathematics and rate of silent reading.

The rate of silent reading scores vary from 13 to 47 which means in grade levels that these students' rate of silent reading ability varies from the eighth grade level to the level of college sophomores and above.[57] The mean score of this group of scores is 26.11. This mean score is .25 below the standard norm for ninth grade students.[58] The standard norm for seniors in this rate of silent reading scores is 31, which means that these students are 4.89 points below where their average should be in order to be normal.

The probable norm listed below Table XV is 32.14. This is figured on the basis of the mean score of intelligence of the students and means that these students should have established a mean score of 31.98 instead of 26.11 in rate of silent reading on the basis of what their average was in intelligence.

The scores in mathematics, as shown by this table, range from 68 to 97. The mean score in mathematics is 85.07 with a standard deviation[59] of 6.96. Eight students who scored below the mean in mathematics scored above the

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[57] Iowa Silent Reading Test.

[58] Ibid.

[59] Standard deviation explained on page 13.

mean in rate of silent reading. Twenty-four students who scored above the mean in mathematics scored below the mean in rate of silent reading.

The coefficient of correlation of the two groups of scores shown in Table XV is .29 and the probable error[60] of this correlation is .062.

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[60] Probable error explained on page 10.

TABLE XV
THE CALCULATION OF CORRELATION BY THE PEARSON PRODUCT-MOMENT METHOD

The X Axis - Mathematics Scores

The Y Axis - Rate of Silent Reading Scores

	68-70	71-73	74-76	77-79	80-82	83-85	86-88	89-91	92-94	95-97	f	d	fd	fd^2	xy
46-48							1			2	3	6	18	108	60
43-45											0	5	0	0	0
40-42						1	1		1	1	4	4	16	64	32
37-39						2	2				4	3	12	36	18
34-36		1			1	1		1	1		5	2	10	20	0
31-33				1			2	1			4	1	4	4	2
28-30				5		1		2		2	10	0	(60)		
25-27		2			3	3	2	1	3	1	15	-1	-15	15	-6
22-24	1	1	2	4	3	3	6	5	2		27	-2	-54	108	8
19-21	1	1	3	2	2			3	3		15	-3	-45	135	27
16-18		1			1	2		1	1		6	-4	-24	96	0
13-15			1	1	1	1	2	1			7	-5	-35	175	10
f	2	6	6	13	11	12	15	18	11	6	(100)		(-173)	(761)	(151)
d	-5	-4	-3	-2	-1	0	1	2	3	4					
fd	-10	-24	-18	-26	-11	(-89)	15	36	33	24	(108)				
fd^2	50	96	54	52	11		15	72	99	96	(545)				

Rate of Silent Reading Scores
Mean = 26.11
S. D.= 7.53

Mathematics Scores
Mean = 85.07
S. D.= 6.96

Standard Norm = 31
Probable Norm = 32.14

$r = .29$
P. E. $r = .062$

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CHAPTER III

INTERPRETATION OF DATA

The coefficient of correlation is now widely used as a measure of the degree of relationship existing between two sets of paired measures or between the two variables represented by them.[1] Coefficients of correlation appear in large numbers in our more technical educational journals and are to be found in many educational texts. When one consults texts on educational statistics concerning the meaning to be associated with a given coefficient he is told that the values of a coefficient of correlation[2] cannot be greater than a plus 1.00 or less than a negative 1.00; that a positive coefficient is evidence that the larger magnitudes in one set of data tend to be paired with the larger in the other, and likewise the smaller magnitudes in one set of data tend to be paired with the smaller in the other. A negative coefficient is evidence of inverse pairing, the larger magnitudes in one set tending to be paired with the smaller ones in the other; the magnitude of the coefficient is indicative of the completeness of the pairing, being complete when r or the coefficient

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[1] Walter S. Monroe and Dewey B. Stuit, "The Interpretation of the Coefficient of Correlation," *Journal of Experimental Education*, Vol. I, p. 168.

[2] Ibid.

of correlation is equal to a positive or negative 1.00.
When the coefficient of correlation is 0.00 the pairing
is on the basis of chance and no relation exists between
the two sets of measures or scores. Values of r between
0.00 and 1.00 indicate the existence of a relationship
between the two sets of paired measures or the variables
represented by them, and obviously there is some type of
correspondence between the magnitude of the coefficient
and the degree of relationship. But educational statis-
ticians have given scant attention to the degree of re-
lationship to be associated with particular numerical
values of r, such as .18, .30, .50 or .75.

