Prediction of grades in high school stenography.

PREDICTION of GRADES IN HIGH SCHOOL STENOGRAPHY

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Prediction of Grades in High School Stenography

by

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TABLE OF CONTENTS

INDEX OF TABLES

PREDICTION OF GRADES IN HIGH SCHOOL STENOGRAPHY

CHAPTER I

THE INTRODUCTION

CHAPTER 1

THE INTRODUCTION

One of the most striking changes in secondary education of the past two decades has been the great increase in student enrollment. An analysis of the reasons for this influx of students will show them to be philosophic, economic, and social.

(1) Our Philosophy of Education: Our philosophy of education as far back as colonial days, but more specifically since the time of Horace Mann, has stressed the need for a universal, liberal, tax-supported education. Our way of life demands this type of education because a democracy flourishes only if it is peopled by an intelligent, educated citizenry. In comparatively recent times, the need for more and more education has been realized until, at present, a child must remain in school until he has either completed the eighth grade or attained the age of sixteen or seventeen. Consequently the vast majority of children in the United States today experience some secondary school education and our secondary school population has changed from a few selected individuals to a cross-section of society itself.

(2) Economic Changes and Our Schools: The second reason for the great influx of pupils is an economic one. This is the age of specialization. With our increasing scientific knowledge, our highly systematized

"big business", and our mechanized, scientific farming, there is little room or call for the untrained worker. Each man must be so well-equipped to do his specific task that he can withstand the ever increasing pressure of competition which has been felt so keenly these past thirteen years. To a large extent this advanced skill or specialization is derived from advanced training obtained through a longer period of school life. The day of the self-made, self-educated man is passing. More and more formal education is being demanded by employers and a secondary education is today practically a necessity.

(3) Social Changes and Our Schools: Our larger school enrollment is not, however, due alone to our stricter educational laws and economic changes. There is a social factor which plays a definite part. With our increased medical knowledge, longevity is becoming increasingly prevalent. This means that men are remaining longer at their work than heretofore. This, in turn, means that there are fewer positions for the younger workers. Although our government has attempted to overcome this condition by the institution of Old Age Assistance and the termination of work at the age of sixty-five, the situation, as yet, has, at best, been only partially alleviated. This is becoming a "middle age" world and we can expect that the gap between leaving school and receiving permanent employment will tend to

increase unless this tendency is accompanied by a tendency to increase the period of formal schooling.

(4) Varied Student Ability and Interests: Naturally the academic level of secondary school students, due to this increased enrollment, has been lowered. No longer can the College Preparatory Curriculum alone be stressed. Equal emphasis must be given to those pupils who plan to find employment immediately upon high school graduation and also to those boys and girls who, years ago, would have been forbidden any higher learning because of their low mental capabilities. Today such pupils experience special classes where their peculiar needs are emphasized in an attempt to make them happy, intelligent followers, if not leaders in our country's work.

(5) Need for Prognosis in High School: A general secondary school education is not, however, the order of the day. Specialization has entered even the high schools, for we find definite vocational training on all sides. The Commercial, Manual Training, and Home Economic departments are illustrations of this. It is consequently of vital importance that some means of prognosis be applied to insure the likelihood of a pupil's taking up a type of work for which he is mentally, physically, and temperamentally suited. Such a means of prognosis would tend to eliminate the waste of time, money, and effort which occurs each year through the failure of students due to their inability to cope with certain courses.

Much has already been accomplished in the way of prognosis in many departments of the secondary school. Studies have been made and theses written on methods of prediction in such fields as General Science and Physics. Few students entering high school are allowed to take the College Preparatory Course unless their scholastic accomplishments in the grades seem to warrant it. In the Brattleboro High School, for example, each entering student is pretested in composition so that his work may be evaluated and the pupil placed in the English class suitable to his capabilities. Such pretesting is based on the supposition that a written paragraph plus a punctuated sheet will show up one's English faults.

(6) Need for Prognosis in the Commercial Field: No such steps and few if any such studies have been made in the Commercial field. In fact the Commercial department in many schools has been used as a grand "dumping ground" for the "scholastic mis-fits". Consequently, many Commercial departments have been forced to lower their standards to accommodate this type of pupil assigned to them.

No longer can this be done. Business is playing a more and more important role. Professor Nichols of Harvard in a lecture given to the Commercial Teachers at the Vermont State Teachers' Convention held at Burlington, Vermont in October of 1940 stated that employers are already complaining that the average high school Commercial graduate is not adequately fitted to successfully hold down an office position today and that much time has to

be spent in the offices retraining the recent graduates to do the work satisfactorily.

