THE VALIDITY OF EXPERIENCE AS A FACTOR

IN THE CLASSIFICATION OF WAVES IN CORRESPONDENCE AND PERSONNEL

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IN THE CLASSIFICATION OF WAVES IN CORRESPONDENCE AND PERSONNEL

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CHAPTER I

INTRODUCTION

Historical Background

The law creating an organization of the Naval Reserve--Women Accepted for Volunteer Emergency Service, commonly abbreviated and known as WAVES--was approved by the Senate and the House of Representatives of the United States of America in Congress, July 30, 1942, PUBLIC LAW 689--77th CONGRESS, Chapter 538--2d Session, H. R. 6807. The following are excerpts from Chapter 12, Part H, Bureau of Naval Personnel Manual:

"H-12101. PURPOSE. The purpose of the Women's Reserve, which has been established by law as a branch of the Naval Reserve, is to expedite the war effort by releasing officers and men for duty at sea and their replacement by women in the shore establishment of the Navy within the continental United States."

"H-12201. COMPOSITION. (1) The Women's Reserve shall be composed of Women Accepted for Volunteer Emergency Service and shall be referred to by the brief title "WAVES.""

"H-12302. DUTIES. (1) Members of the Women's Reserve shall be restricted to the performance of shore duty only within the continental limits of the United States and shall not be assigned to duty on board vessels of the Navy or in combat aircraft.

(2) Officers and enlisted personnel will be trained for the following duties and such other duties as may be prescribed from time to time:

(a) Communications: Various communication duties including coding, cryptanalysis and operation of communication service.

(b) Administration: Various administrative duties including those performed by laboratory and other technicians, and research and analytical duties.

(3) The members of the Women's Reserve shall not be used to replace Civil Service personnel employed in the Naval establishment.

"H-12304. QUALIFICATIONS FOR ENLISTMENT. (1) For enlistment an applicant must be a citizen of the United States or its insular possessions, not less than 20 years of age. The upper age limit shall be as prescribed by the Chief of Naval Personnel from time to time.
(2) Applicant must be a graduate of high school or business school, or have technical training or experience appropriate to rating."[1]

Even before the passage of this Act, the Oklahoma Agricultural and Mechanical College of Stillwater had felt that its facilities, already in existence in the School of Intensive Business Training, might be used to advantage by the military forces in the training of clerical workers. The services of the institution were offered to the War Department by the president of the college. As a result of this contact, the college was selected, along with the University of Indiana, to train clerical workers. It was understood at that time that the training would be for men.

It was intended for the school to open in June, 1942. The opening was postponed, supposedly for thirty days. It is possible that it was postponed because the Bill for WAVES was pending and might result in women coming to Stillwater instead of men. Additional postponements caused the school not to be opened until October 7, 1942. Class work began on October 12, 1942.

The United States Naval Training School (Yeoman) for Women was operated by Oklahoma Agricultural and Mechanical College under contract with the Navy, whereby the students were sent directly to the college from civilian occupations, and arrived in civilian clothes.

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[1]Bureau of Naval Personnel, Manual Circular Letter No. 13-42, July, 1942.

After these trainees arrived on the campus, they were issued uniforms. They received four months' training which included one month's "boot" training, normally graduating as yeomen, 3d class, after sixteen weeks of training. This program operated in the Division of Commerce with civilian instructors. There were 625 women in the first group to receive training. By April 13, 1945, approximately 10,000 had been trained.

The term "boot" training includes the indoctrination, which the Navy considers essential, consisting of elementary drill, physical education, Naval Customs, a study of the Blue Jacket Manual pertaining to "Subjects All Enlisted Men Should Know," and Organization of the Navy.

After a period of a few months, Hunter College, New York City, was commissioned by the Navy for the purpose of assembling, testing and classifying recruits from civilian life. Here uniforms were issued and "boot" training, originally included in the sixteen weeks' course at Stillwater, was given. At that time the course at Stillwater was shortened to three months. Over the majority of the life of the program, the training extended over a period of twelve weeks.

The curriculum included:

English Usage.--"The efficient yeoman knows and uses good English in all of his work, oral and written. The most important and useful rules of grammar for the yeoman are presented, and the study of that material should be coordinated closely with the practical work in correspondence."

Spelling.--"The yeoman is expected to spell words correctly in all the written material he produces. Mistakes in spelling are unnecessary and detract seriously from the quality of a yeoman's work. Errors in spelling frequently make letters unmailable, and Navy business is slowed when correspondence must be rewritten. A good dictionary is the accepted authority on spelling. Every yeoman should keep a dictionary handy and should refer to it whenever any doubt arises with respect to

spelling. Some of the most commonly misspelled words and most common Naval terms have been listed. You will be expected to learn these words and to use them correctly in the practical work in correspondence."[2]

Navy Correspondence.--"Correspondence, as defined in the Navy Regulations, embraces letters, messages, reports, and similar matter.

"It may then be presumed that Navy correspondence embraces the field of written law governing the Navy and its operation, the written record of its operation and all written communications made in relation to the Navy or its operation. From usage in the Navy, however, we find that the term 'correspondence' is applied to communications by mail and the term 'communications' applied to messages.

"Because the yeoman is responsible for the correct forms and neat appearance of the correspondence which he prepares and for the local distribution and filing of official papers, this book on Navy Correspondence has been prepared especially for the training of yeomen in the Navy methods of preparing and handling correspondence."[3]

Navy Personnel.--"Much of the administrative work of the Navy involves making reports and keeping records. The yeoman is directly responsible for the form, neatness, and accuracy of the reports and records on which he works. This syllabus on Navy reports, records, and forms has been prepared especially to assist the yeoman trainee in learning the Navy methods of preparing and handling its records and reports. The records and reports with which a yeoman is most likely to come into contact will be presented and explained. Some of the forms used are self-explanatory. Others have detailed instructions. The important sources of information and procedure the yeoman will need to use in making reports and keeping records will be introduced and woven intimately into the fabric of the course."[4]

Navy Personnel included instruction in Administration, Enlistments,

Reenlistments, Extension of Enlistments, Service Records, Discipline,

Changes of Status, Reports of Enlisted men; Advancement in Rating;

Transfers, Quarters, Subsistence; Separations from the Service, etc.

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[2] Bureau of Naval Personnel, Navy Correspondence Manual, p.4.

[3] Bureau of Naval Personnel, Navy Correspondence Manual, p.3.

[4] Bureau of Naval Personnel, Navy Personnel Manual, p.1.

Shorthand.--An intensive course in Shorthand was given to the trainees who had no experience in that subject. However, the majority of these students had some knowledge of Shorthand, and many were able to take dictation at a rate of 120 to 160 words per minute when they entered the school. Advanced dictation, transcription, and practice on Naval terms were given to these trainees. Perfection in the transcription of Shorthand notes was stressed in the advanced classes.

Typewriting.--The work was presented in a way to help beginning students and those who had had considerable experience in typing. Improvement in speed, accuracy, and efficiency of operation were stressed. Drills emphasizing Navy vocabulary, abbreviations, and instruction in Navy procedure were included in this course.

History.--History as it related to current war events and the place geography connected therewith was included in the third month.

The WAVES were classified upon arrival according to their skills in Shorthand and Typewriting. An effort was made to make Shorthand and Typewriting classes as homogeneous as possible.

The course of study for the first two months' training during this period of time was as follows: Shorthand, two hours daily; Typewriting, two hours daily; Correspondence, one hour daily; Personnel, one hour daily; English and Spelling, one hour daily. The third month's training included one hour daily in each of the following subjects: Correspondence, Correspondence Typing, Personnel, Personnel Typing, Shorthand, and Current War History. An effort was made to provide the student with situations comparable to those which might be met later in actual Naval experience. In Correspondence Typing, unarranged letters from Shorthand notes were transcribed, conforming to requirements learned

during the preceding weeks of study. In Personnel Typing, a fictitious character, "John Lee Brown," was enlisted and taken through the experiences of an enlisted man. The student was required to complete all necessary forms involved in these experiences. Classes met Monday, Tuesday, Wednesday, Thursday, and Friday, from 8 to 4, with a staggered lunch hour. The Physical Education period was from 4 to 5:30 daily. A formal examination, covering the week's work, was given to all trainees each Saturday morning in the College Auditorium, under the supervision of the faculty. Failure to meet the passing mark requirement for two weeks in succession resulted in the reporting of the student as unsatisfactory for yeoman. The policy in regard to trainees so reported was to order them dropped from yeoman training and transfer them for assignment to general unspecialized duties.

In July, 1943, the faculty and the college council voted to grant college credit for work done by the WAVES, up to maximum of ten hours. Students were graded for credit purposes according to the courses in secretarial administration.

Need for the Study

The classification outlined grouped students on the basis of similarity in Typewriting and Shorthand, but did not take into account the differences in education, experience, or classification test grades. These scores were not taken into consideration because general classification tests were not developed during approximately the first year. Clerical aptitude tests were developed later in the program. The only convenient information available during the early period was the approximate skill level of the student.

Since many of the students had from one to ten or fifteen years of experience in business, these questions arose: Should persons who have had years of experience, with a high classification test grade, be put in classes with persons having no experience, or very little experience, but who have the same high classification test grade, and be required to stay for the same length of time? Could the student with broader experience learn more rapidly or reach a higher degree of skill in less time? Would the efficiency of training be further increased if experience and classification test grades were considered in the original grouping?

It was also felt that incidental benefits might accrue from such a study through a carry-over into civilian teaching of some of the more desirable techniques developed in the military programs.

Purpose of the Study

The study involves the gathering of data on 400 WAVES, trainees in the United States Naval Training School for Women (Yeoman) at Stillwater, Oklahoma.

The study seeks to discover and to determine the following:

1. The validity of experience as a factor in the classification of WAVES in Correspondence and Personnel.

2. The correlation of age and grades made in Correspondence and Personnel.

3. The correlation of education and grades made in Correspondence and Personnel.

4. The correlation of experience and grades made in Correspondence and Personnel.

5. The correlation of the General Classification Test (GCT) and the combined grades made in Correspondence and Personnel.

Method of Study

The statistical method of research was employed.

> "The statistical method may be considered as a way of
> manipulating data rather than as a technique for
> securing new information."[5]

A data card was prepared for each of the 400 cases used for the
study. Data were collected for these cards from the Enlisted Personnel
Qualification Cards which had been filled out for every recruit and
filed in the Chief Yeoman's office during the time the seaman was in
training.

The Qualification Cards consisted of the following information:
Service number, name, rate at enlistment, date of enlistment, test
scores, assignment made, location assigned, date transferred, home
address, birthplace, father's birthplace, mother's birthplace, previous
military or sea duty, education, specialized training, main occupation,
employer, kind of business, department, date left, years service,
weekly wage, trade test indicated, trade test rating, duties, skills,
machines, language fluency, leisure time activities, talent for public
entertainment, physical qualifications, special tests, naval station,
date, finger print, etc. These cards are used to select men for all
types of naval training; to select strikers for rates on board ship;
in considering enlisted men for officer candidacy; in identifying
such specialists as linguists, photographers, etc.; in handling of
disciplinary problems.[6]

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[5] Carter V. Good, A. S. Barr and Douglas E. Scates, The Methodology
of Educational Research, p. 228.

[6] United States Naval Training School (Yeoman) Personnel Projects
Book, pp. 87-88.

The grades were obtained from the individual permanent records which were kept on file in the recorder's office in connection with the Chief Yeoman's office.

A weekly grade was posted on the individual record of each trainee for Personnel, Correspondence, History, Naval Organization, and Spelling.

The grades taken from this card were the bases for promotion and college credit.

The school was in operation for a period of two and one-half years (30 months). The data were gathered at approximately the mid-point. Every effort was made to obtain a sample which would be representative of the entire training school.

DATA CARD USED

Limitations

This study is limited to the grades made by the trainees in the United States Naval Training School (Yeoman) for Women in Correspondence and Personnel, and from information concerning the age, education, work experience, and the general classification test grade of each trainee. The other studies pursued were not used.

Definitions

Coefficient of Correlation: "A measure of the amount of variation in a dependent variable which is associated with variation in one or more independent variables expressed as the square root of a percentage. Complete or perfect correlation is designated as 1.00."[7]

The coefficient of total determination is expressed as a percentage. It is a measure of the amount of variation in a dependent variable, this dependent variable being associated with one or more independent variables. Determination is the square of correlation.

The relationship between determination and correlation may be illustrated as follows:[8]

Coefficient of Correlation $r = \sqrt{\%}$	Coefficient of Determination $r^2 = \%$
1.00	1.00
.90	.81
.80	.64
.70	.49
.60	.36
.50	.25
.40	.16
.30	.09
.20	.04
.10	.01

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[7]Morris Miles Blair, Elementary Statistics, p. 637.

[8]Ibid., p. 265.

The standard error of coefficient of correlation, σ_r, shows the dependability of the coefficient of correlation.

The standard error of estimate, S_y, "measures the scatter of the Y-data around the regression line. The S_y is always measured on the Y-axis vertically from the regression line. One S_y + and - from the regression line includes approximately .6827 of the items of data, or about two-thirds of the data."[9]

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[9]Blair, Op. Cit., 11, 248.

CHAPTER II

PREVIOUS INVESTIGATIONS

As far as can be determined, no study of this kind (correlation) has been made, due, possibly, to the recency of the program.