In 1917 Rugg[3] suggested the following general inter-
pretation: r less than .15 to .20, correlation "negligi-
ble" or "indifferent"; r from .15 or .20 to .35 or .40,
correlation "present but low"; r from .35 or .40 to .50
or .60, correlation "marked"; r above .60 or .70, corre-
lation "high". A general classification of this type is
misleading because the meaning of the terms varies with
the type of data being considered. Coefficients calcu-
lated from the scores obtained from the administration of
two forms of test are, other things being equal, higher
than those calculated from intelligence test scores and
measures of silent reading ability; these are higher than

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[3] H. O. Rugg, Statistical Methods, p. 256.

Those summarizing the relationship between high school marks and those received in college so it is evident that the value of the score will vary some according to the scores correlated.

The coefficient of correlation between the intelligence quotient scores and comprehension reading scores is .78. This means that there is a high positive correlation between intelligence and comprehension, indicating that general intelligence or ability to learn is an essential factor in determining success in school. Those seniors who made the best mental rating on the intelligence tests, if taken as a group, made the best scholastic record in comprehension. Those making the poorest intelligence rating on the mental tests made the poorest comprehension rating. The ability to learn will not insure its accomplishment. Ability to perform is not synonymous with actual performance. Mere intellectual capacity, or the ability to do school work, will not insure successful work, though it is a necessary precondition, and one of the most important factors in bringing it about.[4] This high correlation between these two groups of scores indicates that there is a close relation between intelligence and comprehension. Either of the two qualities could be,

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[4] William F. Book, The Intelligence of High School Seniors, p. 309.

fairly accurately, judged by the other or in other words a person with a high rating in intelligence will also rank high in comprehension.

Since the probable error of the correlation coefficient is .027, which is much less than one-fourth of the correlation coefficient of .78, this indicates the correlation reliable and significant.

The coefficient of correlation between rate of silent reading and intelligence is .46. This correlation would fall in the class of "marked" correlation. This would indicate under average conditions that this correlation is still high enough to be of some significance. The size of the probable error in this case also adds to the significance and reliability of the correlation. The probable error of the correlation between rate of silent reading and intelligence is .05, which is less than one-fourth of the coefficient of correlation. Although this correlation is not as high as the ocrrelation between intelligence and comprehension it is high enough to be of significance and shows that there is a marked positive correlation between intelligence and rate of silent reading. This would naturally be an expected condition since the greater the intelligence the greater would be the ability to grasp proper methods and instruction. The more intelligent student would be able to gain the words, meaning and

thought more easily and thus increase the rate of read-
ing.[5]

A question naturally arises about the amount of cor-
relation that exists between the rate of reading and com-
prehension when these aspects of reading ability are
differentiated by the test. Some recent studies indicate
that under such conditions the agreement is not very
close. For instance, Eurick[6] has reported twenty-six
correlation coefficients for rate of reading and compre-
hension. The average of the twenty-six correlations was
.31, which indicates a positive but not close relationship
between rate of reading and comprehension.

The coefficient of correlation of rate of reading
and comprehension found in this study is .55 and its prob-
able error is .047. This correlation would classify as
a "marked" correlation. This indicates that, although
this is not a high correlation, there is a positive rela-
tion between rate of reading and comprehension. It is
frequently assumed that the rapid reader does not under-
stand what he reads as well as does the slow reader. If
this were true, the development of speed in reading would

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[5] Ibid., p. 103.

[6] Alvin C. Eurich, "The Relation of Speed of Reading
to Comprehension," School and Society, XXXII, September 20,
1930, pp. 404-6.

contribute little or nothing to economy and efficiency in silent reading. One would expect this result since rate of reading above normal and comprehension above normal would be associated with a mind above normal along these lines of development.[7]

The ability to make grades in history depends on several things, such as, the ability to concentrate attention, interest developed, ability of teacher, natural ability or intelligence, rate of reading and comprehension.[8] The value of each of these will vary with different existing conditions[9] but the factor under consideration here is the value of comprehension to achievements in history. The writer found, as cited in previous material presented in this study, that the coefficient of correlation between history scores and comprehension scores is .61 with a probable error of .043. This coefficient of correlation would classify as a "high" correlation, indicating that there is a high positive relationship between the pair of scores correlated. This means that the ability to comprehend material read is one important factor that would determine achievements in history.