Such a statement illustrates the necessity of seeing to it that only those students who are, in every way, adapted to commercial work be permitted to enroll in the Commercial Course. When this is accomplished, the standards can be raised to their proper level. Such a situation can only be attained through the medium of prognosis, but it must be a pretesting so "fool-proof" in itself that it accurately and reliably measures what it professes it will measure.

(7) <u>This Study</u>: Consequently, realizing the benefits which could be derived from a means of predicting a student's ability to do commercial work and, more specifically, to cope with stenography, and discovering that much of the predictable data available for testing stenographic ability has not been thoroughly examined to measure its true worth, this study was made. Its ultimate aim was to determine if, in any way, the Hoke Prognostic Test is an accurate means of determining the pupil's ability to take stenographic work in the Brattleboro High school and, if not, are any better means of prognosis available.

CHAPTER II

REVIEW OF THE LITERATURE

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REVIEW OF THE LITERATURE

When the studies which have been made regarding means of prognosis in secondary commercial work have been investigated, one is surprised at the direct contradictions to be found in the various conclusions reached. They leave a confused impression in one's mind and make it more convincing that much more intensive study must be made before any satisfactory conclusions can be reliably accepted.

The research related to the prediction of vocational success in high school has been principally directed toward occupations requiring mechanical and clerical skills. The majority of the prognostic techniques developed for clerical occupations have been attempts of two kinds, namely: general and specific. Specific tests have attempted to measure unique traits indicative of one's ability to do clerical work such as stenography, filing, accounting, and the like, while the general tests have tended to measure the general ability of the student. Although much study has been devoted to clerical work in general and typewriting in particular, very little material is available in the field of stenography. Therefore, most of the data contained in this chapter will have to be considered as pertaining, not to stenography alone, but rather to all commercial work in general.

(1) TESTS of CLERICAL ABILITY:

(a) The Minnesota Vocational Test for Clerical Workers which involves number and name comparisons and is prognostic of a wide range of clerical tasks has been found to be most valid for the lower levels of routine work.

(b) National Institute of Industrial Psychology Test has seven parts: oral instructions, classification, arithmetic, copying, checking, filing, and problems. The problems are similar to those appearing in intelligence examinations.

(c) The Scott Company File Clerk's Test[1] is a fifteen minute examination which has been used as a general clerical test, consisting of six sub-tests: number checking, name checking, alphabetical filing, numerical filing, topical filing, and paragraph comprehension.

(d) O'Rourke's Clerical Aptitude Test, Junior Grade, consists of two parts: a reasoning and a clerical problem test related to a wide variety of clerical jobs.

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1. Munroe, Walter S. Encyclopedia of Educational Research, The Macmillian Company, February 1941.

The efficiency of these clerical aptitude tests has been extensively studied and reported upon. O'Rourke[2] obtained correlations of .71 and .76 between efficiency ratings and a series of clerical tests developed for use of stenographers and typists. The National Institute of Industrial Psychology[3] established validity coefficients as high as .87 and .94 for its clerical tests. Andrew[4] studied the Minnesota Vocational Test for Clerical Workers and, by means of factor analysis, found four relatively independent factors--academic, clerical, spatial, and dexterity.

(e) The Thurstone Clerical Test[5] was the first clerical aptitude test to be published. First reported in 1919, it consists of eight parts, as follows:

(a) checking the errors in addition and subtraction.

2. O'Rourke, L. J. "Scientific Personnel Selection in the United States Civil Service". Occupations 12: 29-39; April 1934.

3. Moore, Herbert. "The Institute's Clerical Test in the Westinghouse Electrical Company". Human Factor 10: 221-24; 1936.

4. Andrew, Dorothy. "An Analysis of the Minnesota Vocational Test for Clerical Workers". J. Applied Psychology 21: 18-47, 139-72; 1937.

5. Thurstone, L. L. "Standard Tests for Office Clerks", Journal of Applied Psychology, 3: 248-251, Sept.,1919.

(b) underscoring misspelled words in a passage taken from Arnold Bennett's "Mental Efficiency".

(c) canceling the four letters X, Y,U, and C.

(d) a code-learning substitution test.

(e) a test in alphabetizing.

(f) a test in classifying insurance policies in three classes according to kind of policy, date of issue, and the amount.