During the school year of 1943-1944, an article explaining the educational program of the United States Naval Training School for Storekeepers at Indiana University, Bloomington, Indiana, appeared each month in The Balance Sheet. These articles were prepared by different instructors in this training school.

John C. Crouse, in his article on "Making Business Education More Vocational," gave an adequate vocational guidance program as the first step in any vocational training program.

> "In making business training truly job preparatory, it is important to be able to measure the progress of trainees in their work in terms of the level of proficiency that will be required of them on the job."[1]

In the seventh article, J. H. Morrow gave a summary of an analysis made of the background of the first class of WAVES at the University of Indiana. This analysis included the age and status, education, occupational experience, and general intelligence of these women. A study was also made of the top-ranking trainees in this class.

In the conclusion of this study, Mr. Morrow stated:

> "It is to be noted that the top-ranking 196 trainees rated higher in all phases studied. This group was one and one-half years older than the average of the entire group.

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[1] John C. Crouse, "Making Business Education More Vocational," The Balance Sheet (November, 1943) 110.

Their educational background was significantly superior. The average number of months employed was greater in each of the three positions studied. In general intelligence, they compared favorably with the top-ranking college freshman."[2]

No correlation was computed in any of these studies.

[2]J. H. Morrow, "Marching Women," The Balance Sheet (March, 1944) 296.

CHAPTER III

ANALYSIS AND INTERPRETATION OF DATA

The purpose of this study, as previously stated, is to seek to discover and to determine the following:

1. The validity of experience as a factor in the classification of WAVES in Correspondence and Personnel.

2. The correlation of age and grades made in Correspondence and Personnel.

3. The correlation of education and grades made in Correspondence and Personnel.

4. The correlation of experience and grades made in Correspondence and Personnel.

5. The correlation of the General Classification Test (GCT) and the combined grades made in Correspondence and Personnel.

The technique employed in determining these relations was that of simple coefficient of correlation. "This is the measure obtained by what is called the product-moment method and abbreviated by r."[1]

"When the changes in the variation of two or more variables move in the same direction, the correlation is said to be positive. When the changes in variation move in opposite directions, the correlation is said to be negative. Correlation may range from perfect positive correlation, +1, through zero (0), or no correlation, to -1, or perfect negative correlation."[2]

The Pearsonian Table of correlation was used in this study. This table enables one to compute two standard deviations simultaneously, one on the X axis and one on the Y axis.

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[1]Charles W. Odell, Statistical Method in Education, p. 151.

[2]Blair, Op. cit., 12, 266.

The totals for the bottom lines of the tables dx, fdx, fdx^2, EdyFx, fdxdy give the X standard deviation. The totals on the right, dy, fdy, fdy^2, EdFy, fdxdy, supply the Y standard deviation.

At the bottom of each table, the sums for Edxf, Edyf, Edx^{2}f, Edxdyf are given. The sums for Edxf, Edyf, Edxdyf are shown in the totals of both the X and Y axes, checking the correctness of these totals. For instance, Edxdyf on the X-axis should be the same as Edxdyf on the Y-axis, etc.

The means of the sums are found by dividing Edxf by the total number of the sample and by dividing Edyf by the same number.

To compute the corrections (corrections subtracted), the product of the Edxf and the mean of that sum is obtained. The same computation is used to arrive at the correction for Edyf; and for Edxdyf, the sum of Edyf times the mean of Edxf.

Under each table, the following computations are given:

$r = \dfrac{\text{Exy}}{\text{Ex}^2\text{Ey}^2}$, the figures opposite "correction values" being used.

$\overline{X} = A + \dfrac{\text{Efd}}{N} i$ (Arithmetic Mean of X)

$\overline{Y} = A + \dfrac{\text{Efd}}{N} i$ (Arithmetic Mean of Y)

$\sigma_y = i\sqrt{\dfrac{\text{Ey}^2}{N}}$ (Standard deviation of Y)

$r^2 = r \times r$ (coefficient of determination)

$S_y = \sigma_y\sqrt{1-r^2}$ (Standard error of estimate)

$\sigma_r = \dfrac{1-r^2}{\sqrt{N}}$ (standard error of coefficient of correlation)

Correlation Between Age and Correspondence Grades

The age range of this group of trainees was from 20 to 36, with an average of 22+. From Table I, page 17, it can be seen that 259, or 64.75%, of the 400 were from 20 to 22 years of age. Of this number, 4 had

averages of from 60 to 64 in Correspondence. The lowest, an average
of 60, was made by a high school graduate with 2 years of college and
2 years of work experience. This trainee was 20 years of age. There
were two with an average of 62 in this subject, both 20 years of age,
one a high school graduate and one with only 3 years. Both had 6
months of work experience. The one trainee receiving the average
grade of 64 in Correspondence was 21 years of age and a high school
graduate. There were 7, or 1.75% of the entire sample, with averages
of 95 to 99; and 73, or 18.25%, with average grades from 80 to 84.
One hundred fifteen out of 259 in this class (20-22), or 28.75% of the
entire sample, received an average grade of 85 to 99, which was above
the arithmetic mean (84.7).

There were 19.5% from 23 to 25; 10% from 26 to 28; 3.5% from 29 to
31; 1.75% from 32 to 34; and .5% from 35 to 37 years of age.

The table shows the arithmetic mean (average) of age to be 23.28;
of grades in Correspondence, 84.7.

The coefficient of correlation between the age of the 400 WAVES
and the Correspondence grades made by these trainees and the standard
error of this coefficient of correlation is also shown on page 17.
The coefficient of correlation, r, was found to be .164, with a σ_r
(standard error of coefficient of correlation) of ± .049. The corre-
lation was .164 plus or minus .049, or between .115 and .213.

The coefficient of determination, r^2, was .027, or 2.7%--that is,
2.7% of the grades in Correspondence could be accounted for by the age
of the student or trainee.

Graph I-a, page 18, shows the error or deviation between the actual
grades and the estimated grades in most cases. The standard error of

X = Age TABLE I — CORRELATION BETWEEN AGE AND CORRESPONDENCE GRADES

Y = CORRESPONDENCE GRADES

Y	X						Fy	dy	fdy	fdy²	EdxFy	fdxdy
	20-22	23-25	26-28	29-31	32-34	35-37						
60-64	4						4	-4	-16	64	-4	16
65-69	3	2	2				7	-3	-21	63	-1	3
70-74	24	3	1	1		1	30	-2	-60	120	-17	34
75-79	40	6	5	2		1	54	-1	-54	54	-27	27
80-84	73	12	10	1			96	0			-61	
85-89	64	31	9	2	3		109	+1	109	109	-42	-42
90-94	44	20	8	7	3		82	+2	164	328	-13	-26
95-99	7	4	5	1	1		18	+3	54	162	+3	+9
Fx	259	78	40	14	7	2	400		+176	900	-162	21
dx	-1	0	+1	+2	+3	+4						
fdx	-259		+40	+28	+21	+8	-162					
fdx²	259		40	56	63	32	450					
EdyFx	+60	+65	+27	+15	+12	-3	+176					
fdxdy	-60		+27	+30	+36	-12	21					

	Edxf	Edyf	Edx²f	Edy²f	Edxdyf
Sums	-162	+176	+450	+900	21
Means of Sums		-405	.44		
Corrections (subtracted)			65.61	77.44	-71.28
Correction Values			384.39	822.56	92.28

$$r = \frac{Exy}{\sqrt{Ex^2Ey^2}} = \frac{92.28}{\sqrt{384.39 \times 822.56}} = \frac{92.28}{562.30} = .164$$

$$\bar{X} = A + \frac{Efd}{N}\,i \quad 24.5 + \frac{-162}{400} \times 3 = 24.5 - 1.22 = 23.28$$

$$\bar{Y} = A + \frac{Efd}{N}\,i = 82.5 + \frac{176}{400} \times 5 = 82.5 + 2.2 = 84.7$$

$$\sigma_y = i\sqrt{\frac{Ey^2}{N}} = 5\sqrt{\frac{822.56}{400}} = 5 \times 1.434 = 7.17$$

$$\frac{y\ class}{x\ class} = \frac{5}{3} = 1.666$$

byx in class intervals

$$byx = \frac{Exy}{Ex^2} = \frac{92.28}{384.39} = .24$$

$$bxy = .24 \times 1.666 = .4$$
in terms of original data

$$a = \bar{Y} - b\bar{X}$$
$$= 84.7 - .4 \times 23.28$$
$$84.7 - 9.31 = 75.39$$

$$Y = a + bX = 75.39 + .4X$$

$$r^2 = .164 \times .164 = .027$$

$$S_y = \sigma_y\sqrt{1 - r^2} = 7.17\sqrt{1 - .027}$$
$$7.17\sqrt{.973} = 7.07$$

$$\sigma_r = \frac{1 - r^2}{\sqrt{N}} = \frac{1 - .027}{\sqrt{400}} = \frac{.973}{20} = \pm .049$$

GRAPH I-a

18

I-a Regression-Line Graph, Showing The Standard Error
of Estimating Correspondence Grades From Age