[7] William Scott Gray, "Speed of Silent Reading," Summary of Investigations Relating to Reading, The University of Chicago, pp. 123-124.

[8] Ibid., p. 103.

[9] Ibid., p. 103.

Since comprehension is the absorbing of facts and material read there would naturally be a positive relationship between these two factors.[10]

Comprehension ability varies with different fields because of the variation of interest, ability of teacher, ability to apply one's self and many other human factors as well as the variation in ability to understand the variety of terms used in different fields.[11] For the reasons stated above, the coefficient of correlation of comprehension with the different academic fields would not be expected to be the same, although there should be some relation between them, since the desirable factors would be common with students at the top of the scale of scores. Theoretically speaking, there should be a very high correlation between achievements in school subjects and comprehension, but this does not prove out in practice since there are many other factors that enter in to determine achievement.[12] The coefficient of correlation between English scores and comprehension is .66 with a probable error of .038. The coefficient of correlation would classify as a "high" correlation with significance

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[10] _Ibid._, p. 103.

[11] _Ibid._, p. 103.

[12] William Scott Gray, "Individual Differences, Relation of Intelligence to Achievement, Types of Class Organization," _Summary of Investigations Relating to Reading_, The University of Chicago, p. 42.

and reliability. This indicates that there is a high positive relationship between achievement in English and comprehension and that a student who scores high in comprehension will score high in English.

Science scores and comprehension in reading are shown to have a "marked" relationship since they proved to have a coefficient of correlation of .57. The probable error of this correlation is .046, which means that the actual coefficient of correlation of this pair of scores is between .524 and .616 when the probable error is taken into consideration. The calculations on these scores indicate that there is a positive relation between English and comprehension and that achievements in English could be foretold to a fair degree of accuracy by knowing the comprehension ability of a student. In the study of this pair of scores, as well as several pairs of scores in this study, it is noticeable that several of the students make grades above the average when their ability, as shown by the tests, is below average. The same things could possibly be true in all cases, that these students have perseverance, interest in subject, or some other quality that is overcoming their weakness. In some cases it might be that they were overgraded due to some failing of the teacher. Any one of these factors might be the contributing cause in any case or all these factors as well

CHAPTER I

INTRODUCTION

It has been demonstrated by several other experiments that the ability to read largely determines the ability of a student to make good grades or to get his lessons.[1] With this idea in mind, this study has been made for the purpose of finding, more specifically, the relation between reading ability in Blackwell and Tonkawa High School Seniors and grades made in history, English, science and mathematics. For the purpose of weighting, intelligence is also included in this study. Intelligence is included partly because of the interest in intelligence and its relation to grades made and reading ability. It is used for a check on other scores used in this study.

The tendency to treat reading as the most important tool in learning has resulted in establishing a close relation between reading and practically every school subject. As a means of gaining information and pleasure it is essential in every content subject, such as history, English, science and mathematics. In fact, scholarship depends on ability to read, supplemented by other qualities, such as high level of intelligence.[2] It follows,

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[1] Elbert Kirtley Fretwell, "A Study in Educational Prognosis," Teachers College Contribution to Education, No. 99, p. 56.

[2] William Scott Gray, "Summary of Investigations Relating to Reading, p. 42.

as others might have entered into decreasing the correlation between factors considered.[13]

The coefficient of correlation between mathematics scores and comprehension scores is .55 with a probable error of .047. This coefficient of correlation would rank as a "marked" correlation. In common words, this indicates that there is positive relation between these scores of significant value. This study indicates that comprehension is an important factor in determining what scores will be made in mathematics. Since mathematics requires much constructive thought, it might be expected to have a significant relation with comprehension. Probably with mathematics more than any other academic subject, it is necessary to comprehend the fundamental ideas presented before it is possible to procede with the work.[14]

In considering the correlations between comprehension and scores in history, English, science and mathematics it will be noticed that all of these correlations are very close in values. The average of the four correlations is .5975. The lowest of these correlations is between mathematics and comprehension and the highest is between English and comprehension, with correlations of .55 and .66, respectively.

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[13] William F. Book, Op. Cit., p. 94.

[14] Ibid., p. 166.