$X = 20, Y = 83.39$
$X = 36, Y = 89.79$
$Sy = \pm 7.07$

GRAPH I-b   X = AGE   19
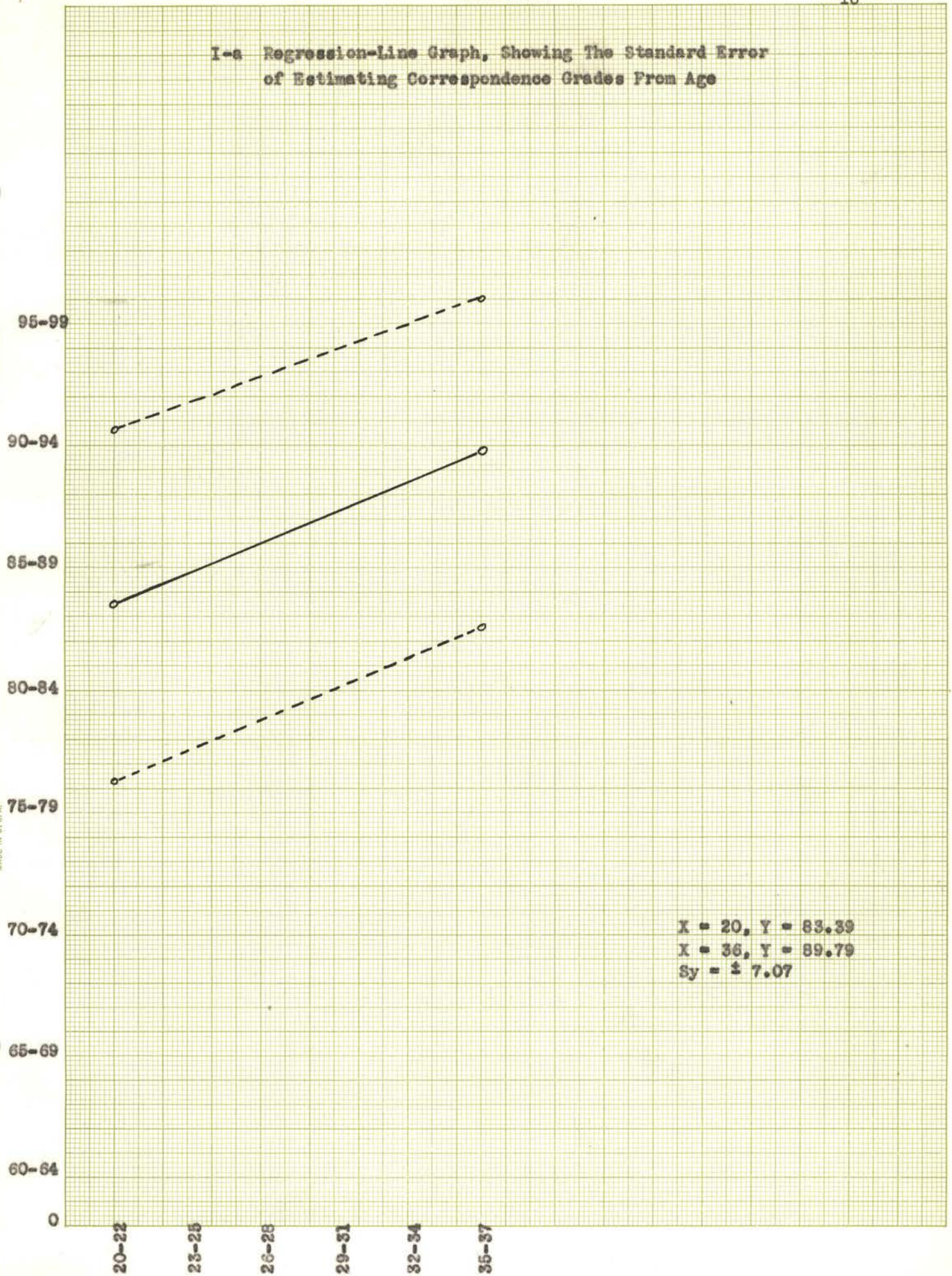
I-b Line Graph, Showing The Relationship Between Age
and Correspondence Grades
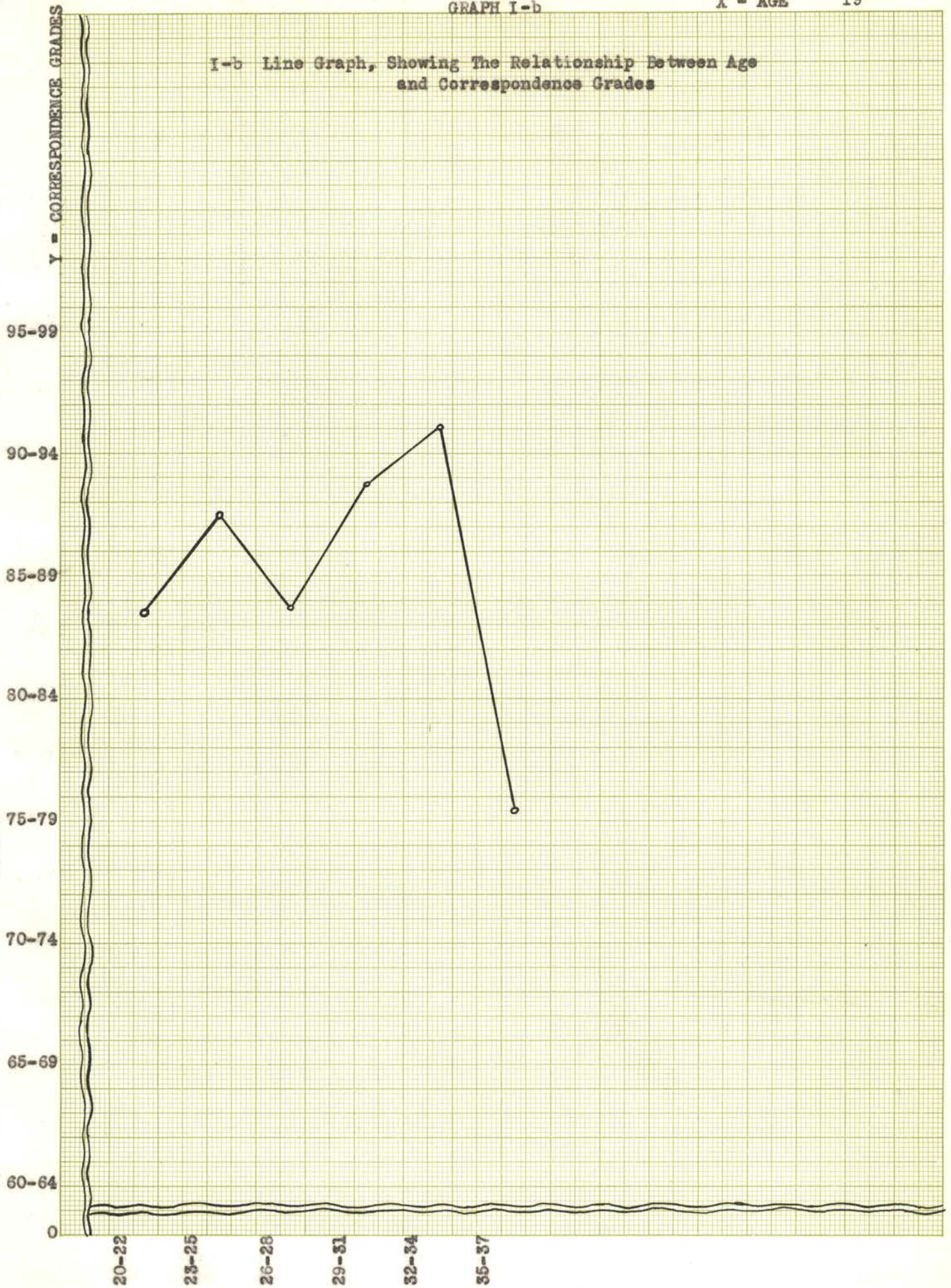
estimate, S_y, is expressed in terms of the units of the original data
of the dependent variable, Y (grades). Using the formula Y = a + bX,
let X = 20, (Y = 75.39 + .4 x 20) Y = 83.39. Letting X = 36,
(Y = 75.39 + .4 x 36) Y = 89.79. The accuracy of this estimate would
be that a trainee 20 years of age would have 68 chances out of 100 of
making a grade of 83.39 ± 7.07, or 76.32 to 90.46.

A line graph is shown on page 19 (Graph I-b). This graph shows
the grades made in Correspondence by the 400 WAVES used in this study,
and the corresponding ages of these trainees. Age is shown on the
X-axis; Correspondence, on the Y-axis.

Correlation Between Age and Personnel Grades

The relationship between age and grades made in Personnel is
shown in Table II, page 21. Three out of the class of 20-22 years
of age had averages of from 60 to 64 in Personnel; all were 21 years
of age. Two of these trainees had received averages of 62 in Corre-
spondence. One averaged 60; the other, 61 in Personnel. The 1 who
had an average of 60 in Personnel averaged 72 in Correspondence, was
a high school graduate, and had no work experience. Out of 14 with
averages of 95 to 99, 8 were out of this class (20-22). There were
66, or 16.5% of the entire sample, with average grades of 80 to 84.
Out of the 259, between the ages of 20-22, 99 had averages of 85-99.
The arithmetic mean of Personnel grades was 83.24.

The coefficient of correlation between age and Personnel grades
was .151, with a standard error of coefficient of correlation of ± .049.
The correlation was .151 ± .049, or between .102 and .200.

The coefficient of determination, which was .023, shows that 2.3%
of the grades in Personnel could be accounted for by the age of the

X = Age   TABLE II – CORRELATION BETWEEN AGE AND PERSONNEL GRADES

Y = PERSONNEL GRADES

Y	X						Fy	dy	fdy	fdy²	EdxFy	fdxdy
	20-22	23-25	26-28	29-31	32-34	35-37						
60-64	3						3	-4	-12	48	-3	12
65-69	13	3	1	1		1	19	-3	-57	171	-6	18
70-74	26	4	4	1		1	36	-2	-72	144	-16	32
75-79	54	11	4	0			69	-1	-69	69	-50	50
80-84	66	15	10	1	1		93	0			-51	
85-89	58	28	11	7	1		105	+1	+105	105	-30	-30
90-94	31	14	7	4	5		61	+2	+122	244	-1	-2
95-99	8	3	3				14	+3	+42	126	-5	-15
Fx	259	78	40	14	7	2	400		+59	907	-162	65
dx	-1	0	+1	+2	+3	+4						
fdx	-259		+40	28	21	8	-162					
fdx²	259		40	56	63	32	450					
EdyFx	-13	+37	+19	+10	+11	-5	+59					
fdxdy	13		19	20	33	-20	65					

	Edxf	Edyf	Edx²f	Edy²f	Edxdyf
Sums	-162	+59	450	907	65
Means of Sums		-.405	.1475		
Corrections (subtracted)			65.61	8.7	-23.895
Correction Values			384.39	898.3	88.895

$$r = \frac{Exy}{\sqrt{Ex^2Ey^2}} = \frac{88.895}{\sqrt{384.39 \times 898.3}} = \frac{88.895}{587.62} = .151$$

$$\overline{X} = A + \frac{Efd}{N}i = 24.5 + \frac{-162}{400} \times 3 = 23.28$$

$$\overline{Y} = A + \frac{Efd}{N}i = 82.5 + \frac{59}{400} \times 5 = 83.24$$

$$\sigma_y = i\sqrt{\frac{Ey^2}{N}} = 5\sqrt{\frac{898.3}{400}} = 5 \times 1.4985 = 7.49$$

$$\frac{y\ class}{x\ class} = \frac{5}{3} = 1.666$$

bxy in class intervals

$$byx = \frac{Exy}{Ex^2} = \frac{88.895}{384.39} = .2313$$

$$bxy = .2313 \times 1.666 = .385$$
in terms of original data

$$a = \overline{Y} - b\overline{X} = 83.24 - .385 \times 23.28$$
$$= 83.24 - 8.96 = 74.28$$

$$Y = a + bX = 74.28 + 385X$$

$$r^2 = .151 \times .151 = .023$$

$$S_y = \sigma_y\sqrt{1-r^2} = 7.49\sqrt{1-.023}$$
$$= 7.49\sqrt{.977} = 7.34$$

$$\sigma_r = \frac{1-r^2}{\sqrt{N}} = \frac{1-.023}{\sqrt{400}} = \frac{.977}{20} = .049$$

GRAPH II-a   22

II-a.   Regression-Line Graph, Showing The Standard Error
of Estimating Personnel Grades From Age
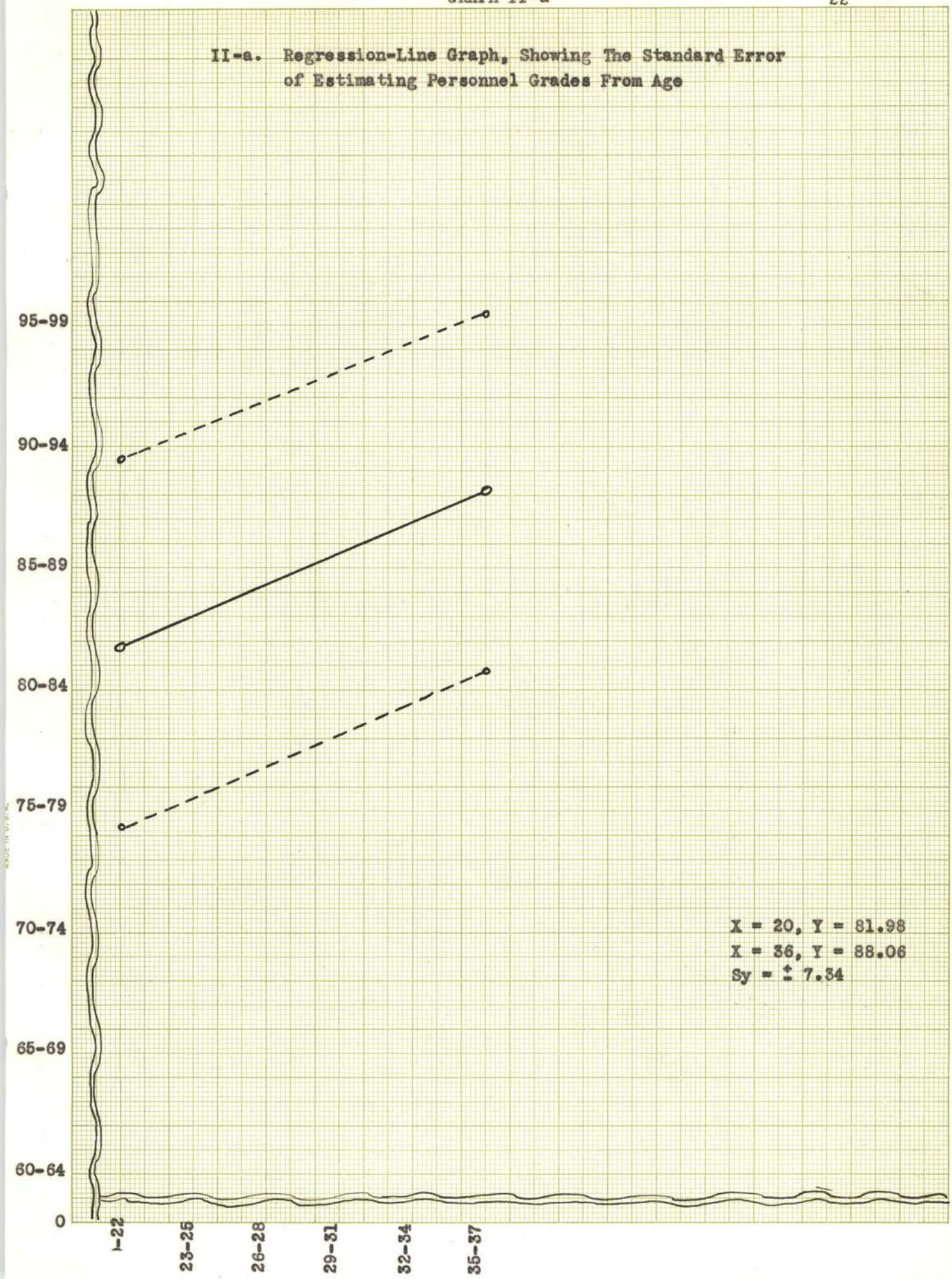
X = 20, Y = 81.98
X = 36, Y = 88.06
Sy = ± 7.34

GRAPH II-b   X = Age   23

II-b   Line Graph, Showing The Relationship Between Age
and Personnel Grades

Y = Personnel Grades

95-99

90-94

85-89

80-84

75-79

70-74

65-69

60-64

0

20-22   23-25   26-28   29-31   32-34   35-37

trainee. The preceding table, page 17, shows that 2.7% of the grades in Correspondence could be accounted for by age.

Tables I and II show the same standard error of coefficient of correlation, .049. The correlation between age and Correspondence was .013 higher than the correlation between age and Personnel.

To show the error or deviation between the actual grades made in Personnel and the estimated grades made in this subject in most cases, Graph II-a is given on page 22. The standard error of estimate is 7.34. On this graph, let $X = 20$, $(Y = 74.28 + .385 \times 20)$ $Y = 81.98$. Letting $X = 36$, $(Y = 74.28 + .385 \times 36)$ $Y = 88.06$. The accuracy of this estimate would be that a trainee 20 years of age would have 68 chances out of 100 of making a grade of 81.98 ± 7.34, or 74.64 to 89.32.

On page 23, Graph II-b is shown, giving the grades made in Personnel by the 400 trainees.

Correlation Between Education and Correspondence Grades

In organizing Table III on page 25, the columns under education, the X-axis, were captioned .1-1.0, 1.1-2.0, etc. These numbers correspond to 3 years of high school; 4 years of high school; 1, 2, 3, and 4 years of college, respectively.

Twenty-seven, or 6.75% of the sample of 400, had attended high school only 3 years; and 289, or 72.25%, were high school graduates or the equivalent.

Seventy-nine, or 84 trainees had attended college. The distribution is shown in the table.

In comparing the averages (arithmetic mean) of these groups, it is interesting to note that the average grade in Correspondence for the 27 with 3 years of high school was 79.96, while that of the high

X = Education

TABLE III - CORRELATION BETWEEN EDUCATION AND CORRESPONDENCE GRADES

Y = CORRESPONDENCE GRADES

Y	X						Fy	dy	fdy	fdy²	EdxFy	fdxdy
	.1-1.0	1.1-2.0	2.2-3.0	3.3-4.0	4.1-5.0	5.1-6.0						
60-64	1	2		1			4	-5	-20	100	+1	-5
65-69	2	5					7	-4	-28	112	-2	+8
70-74	5	23	2				30	-3	-90	270	-3	+9
75-79	5	42	2	3		2	54	-2	-108	216	+11	-22
80-84	4	74	12	3	2	1	96	-1	-96	96	24	-24
85-89	6	81	13	6	1	2	109	0			30	
90-94	4	51	15	9		3	82	+1	+82	82	41	+41
95-99		11	1	3		3	18	+2	+36	72	19	+38
Fx	27	289	45	25	3	11	400		-224	948	121	45
dx	-1	0	+1	+2	+3	+4						
fdx	-27		+45	50	9	44	121					
fdx²	27		45	100	27	176	375					
EdyFx	-38	-184	-5	+1	-2	4	-224					
fdxdy	+38		-5	+2	-6	+16	45					

	Edxf	Edyf	Edx²f	Edy²f	Edxdyf
Sums	121	-224	375	948	45
Means of Sums	.3025	-.56			
Corrections (subtracted)			36.60	125.44	-67.76
Correction Values			338.40	822.56	112.76

$$r = \frac{Exy}{\sqrt{Ex^2Ey^2}} = \frac{112.76}{\sqrt{338.40 \times 822.56}} = \frac{112.76}{527.59} = .214$$

$$\bar{X} = A + \frac{Efd}{N}\,i = 1.5 + \frac{121}{400} \times 1 = 1.5 + .3025 = 1.80$$

$$\bar{Y} = A + \frac{Efd}{N}\,i = 87.5 + \frac{-224}{400} \times 5 = 87.5 - 2.80 = 84.7$$

$$\sigma_y = i\sqrt{\frac{Ey^2}{N}} = 5\sqrt{\frac{822.56}{400}} = 5 \times 1.434 = 7.17$$

$$\frac{y\ class}{x\ class} = \frac{5}{1} = 5$$

bxy in class intervals

$$byx = \frac{Exy}{Ex^2} = \frac{112.76}{338.40} = .333$$

$$bxy = .333 \times 5 = 1.67$$
in terms of original data

$$a = \bar{Y} - b\bar{X} = 84.7 - 1.67 \times 1.80 = 84.7 - 3.0 = 81.7$$

$$Y = a + bX = 81.7 + 1.67X$$

$$r^2 = .214 \times 214 = .046$$

$$S_y = \sigma_y\sqrt{1 - r^2} = 7.17\sqrt{1 - .046} = 7.17\sqrt{.954} = 7.0$$

$$\sigma_r = \frac{1 - r^2}{\sqrt{N}} = \frac{1 - .046}{\sqrt{400}} = \frac{.954}{20} = \pm.047$$

GRAPH III-a 26

III-a Regression-Line Graph, Showing The Standard Error
of Estimating Correspondence Grades From Education

95-99

90-94

85-89

80-84

75-79

70-74

X = 1, Y = 83.37
X = 6, Y = 91.72
Sy = ± 7.0

65-69

60-64

0

1   2   3   4   5   6

GRAPH III-b   X = Education   27
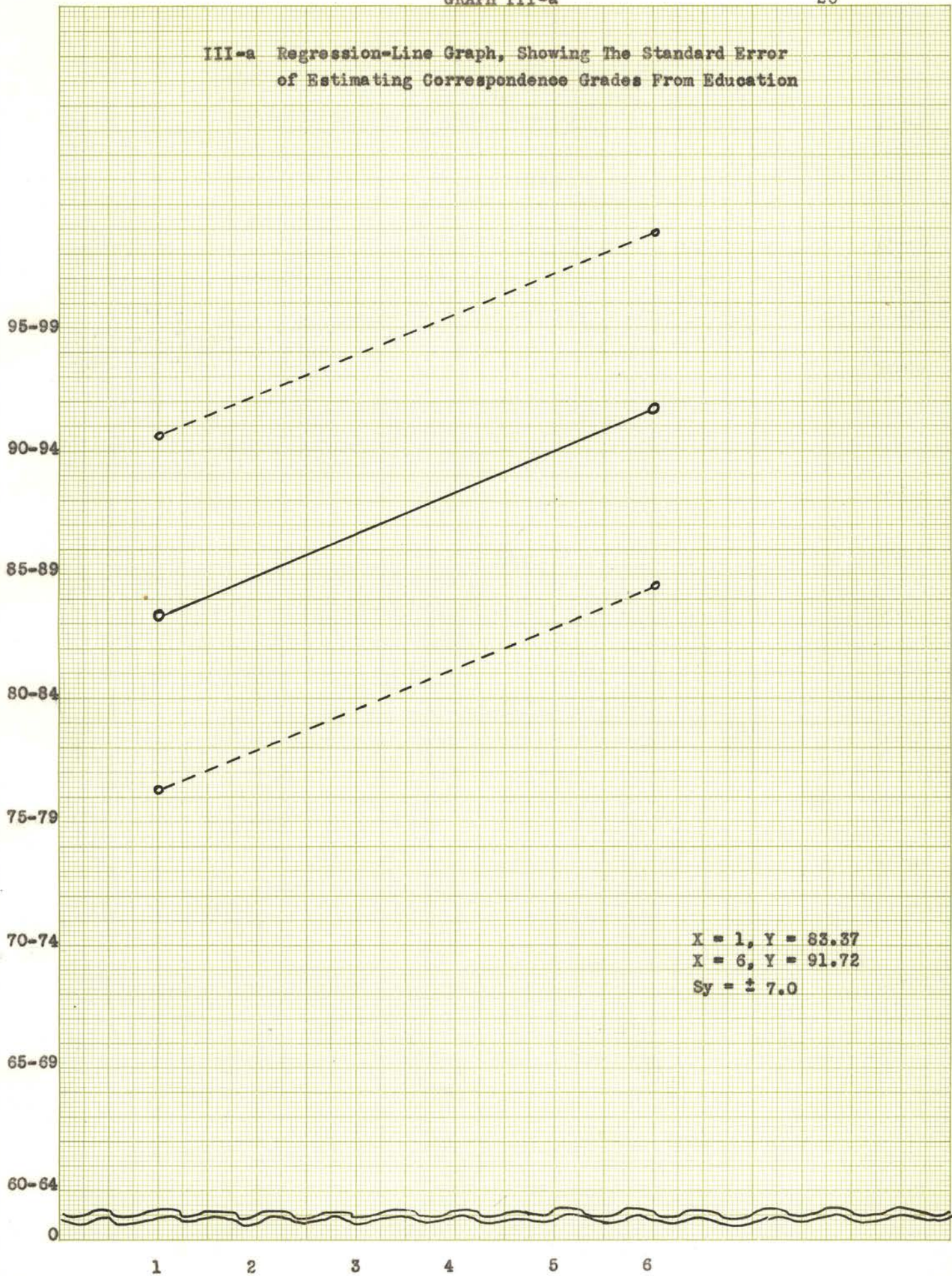
III-b Line Graph, Showing The Relationship Between Education
and Correspondence Grades

school graduates or the equivalent was 83.82. The trainees with 1
year college had an average of 86.44, while the college graduates or
the equivalent averaged 86.82. The average for the entire group
was 84.7.

A coefficient of correlation of .214, with a standard error of
the coefficient of correlation of .047, was found. The correlation
was .214 ± .047, or between .167 and .261.

From the coefficient of determination, it was found that 4.6%
of the grades in Correspondence could be accounted for by the educa-
tion experience of the trainees.

The error or deviation between the actual grades and the esti-
mated grades in most cases is shown on Graph III-a, page 26. The
standard error of estimate measures the scatter of the grades, or
Y-data, around the regression line. On this graph, X = 1, (Y = 81.7
+ 1.67 x 1) Y 83.37. X = 6, (Y = 81.7 + 1.67 x 6) Y = 91.72. In
this case, a trainee who had attended high school 3 years would have
68 chances out of 100 of making a grade of 83.37 ± 7.0, from 76.37
to 90.37. The standard error of estimate was 7.0.

The grades made in Correspondence by the trainees, according to
their education, is given on page 27, Graph III-b.

Correlation Between Education and Personnel Grades

Table IV, on page 29, has the same captions as Table III, on
page 26.

The coefficient of correlation found between education and Person-
nel grades was .176, with a standard error of coefficient correlation
of ± .049. The correlation in this instance was .176 ± .049, or between
.127 and .225.

X = Education   TABLE IV – CORRELATION BETWEEN EDUCATION AND PERSONNEL GRADES

Y = PERSONNEL GRADES

Y		X						Fy	dy	fdy	fdy^2	EdxFy	fdxdy
	.1-1.0	1.1-2.0	2.2-3.0	3.3-4.0	4.1-5.0	5.1-6.0							
60-64	1	2						3	-4	-12	48	-1	4
65-69	1	15	1	2				19	-3	-57	171	+4	-12
70-74	4	29	2			1		36	-2	-72	144	+2	-4
75-79	7	53	5	3		1		69	-1	-69	69	+8	-8
80-84	6	70	13	2	1	1		93	0			+18	
85-89	1	73	15	12	2	3		106	+1	+106	106	+56	+56
90-94	7	37	9	5		3		61	+2	+122	244	+24	+48
95-99	0	10	0	1		2		13	+3	+39	117	+10	+30
Fx	27	289	45	25	3	11	400			+57	899	121	114
dx	-1	0	+1	+2	+3	+4							
fdx	-27		+45	+50	+9	+44	121						
fdx^2	27		45	100	27	176	375						
EdyFx	-7	+13	+21	+16	+2	+12	+ 57						
fdxdy	7		21	32	6	48	114						

	Edxf	Edyf	Edx^{2}f	Edy^{2}f	Edxdyf
Sums	121	57	375	899	114
Means of Sums		.3025	.1425		
Corrections (subtracted)			36.60	8.12	-17.24
Correction Values			338.40	890.88	96.76

$r = \dfrac{Exy}{\sqrt{Ex^2 Ey^2}} = \dfrac{96.76}{\sqrt{338.40 \times 890.88}} = \dfrac{96.76}{549.07} = .176$

$\overline{X} = A + \dfrac{Efd}{N} i = 1.5 + \dfrac{121}{400} \times 1 = 1.80$

$\overline{Y} = A + \dfrac{Efd}{N} i = 82.5 + \dfrac{57}{400} \times 5 = 83.21$

$\sigma_y = 5 \sqrt{\dfrac{Ey^2}{N}} = 5 \sqrt{\dfrac{890.88}{400}} = 7.46$

$\dfrac{y\ class}{x\ class} = \dfrac{5}{1} = 5$

bxy in class intervals

$byx = \dfrac{Exy}{Ex^2} = \dfrac{96.76}{338.40} = .2859$

$bxy = .2859 \times 5 = 1.4295 = 1.430$
in terms of original data

$a = \overline{Y} - b\overline{X} = 83.21 - 1.430 \times 1.80$
$= 83.21 - 2.57 = 80.64$

$Y = a + bX = 80.64 + 1.43X$

$r^2 = .176 \times .176 = .031$

$S_y = \sigma_y \sqrt{1 - r^2} = 7.46 \sqrt{1 - .031}$
$= 7.46 \sqrt{.969} = 7.46 \times .9844 = 7.35$

$\sigma_r = \dfrac{1 - r^2}{\sqrt{N}} = \dfrac{1 - .031}{\sqrt{400}} = \dfrac{.969}{20} = .049$