In the comparison of the intelligence and history scores the coefficient of correlation is found to be .52 with a probable error of .049. The coefficient of correlation classifies as a "marked" correlation. The indication from this correlation is that there is a positive correlation between these two factors considered. The correlation is high enough that there is significance in their relationship, that is, one may be expected to accompany the other. This indicates that a student with intelligence above normal will have similar ability in history.

The coefficient of correlation of the intelligence and English score is .51. The probable error of this correlation is .05. This correlation would classify as a "marked" correlation. This indicates a significant relationship between intelligence and English, which means that a successful achievement in English will be common with students of high intelligence. This correlation shows a positive relationship between intelligence and English that is high enough to be of important significance. The probable error of .05 of the coefficient of correlation indicates a reliable correlation.

The study on the science and intelligence scores proved the coefficient of correlation to be .51. The probable error is .05, which indicates that the coefficient of correlation is reliable. The coefficient of correlation

would classify as a "marked" correlation. This indicates that it is a positive correlation of significant value although it is midway between a perfect correlation and no correlation. Natural ability to gain knowledge is an important factor in the determining of achievements in science.

The coefficient of correlation between intelligence and mathematics scores is .5. The probable error of the coefficient of correlation is .05, which indicates that the coefficient of correlation is reliable. This coefficient of correlation would classify as a "marked" correlation. This means that this correlation between this pair of scores shows a positive relation of medium significance. The relation between the two groups of scores indicates that general intelligence, or natural ability, is an essential factor in determining success in mathematics as measured by grades received. There is sufficient relation here that one might judge a student's ability in mathematics by his intelligence, other things being near normal. Fundamental thinking and basic thought would have a significant positive correlation with intelligence according to the correlation between intelligence and comprehension.[15]

In summing up the results of the correlations between intelligence and history, English, science and

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[15] Ibid., pp. 109-110.

mathematics it is found that the average of the correlations is .51. The lowest correlation of the group is between mathematics and intelligence, which was .5, and the highest correlation is between history and intelligence, which is .52. Considering the average of these correlations it shows that there is a "marked" correlation between intelligence and achievements in these four school subjects. This average of correlations would indicate that general intelligence or natural ability is a determining factor in school achievements in the subjects studied.

A coefficient of correlation of .38 was found between history scores and rate of reading. The probable error in this correlation is .058, which, if added or subtracted from the correlation coefficient, would place the actual correlation coefficient somewhere between .322 and .438. This would classify as a "present but low" correlation. This means that there is a positive relation between history achievements, as measured by grades received, and rate of reading, but the relation is not close. The reliability of judging, what achievements would be in history, by rate of reading would not be very great. The ability to obtain the required material from a history course does not depend on being a fast reader so much as it does on other factors. This would no doubt vary in different courses, depending on the amount of material assigned to be read.

The English scores and rate of reading scores proved to have a correlation of .27 with a probable error of .063. This low probable error would indicate that the correlation coefficient is reliable since the probable error is less than one-fourth of the coefficient of correlation. As long as the coefficient of correlation is four or more times as large as the probable error the coefficient of correlation is said to be reliable. The coefficient of correlation found to exist between this pair of scores would classify as rather low in the "present but low" group. This result indicates that achievement in English does not depend very much on rapid reading although there is a small positive relationship between these two groups of scores. Again it would be true that this would vary, depending on the amount of material that was required to be read, that is, where the amount of material assigned was great enough that the total time required would cause the student to hurry with his reading.

The rate of reading and science scores proved to have a coefficient of correlation of .38. The probable error of this correlation is .058, which indicates that this correlation is reliable. This coefficient of correlation would classify in the upper part of the "present but low" group of correlations. This indicates a positive relation and tells us that a rapid reader has some advantage

in studying science but there would not be such a great
advantage that it could be easily overcome by other
factors that might enter. Probably in this case the
more limited the student's time the greater the advantage
would be of being a rapid reader.

The coefficient of correlation between rate of read-
ing and mathematics is .29. The probable error with
this calculation is .062. This indicates that this cor-
relation coefficient is reliable. In this case the probable
error is less than one-fourth of the coefficient of corre-
lation. This correlation coefficient of .29 between rate
of reading and mathematics would classify in the upper
part of the "present but low" group of correlations. This
means that there is a positive relation between the rate
of reading and grades made in mathematics although the re-
lation is not of great significance. The ability to
achieve in mathematics is not greatly dependent on being
a rapid reader but this correlation indicates that the
rapid reader has some advantage over the slow reader in
this subject field.