GRAPH I V-a   30

IV-a   Regression-Line Graph, Showing The Standard Error
of Estimating Personnel Grades From Education
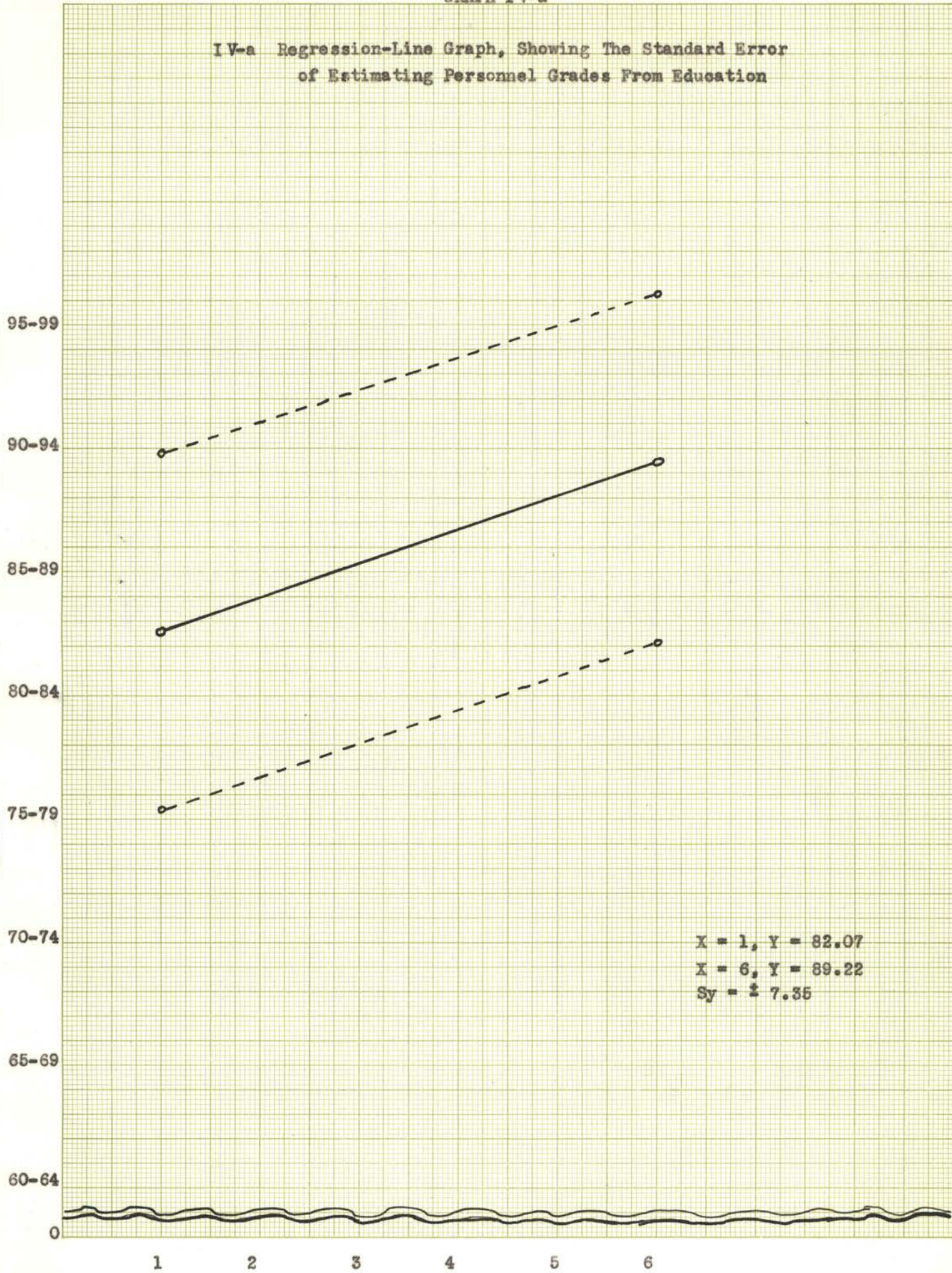
X = 1, Y = 82.07
X = 6, Y = 89.22
Sy = ± 7.35

GRAPH I V-b   X = Education

I V-b Line Graph, Showing The Relationship Between Education
and Personnel Grades

Y = Personnel Grades

95-99

90-94

85-89

80-84

75-79

70-74

65-69

60-64

0

1   2   3   4   5   6
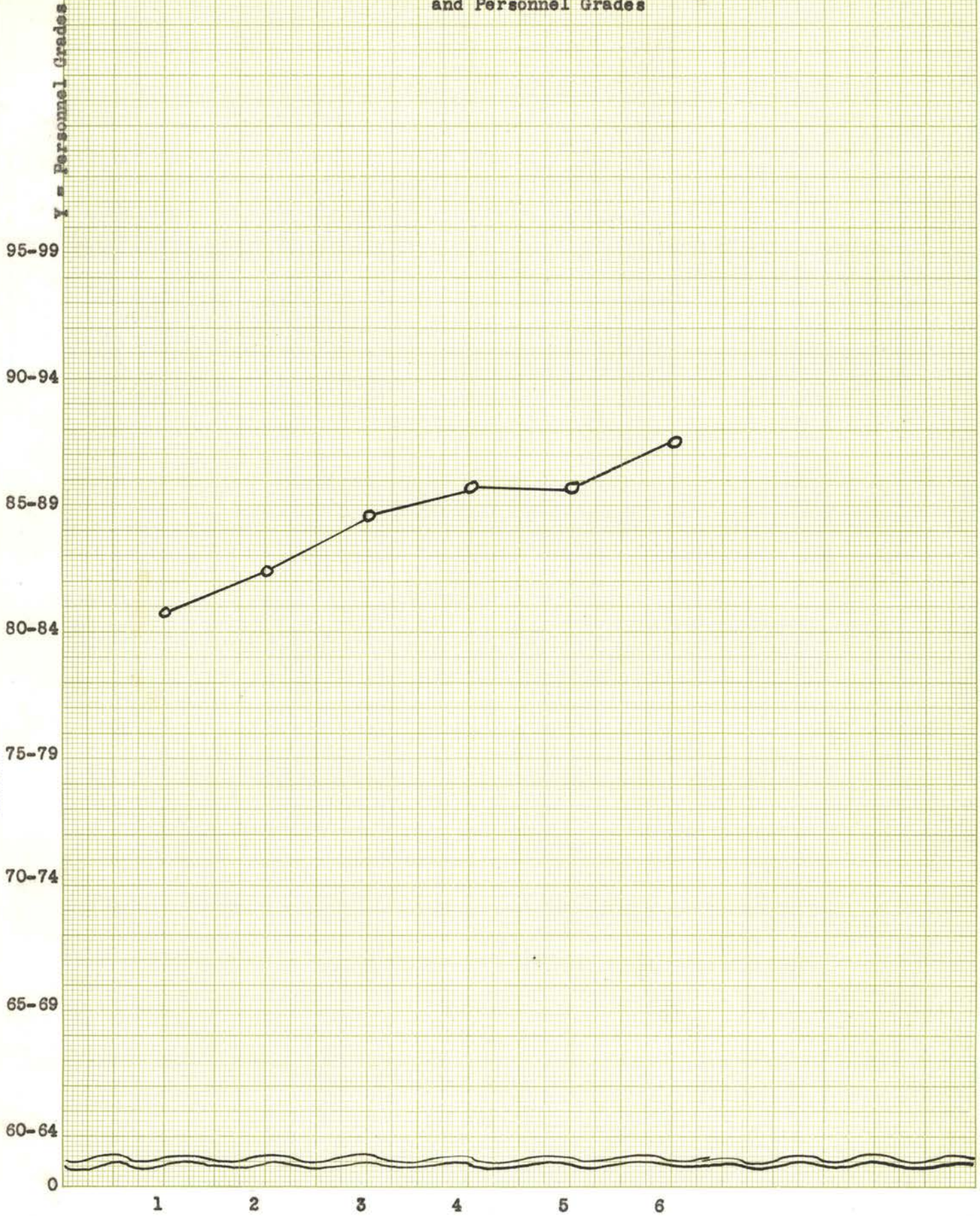
The arithmetic mean (average) of education was 1.8; of Personnel grades 83.21. The trainees with 3 years of high school education had an average of 80.7; high school graduates or the equivalent, 82.23; 1 year college, 84.33; and college graduates or the equivalent, 87.45.

The coefficient of determination was .031 or 3.1%--that is, 3.1% of the grades in Personnel could be accounted for by the number of years of education the trainee had.

On Graph IV-a, page 30, the error or deviation between the actual grades and the estimated grades in most cases is shown. The standard error of estimate was ± 7.35. This is shown on either side of the regression line on the above-mentioned graph. In 68 chances out of 100, the trainee with 3 years of high school education would make a grade of 82.07 ± 7.35, or from 74.72 to 89.42. The one who had graduated from college, or had the equivalent of graduation, would make a grade of 89.22 ± 7.35 or 81.87 to 96.57.

Graph IV-b, page 31, shows the grades made in Personnel, according to education.

Correlation Between Experience and Correspondence Grades

There were 66 out of the 400 trainees who were classified as having no experience.

The positions held by 334 of these trainees before they entered the service included: clerical work (general office work, file clerk, typist, stenographer, etc.), registrar, secretarial, research laboratory assistant, cosmetology, accounting, selling, teaching, telephone operator, waitress, teletype operator, ordnance plant, usherette, etc.

There were 86 of the above-mentioned 334, or 25.75% of this number, who had 1 year of work experience before receiving their yeoman training.

X = Experience (Work) TABLE V — CORRELATION BETWEEN EXPERIENCE AND CORRESPONDENCE GRADES

Y = CORRESPONDENCE GRADES

Y	.1-1.0	1.1-2.0	2.2-3.0	3.3-4.0	4.1-5.0	5.1-6.0	6.1-7.0	7.1-8.0	8.1-8.0	9.1-10.0	10.1-11.0	Fy	dy	fdy	fdy²	dyFy	fdxdy
60-64		2										2	-5	-10	50	0	0
65-69	2	1										4	-4	-16	64	-1	4
70-74	11	4	1	0	2	1					1	20	-3	60	180	+9	-27
75-79	14	17	1	1		2	1				1	37	-2	-74	148	+11	-22
80-84	21	25	11	10	4	2	1				2	76	-1	-76	76	+53	-53
85-89	16	40	15	7	6	3	3	3	2	1	2	98	0			116	
90-94	21	25	7	10	3	2	4	2	3	0	2	79	+1	+79	79	94	+94
95-99	1	7	2	2		3	1		1		1	18	+2	+36	72	38	+76
Fx	86	121	38	30	15	13	10	5	6	1	9	334			-121	669	+320	72
dx	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9						
fdx	-86		38	60	45	52	50	30	42	8	81	+320					
fdx²	86		38	120	135	208	250	180	294	64	729	2104					
dyFx	-67	-46	-9	+2	-7	-1	+3	+2	+5	0	-3	-121					
fdxdy	67		-9	4	-21	-4	15	12	35		-27	72					

	Σdxf	Σdyf	$\Sigma dx^2 f$	$\Sigma dy^2 f$	$\Sigma dxdyf$
Sums	+320	-121	2104	669	72
Means of Sums	.9581	.36228			
Corrections (subtracted)			306.59	43.84	-115.93
Correction Values			1797.41	625.16	187.93

$r = \dfrac{\Sigma xy}{\sqrt{\Sigma x^2 \Sigma y^2}} = \dfrac{187.93}{\sqrt{1797.41 \times 625.16}} = \dfrac{187.93}{1060} = .177$

$\bar{X} = A + \dfrac{\Sigma fd}{N} i = 1.5 + \dfrac{320}{334} \times 1 + 1.5 + .958 = 2.46$

$\bar{Y} = A + \dfrac{\Sigma fd}{N} i = 87.5 + \dfrac{-121}{334} \times 5 = 87.5 - 1.81 = 85.69$

$\sigma_y = i \sqrt{\dfrac{\Sigma y^2}{N}} = 5 \sqrt{\dfrac{625.16}{334}} = 5 \sqrt{1.8717} = 5 \times 1.368 = 6.84$

$\dfrac{y\ class}{x\ class} = \dfrac{5}{1} = 5$

bxy in class intervals

$byx = \dfrac{\Sigma xy}{\Sigma x^2} = \dfrac{187.93}{1797.41} = .105$

$bxy = .105 \times 5 = .525$
in terms of original data

$a = \bar{Y} - b\bar{X} = 85.69 - .525 \times 2.46$
$= 85.69 - 1.29 = 84.4$

$Y = a + bX = 84.4 \text{ x } .525X$

$r^2 = .177 \times .177 = .031$

$S_y = \sigma_y \sqrt{1 - r^2} = 6.84 \sqrt{1 - .031}$
$= 6.84 \sqrt{.969} = 5.9$

$\sigma r = \dfrac{1 - r^2}{\sqrt{N}} = \dfrac{1 - .031}{\sqrt{334}} = \dfrac{.969}{18.28}$
$= .053$

GRAPH V-a   34

V-a   Regression-Line Graph, Showing The Standard Error
of Estimating Correspondence Grades From Experience