The average correlation coefficient between rate of
reading and history, English, science and mathematics is
.33. This indicates that on the average there is a
"present but low" coefficient of correlation in this field.
This gives an average of a positive relationship between
rapid reading and achievements in these four fields. There

would be no great advantage of being a rapid reader according to this correlation. With this group of correlations history and science both had correlations coefficients of .38 with rate of reading. The lowest correlation was .28 between English and rate of reading.

Taking all correlation coefficients into consideration the highest relationships were found between comprehension and the four subject fields. The next highest relations were found to exist between intelligence and achievements in the four academic subjects. The lowest relations exist between rate of reading and the four subjects taken into consideration.

CHAPTER IV

SUMMARY AND CONCLUSIONS

The conclusions reached in this study are not to be referred to as absolute facts that would be true with any group of students who might be studied. Individual and group differences could enter into the study that would influence the results. The results of this study are dependable and they indicate the existing condition of the group studied although it is not claimed that they indicate the exact result of all similar studies.

The principal facts drawn from this study, to which a few references have been made, are as follows:

1. The highest relationship between factors studied existed between comprehension and intelligence. Comprehension can be evaluated by the degree of intelligence for general school problems, or visa versa.[1]

2. The relation between rate of reading and comprehension is positive and corroborates the findings of Thorndike and others that a rapid reader has greater comprehension than a slow reader.[2]

3. Students with intelligence above average will have rate of reading scores above average, and visa versa.

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[1] William F. Book, The Intelligence of High School Seniors.

[2] William Scott Gray, Summary of Investigations Relating to Reading.

4. Ability to achieve in history can be measured by a student's comprehension ability in reading.

5. Scores made in English are influenced by the comprehension ability of the students.

6. There is a positive correlation between science scores and comprehension scores, which is significant. Therefore, ability in science may be estimated by comprehension ability in reading.

7. Ability to comprehend has some influence on ability to achieve in mathematics. For classification purposes in mathematics, comprehension ability can be used as a basis for subdivision of groups.

8. There is a significant correlation between intelligence and ability in history. Therefore, achievement in history depends on the level of intelligence of the student.

9. There is a positive correlation between English scores and intelligence. The coefficient of correlation is large enough to show a significant relationship. A student with intelligence above normal should make an English grade that is above normal.

10. Intelligence is likewise an important factor in the determining of achievements in science and the division of students into homogeneous groups for science work may be made to a satisfactory degree on a basis of intelligence.

11. There is a significant positive correlation between intelligence and mathematics. Reliable predictions may be made as to what the achievements will be in mathematics on the basis of intelligence. A student, whose intelligence is above normal can be expected to make grades in mathematics that are above normal, and visa versa.

12. There is a positive correlation between history achievement and rate of reading, although it is not a high correlation. A student whose rate of reading is above normal has an advantage in history work and visa versa.

13. There is a low positive correlation between English achievement and rate of reading. English has the lowest correlation to rate of reading of any of the subjects fields studied. There is an advantage to a student of English who has a rate of reading above normal.

14. There is a medium positive correlation between science scores and rate of reading. Science students have a fair advantage by being rapid readers.

15. Rate of reading and achievements in mathematics have a low positive correlation. There is a small advantage to a mathematics student who has a rate in reading ability above normal.

Comprehension ability is found, by this study, to be the most important factor as a determiner of achievements.

The highest coefficients of correlation were found to exist between comprehension and other factors studied, that is, between either intelligence or rate of reading and other factors studied. Since there was a higher correlation between comprehension and intelligence than in any other it would be expected that intelligence would be the second most important factor. This study showed intelligence to be second in importance, of the three basic factors studied, as a determiner of achievements. Rate of reading showed itself to have a positive relationship throughout the study but the relation was low.

Since intelligence is considered to be a natural fixed quality and rate of reading is shown to be of minor importance, comprehension in reading holds an outstanding place in importance as a determiner of achievements, in the basic academic fields studied.

Upon the basis of this study and the conclusions drawn, reading is the most important of the basic academic subjects. A student's achievements in school depend more on his reading ability than on any other acquirable factor.

In the division of reading, as it was divided for this study, comprehension is the more important division. Since rate of reading would naturally increase with comprehension it would be necessary to direct most attention to the improvement of comprehension.

In the school program, reading should be treated as the most important factor for attention. Nothing practical, should be spared to present a well developed reading program.

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