95-99

90-94

85-89

80-84

75-79

70-74   X = 1, Y - 84.93
             X = 11, Y = 90.18
             Sy = ± 5.9 - - - -

65-69

60-64

0

     1   2   3   4   5   6   7   8   9   10   11

GRAPH V-b   X = Experience
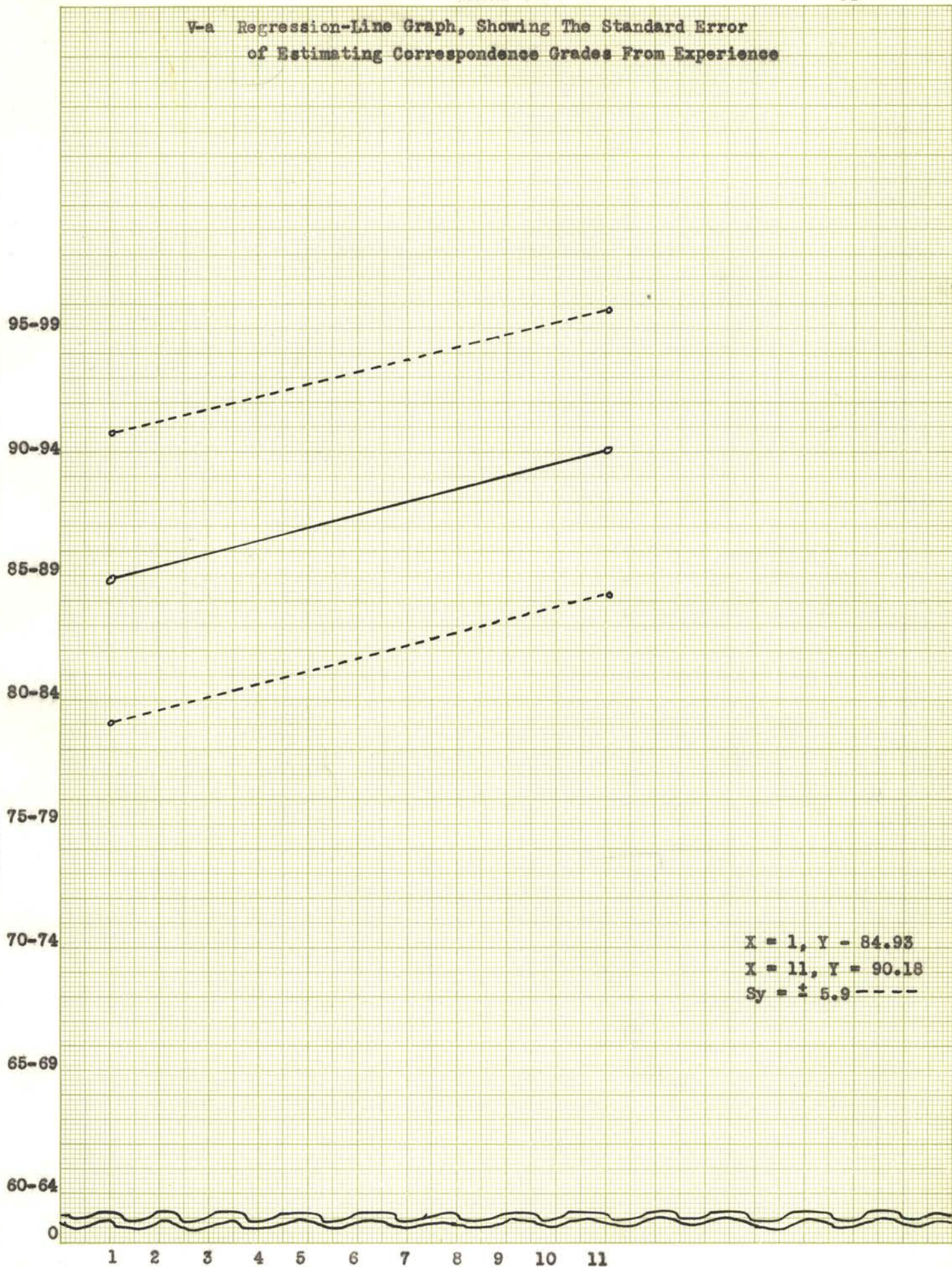
V-b Line Graph, Showing The Relationship Between Experience
and Correspondence Grades
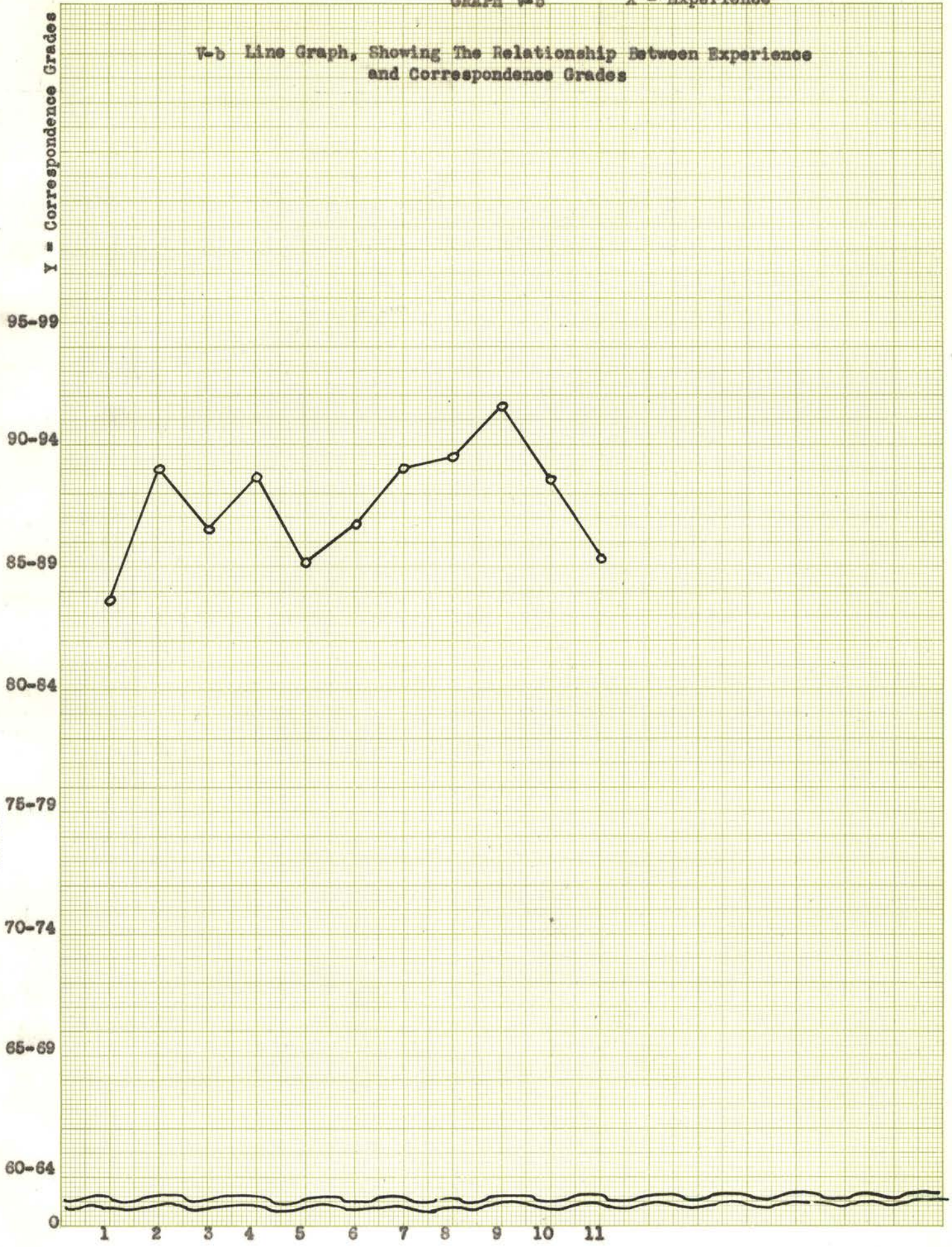
Out of the 334 having work experience, 71.25% had done clerical work, and 13.77% had served as secretaries.

The average grade in Correspondence for the 121, 36.2%, having 2 years of experience, was 88.9. There were 13, or 3.9% of the 334, with 6 years experience. This group averaged 86.62. The 9 who had worked 11 years averaged 85.34. It will be noted that the trainee with 2 years of experience had a higher average than the one who had 6 or 11 years.

The relationship between the experience and grades in Correspondence for this group is shown on Table V, page 33. The coefficient of correlation was .177 with a standard error of coefficient of correlation of ± .053, or between .124 and .230.

The coefficient of determination was .031. Interpretation of this coefficient shows that 3.1% of the grades in Correspondence could be accounted for by the experience the trainees had before taking the course.

The standard error of estimate, shown on Graph V-a, page 34, was 5.9. Letting X = 1, (Y = 84.4 + .525 x 1) Y = 84.93. Letting X = 11, (Y = 84.4 + .525 x 11) Y = 90.18. The accuracy of this estimate would be that a trainee with 1 year of experience would have 68 chances out of 100 of making a grade of 84.93 ± 5.9, or 79.03 to 90.83; a trainee with 11 years of experience, 90.18 ± 5.9, or 84.28 to 96.08.

Graph V-b (line graph), showing the grades made in Correspondence, according to the years of experience, is presented on page 35.

Correlation Between Experience and Personnel Grades

The average grades in Personnel for the 121 having 2 years of experience was 84.15; with 6 years of experience, the average was 85.2. The 9 who had worked 11 years averaged 85.3. The trainee with 10 years experience had the highest average in Personnel in comparison to the

X = Experience

TABLE VI — CORRELATION BETWEEN EXPERIENCE AND PERSONNEL GRADES

Y = PERSONNEL GRADES

Y	.1-1.0	1.1-2.0	2.2-3.0	3.3-4.0	4.1-5.0	5.1-6.0	6.1-7.0	7.1-8.0	8.1-9.0	9.1-10.0	10.1-11.0	Fy	dy	fdy	fdy²	EdyFy	fdxdy
65-69	5	4	1		1						1	12	-4	-48	192	+8	-32
70-74	14	7	1	1	1	4						28	-3	-84	252	+8	-24
75-79	14	19	6	7	1						1	48	-2	-96	192	+18	-36
80-84	20	34	8	6	2	1	3		1		2	77	-1	-77	77	+50	-50
85-89	21	34	16	6	7	3	4	3	2		2	98	0			+110	
90-94	11	18	5	7	3	3	3	1	3	1	2	57	+1	+57	57	+97	+97
95-99	1	5	1	3		2		1			1	14	+2	+28	56	+29	+58
Fx	86	121	38	30	15	13	10	5	6	1	9	334		-220	826	+320	+13
dx	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9						
fdx	-86		38	60	45	52	50	30	42	8	81	320					
fdx²	86		38	120	135	208	250	180	294	64	729	2104					
EdyFx	-97	-81	-20	-10	-8	-6		+3	+2	+1	-4	-220					
fdxdy	97		-20	-20	-24	-24		18	14	8	-36	+13					

	Edxf	Edyf	Edx²f	Edy²f	Edxdyf
Sums	320	-220	2104	826	+13
Means of Sums	.9581	.6587			
Corrections (subtracted)			306.59	144.91	-210.78
Correction Values			1797.41	681.09	223.78

$$r = \frac{Exy}{\sqrt{Ex^2 Ey^2}} = \frac{223.78}{\sqrt{1797.41 \times 681.09}} = \frac{223.78}{1106.434} = .202$$

$$\bar{X} = A + \frac{Efd}{N} i = 1.5 + \frac{320}{334} \times 1 = 2.46$$

$$\bar{Y} = A + \frac{Efd}{N} i = 87.5 + \frac{-220}{334} \times 5 = 84.21$$

$$\sigma_y = i\sqrt{\frac{Ey^2}{N}} = 5\sqrt{\frac{681.09}{334}} = 7.15$$

$\dfrac{y \text{ class}}{x \text{ class}} = \dfrac{5}{1} = 5$

bxy in class intervals

$$byx = \frac{Exy}{Ex^2} = \frac{223.78}{1797.41} = .1245$$

bxy = .1245 x 5 = .6225 in terms of original data

$$a = \bar{Y} - b\bar{X} = 84.21 - .6225 \times 2.46 = 84.21 - 1.53 = 82.68$$

$$Y = a + bX = 82.68 + .6225\, x$$

$$r^2 = .202 \times .202 = .041$$

$$s_y = \sigma_y \sqrt{1 - r^2} = 7.15\sqrt{1 - .041} = 7.0$$

$$\sigma_r = \frac{1 - r^2}{\sqrt{N}} = \frac{.979}{\sqrt{334}} =$$

$$\frac{.979}{18.28} = .053$$

GRAPH VI-a   38

VI-a Regression-Line Graph, Showing The Standard Error
of Estimating Personnel Grades From Experience

X = 1, Y = 83.3
X = 11, Y = 89.53
Sy = ± 7.0 — — — —

GRAPH VI-b   X = Experience
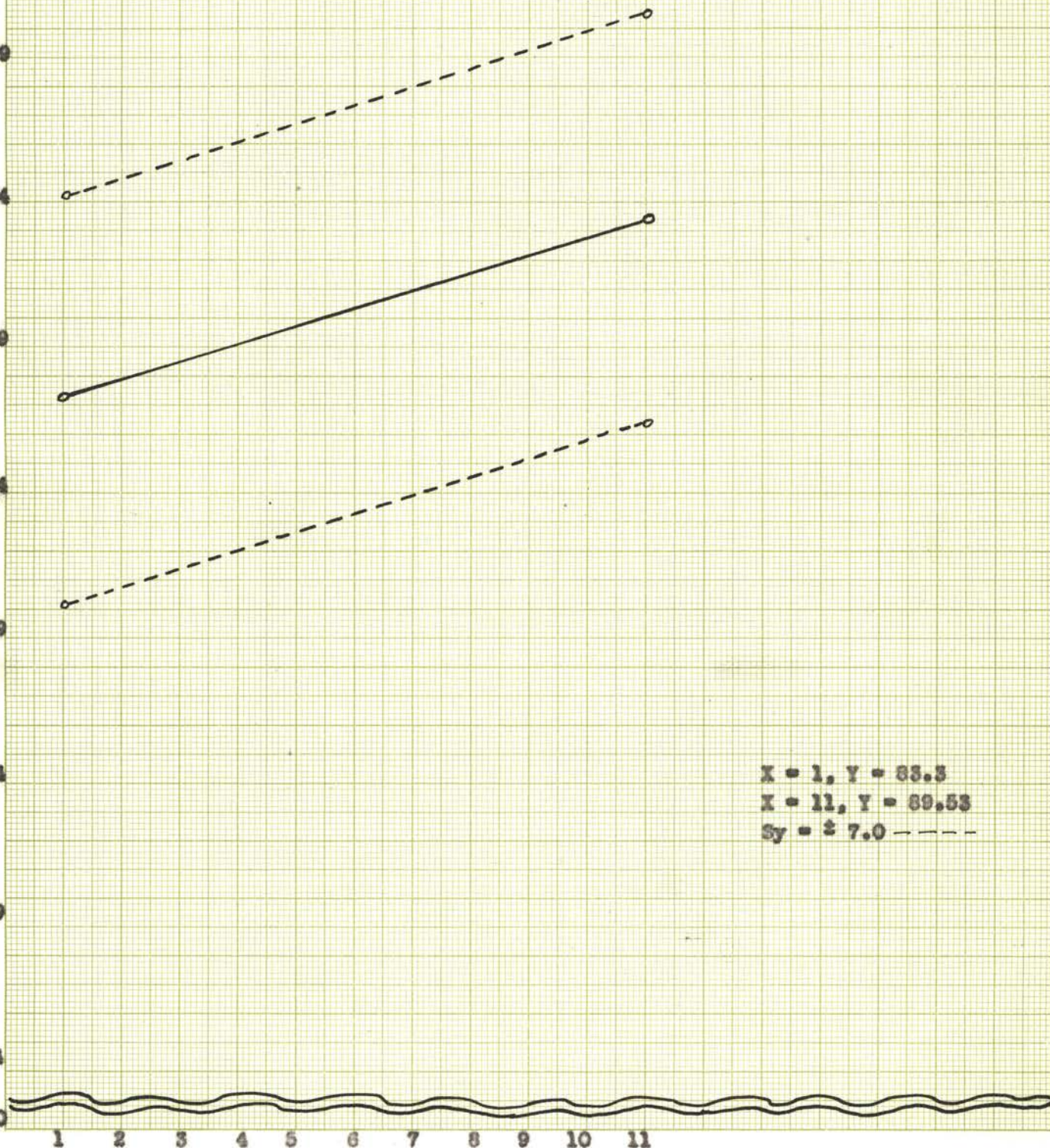
VI-b Line Graph, Showing The Relationship Between Experience
and Personnel Grades
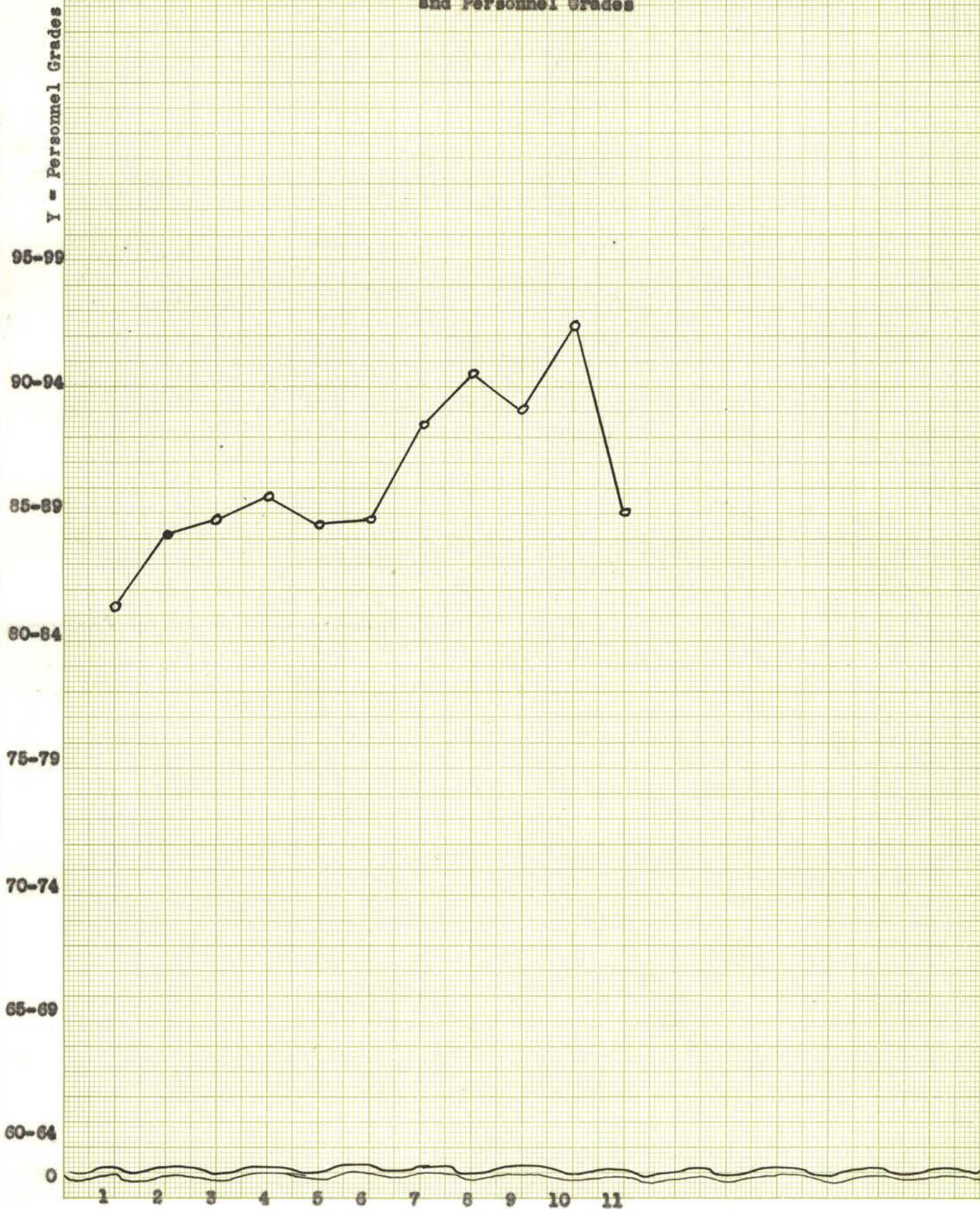
Correspondence grades where 9 years of experience carried the highest average.

Table VI, page 37, shows the coefficient of correlation between the experience of the WAVES and their grades in Personnel. From that table, the coefficient of correlation was found to be .202 with a standard error of coefficient of correlation of ± .053, or .149 to .255.

The coefficient of determination was .041, or 4.1%. This means that 4.1% of the grades in Personnel could be accounted for by previous experience.

Graph VI-a, page 38, shows the error or deviation between the actual grades and the estimated grades in most cases. The standard error of estimate was 7.0. Using the regression equation, let $X = 1$ $(Y = 82.68 + .6225 \times 1)$ $Y = 83.30$. Letting $X = 11$ $(Y = 82.68 + .6225 \times 11)$ $Y = 89.53$. A trainee with 1 year of experience had 68 chances out of 100 of making a grade of 83.3 plus or minus 7.0, or 76.3 to 90.3; one with 11 years of experience, 89.53 plus or minus 7.0, or 83.53 to 96.53.

The line graph (Graph VI-b), showing the Personnel grades by the years of experience, is given on page 39.

Correlation Between the General Classification Test Grades and Combined Grades in Correspondence and Personnel

The general classification test grades of these 400 trainees ranged from 40 to 79, with an average of 55.89. From Table VII, page 41, it can be seen that 21, or 5.25%, had a classification test grade (Navy grading) of from 40 to 44. This group averaged 78.65 in the combined subjects (Correspondence and Personnel). Eighty-six, or 21.5%, had a classification test grade of from 55 to 59; 17, or 4.25%, from 70-74;

X = GCT — TABLE VII – CORRELATION BETWEEN THE GENERAL CLASSIFICATION TEST GRADES AND COMBINED GRADES IN CORRESPONDENCE AND PERSONNEL

Y = CORRESPONDENCE AND PERSONNEL (Average)

Y	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	Fy	dy	fdy	fdy²	Edyfy	fdxdy
60-64	1		1	1					3	-4	-12	48	-4	16
65-69	1	3	4	3					11	-3	-33	99	13	39
70-74	3	14	10	2			1		30	-2	-60	120	-44	88
75-79	6	21	19	10	2	1			59	-1	-59	59	-75	75
80-84	6	24	31	31	9	2	1		104	0			-81	
85-89	3	17	20	19	24	17	4		104	+1	+104	104	-17	7
90-94	1	5	10	18	21	11	8	2	76	+2	152	304	+52	104
95-99				2	2	3	3	3	13	+3	39	117	+29	87
fx	21	84	95	86	58	34	17	5	400		+131	851	-129	416
dx	-3	-2	-1	0	+1	+2	+3	+4						
fdx	-63	-168	-95		58	68	51	20	-129					
fdx²	189	336	95		59	136	153	80	1047					
EdyFx	-14	-31	-15	+34	+70	47	27	13	+131					
fdxdy	42	62	15		70	94	81	52	416					

	Edxf	Edyf	Edx²f	Edy²f	Edxdyf
Sums	-129	+131	1047	851	416
Means of Sums	-.3225	.3275			
Corrections (subtracted)			41.60	42.90	-42.25
Correction Values			1005.40	808.10	458.25

$\dfrac{y\ class}{x\ class} = \dfrac{5}{5} = 1$

bxy in class intervals

$byx = \dfrac{Exy}{Ex^2} = \dfrac{458.25}{1005.40} = .4558$

bxy = .4558 x 1 = .4558 in terms of original data

$a = \overline{Y} - b\overline{X} = 84.1 - .4558 \times 55.89 = 84.1 - 25.47 = 58.63$

$Y = a + bX = 58.63 + .4558X$

Sy = Standard Error of Estimate

$Sy = \sigma_y \sqrt{1 - r^2} = 7.34 \sqrt{1 - .258} = 7.34 \sqrt{.742} = 7.34 \times .86 = 631$

$r^2 = .508 \times .508 = .258$

$\sigma_r = \dfrac{1 - r^2}{\sqrt{N}} = \dfrac{1 - .258}{\sqrt{400}} = \dfrac{.7419}{20} = .037$

$r = \dfrac{Exy}{\sqrt{Ex^2 Ey^2}} = \dfrac{458.25}{\sqrt{1005.40 \times 808.10}} = \dfrac{458.25}{901.368} = .508$
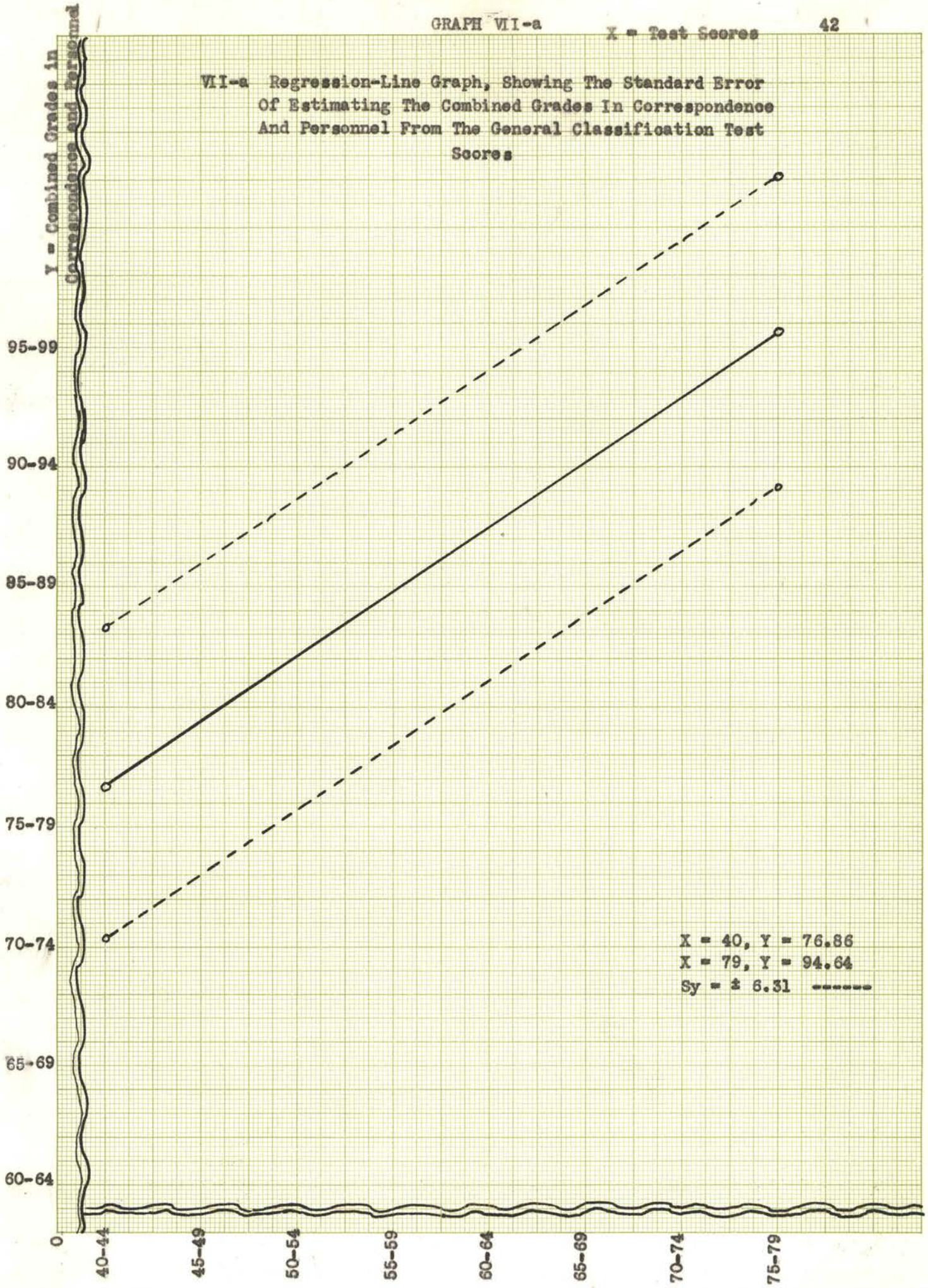
$\overline{X} = A = \dfrac{Efd}{N} i = 57.5 + \dfrac{-129}{400} \times 5 = 57.5 - 1.6125 = 55.89$

$\overline{Y} = A + \dfrac{Efd}{N} i = 82.5 + \dfrac{131}{400} \times 5 = 82.5 + 1.6375 = 84.1$

$\sigma_y = i \sqrt{\dfrac{Ey^2}{N}} = 5 \sqrt{\dfrac{808.10}{400}} = 5 \times 1.484 = 7.34$

GRAPH VII-a   X = Test Scores   42

VII-a Regression-Line Graph, Showing The Standard Error
Of Estimating The Combined Grades In Correspondence
And Personnel From The General Classification Test
Scores

Y = Combined Grades in Correspondence and Personnel

95-99
90-94
85-89
80-84
75-79
70-74
65-69
60-64

40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79

X = 40, Y = 76.86
X = 79, Y = 94.64
Sy = ± 6.31   ------

GRAPH VII-b   X = Test Scores   43

VII-b Line Graph, Showing The Relationship Between The General
Classification Test Scores and The Combined Grades in
Correspondence and Personnel
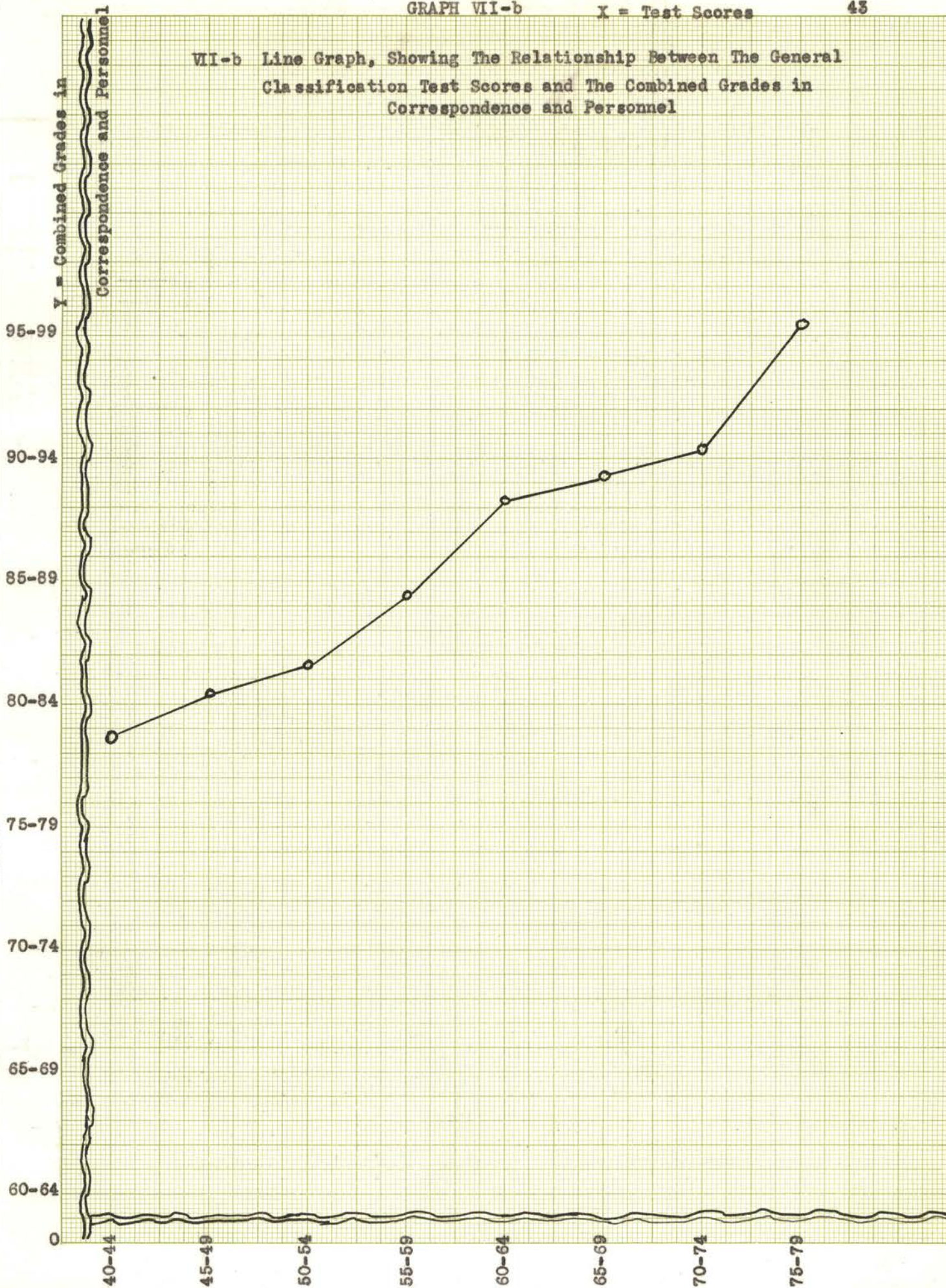
and 5, or 1.25%, from 75 to 79.

The arithmetic mean (average) of the general classification grade (GCT) was 55.89; of the combined grades in Correspondence and Personnel, 84.1.

A coefficient of correlation between the general classification test grade and the combined grades in the above-mentioned subjects, and a standard error of this coefficient of correlation will be found in the table on page 41. The coefficient of correlation was found to be .508 with a standard error of coefficient of correlation of $\pm$ .037. The correlation was .508 plus or minus .037, or between .471 and .545.

The coefficient of determination was .258, or 25.8%--that is, 25.8% of the combined grades in Correspondence and Personnel could be accounted for by the scores made on the GCT (general classification test).

Graph VII-a, page 42, shows the error or deviation between the actual grades and the estimated grades in most cases. The standard error of estimate is expressed in terms of the units of the original data of the dependent variable, Y (combined grades). Using the formula $Y = a + bX$, let $X = 40$, ($Y = 58.63 + .4558 \times 40$) $Y = 76.86$. Let $X = 79$, ($Y = 58.63 + .4558 \times 79$) $Y = 94.64$. The accuracy of this estimate would be that a trainee who had made a grade of 40 on the general classification test would have 68 chances out of 100 of making a grade of 76.86 ± 6.31, or 70.55 to 83.17; one making a grade of 79 on the classification test, 94.64 ± 6.31, or 88.33 to 100.

A line graph is shown on page 43 (Graph VII-b). This graph shows the combined grades made in Correspondence and Personnel and the corresponding general classification test grades. The Correspondence and Personnel grades are shown on the Y-axis; the general classification test grades, on the X-axis.

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to attempt to determine the validity
of experience as a factor in the classification of WAVES in Correspondence
and Personnel, and to seek to determine what other factors should be
considered in this classification.

After the data were gathered from the Qualification Cards and the
Individual Records, the data cards were classified according to age,
education, experience, and general classification test scores. By the
Pearsonian product-moment method of correlation, the relationship between
the age and grades made in Correspondence was found. In the same manner,
the relationship was found between age and grades made in Personnel;
education and grades made in each of the subjects; experience and grades
in each subject; and general classification test scores and the grades
made in the combined subjects.

The highest correlation found was between the general classification
test scores and the combined grades in Correspondence and Personnel.
This coefficient of correlation was .508 plus or minus .037, or between
.471 and .545. From the coefficient of determination, it was found that
25.8% of the combined grades in Correspondence and Personnel could be
accounted for by the scores made on the general classification test. The
relation between education and grades in Correspondence ranked second,
with a correlation of .214 plus or minus .047, or between .167 and .261.
It was found that 4.6% of the grades in Correspondence could be accounted
for by the amount of education the trainee had. The third highest corre-
lation was found in the relationship between experience and Personnel

grades. This coefficient of correlation was .202 plus or minus .053, or between .149 and .255. In Personnel, 4.1% of the grades could be accounted for by previous experience. The correlation between experience and Correspondence grades ranked fourth, with a coefficient of correlation of .177 plus or minus .053, or between .124 and .230. The coefficient of determination was .031, or 3.1% of the grades in Correspondence could be accounted for by the experience the trainee had before taking the course. This was 1% less than the coefficient of determination of Personnel grades. The correlation between education and Personnel grades, fifth in rank, was only .001 smaller than that found between experience and Correspondence grades. The coefficient of correlation between education and Personnel grades was .176 with a standard error of correlation of .049, or a correlation of between .127 and .225. The correlation between age and Correspondence grades and age and Personnel grades ranked 6 and 7, respectively. The correlation between age and Correspondence grades was .164 plus or minus, .049, or a correlation of between .115 and .213, whereas the correlation between age and Personnel grades was found to be .151 plus or minus .049 (standard error of coefficient of correlation), or a correlation of between .102 and .200.

Conclusions

The only useful correlation found was between the general classification test scores and the combined grades in Correspondence and Personnel.

Since the coefficients of correlation found in this study range from .151 plus or minus .049, Table II, to .508 plus or minus .037, Table VII, all positive, it is concluded that there is some relation between all

the factors used in this study and grades. O'Dell,[1] for example, states that "A coefficient of .30 or .40 is high enough to indicate that there is definite relationship between the two things correlated, but is so low that estimates of one of the traits from the other are scarcely better than mere guesses." Rugg,[2] in his Statistical Methods Applied to Education, states that "correlation is 'negligible' or 'indifferent' when r is less than .15 to .20; 'present but low' when r ranges from .15 to .20 to .35 or .40; 'marked present when r ranges from .35 or .40 to .50 or .60; 'high' when it is above .60 or .70."

On the above bases, the correlations obtained could be said to be from 'present but low' to markedly present.'

Just what factors contribute to grades are not definitely known, but there are many. Since there was a markedly present positive relationship between the results on the general classification test scores and grades, it may be concluded that classification testing is one of the factors.

The results from Tables I and II show some, but very little, correlation between the age of the trainees and their grades in Correspondence and Personnel. The best that can be said for this correlation is that it is positive. The maturity, as far as age, of the students or trainees had little influence upon their grades. This seems to indicate that the youngest trainee would be just as likely to make a

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[1] Charles W. O'Dell, Statistical Method in Education (New York, D. Appleton-Century Company, 1935) p. 189.

[2] Harold O. Rugg, Statistical Methods Applied to Education (Boston, Houghton Mifflin Company, 1917) p. 256.

high grade in these two subjects as the older one would. However, it cannot be said that this is definitely true because so many factors enter into grades. Some of the factors which might be considered are health, interests, aptitude, environment, and many others.

There was a low but positive relationship between education and grades made in Personnel, and only a slightly higher relationship between education and grades made in Correspondence. The higher correlation between education and Correspondence might be accounted for by the fact that many of the details in the preparations of Correspondence had been pursued in English classes in civilian education. While on the contrary, Navy Personnel was an entirely new field to the trainees, and required more learning.

Since there was low but positive relationship between experience and Correspondence grades and experience and Personnel grades, the latter having .025 higher correlation, there is an indication that experience has as much influence on the grades in these two subjects as education and age. There is not sufficient correlation between experience and Correspondence and experience and Personnel grades to be used to any large degree as a basis for predicting these grades, but it might be considered one of many factors.

Recommendations

It is recommended that similar studies be made in civilian schools to determine what factors contribute to grades.

In so far as the general classification test is concerned, since the correlation was 'markedly present,' recommendation is made that a study be made of the Navy classification test, with a view of possible

modification of its use in civilian training. From the standpoint of its use in prognostication, this study might determine what points in the classification test could be used and what changes should be made in order to make it useful in administering such a test to beginning students.

That a study be made comparing previous experience with the actual grades made in secretarial subjects; such as shorthand, typewriting, etc., in civilian schools.

A similar study of the cooperative office-practice classes, to determine the relationship, if any, between the experience obtained on the job and the class grades.

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