(g) an arithmetic test.

(h) matching proverbs.

This is an omnibus test with a maximum time of 90 minutes, and an average time of taking 40 minutes. The scoring is in terms of both speed and accuracy. Speed is the number of minutes spent in taking the test--accuracy is the number of correct items. The test was tried out in many large industrial firms. Using as a criterion employees in an invoice company rated in five classes according to the grade of office work in which they were employed, Thurstone found a correlation of .50 between this measure of efficiency and accuracy in the test; .42 between efficiency and speed and .61 between efficiency and speed and accuracy combined. Concerning this test Thurstone says that it endeavors to fit the appropriate intelligence level of clerical workers and to appeal to the applicant for an office position. He adds, "I do not believe that office work has any special abilities that have so far been demonstrated".

(f) Ruggles Test of Clerical Ability[6], compiled by A. W. Ruggles while working with the Wisconsin Civil Service Commission, consists of a battery of six tests for predicting clerical ability. These tests were the result of a thoroughgoing analysis of the skills required in clerical occupations. A careful study of clerical work, especially as illustrated by the clerical performance scale cards, resulted in the selection of six fundamental operations, with varying possible ranges of difficulty within themselves. Those determined upon as practically covering the entire cross-section of clerical work are as follows:

(a) checking of material for correspondence with copy or similar material, with which it is compared for sameness.

(b) selection of data on the basis of comparison.

(c) locating in an alphabetical index.

(d) classification or sorting.

(e) tabulation or selection and transfer of data.

(f) mathematical computations.

6. Ruggles, A. W. A Diagnostic Test of Aptitude for Clerical Office Work, p.15 and 18.

Ruggles also attempted by correlation methods to determine the validity of his tests. Eight groups of clerks were used. Ratings were given by supervisors as overseers on both aptitude and efficiency. Ruggles does not give correlations of the battery of tests as a whole with his criteria, but gives the correlations of each separate test in great detail. These average correlations range from .33 for test 4 to .46 for test 6. These same tests correlate with "Army Alpha" from .15 to .51 although the "Army Alpha" correlations are low in each case except for test 4. Ruggles' thorough analysis of each of his tests is an excellent basis for further work for workers with clerical tests.

While these specific tests have apparent prognostic value, they fail to have much bearing on this thesis in that they appear to be intended either for commercial work of a low level or else are for use with regard to job placement after secondary school education has been completed.

(2) GENERAL TESTS:

It is in the consideration of the general tests that we find the contradictions prevalent. Bills and Hammitt[7] concluded that intelligence tests are more adequate for measuring clerical ability than are clerical ability tests.

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7. Bills, M. A., and Hammitt, C. "Present Status of Aptitude Testing for Clerical Positions in Industry". National Business Educational Quarterly 4: 26-30; March 1936.

Easterbrook and Vavra[8], as well as Puckett[9], who were attempting to discover means of predicting ability to learn typewriting also concluded that the greater mental capacity a student has, the better work he can do. Likewise, Toops, after doing considerable work in this field, concludes that, "At the age of thirteen or fourteen, clerical ability is not sharply distinguished from general academic or intellectual ability".[10] Success in bookkeeping seems to be fairly well predicted from an intelligence test for correlations between intelligence and bookkeeping of about .60 are reported.[11] Correlations between intelligence and either typing or shorthand seem to be lower, ranging somewhere near .40. Limp reports that a special battery of five tests will predict achievement in shorthand or typewriting to the extent of .61 and .63 respectively.

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8. Easterbrook, Mabel and Vavra, Minnie A. "Factors Predetermining Success in Typewriting", Public School Messenger (St. Louis: Board of Education, May, 1924).

9. Puckett, Cecil "The Rank of the Inferior Student in Typewriting", The Balance Sheet (Cincinnati: South-Western Publishing Co., May, 1930), p.262.

10. Allen, Frederick J. Practices in Vocational Guidance (New York, McGraw-Hill Book Company,1927), Chapter xiv.

11. Stedman, M. B. "Factors Influencing School Success in Bookkeeping", J. Applied Psychology, Vol. 14,Feb. 1930, pp74-82.

The most significant of these tests seem to be the Terman Test of Mental Ability--Logical Selection and Courtis' test on Multiplication[12].

Ross and Hooks[13], on the other hand, obtained correlations between school marks and intelligence achievement tests and got the following results:

School Subject	School Marks	Achievement Tests
Science	.44	.45
Mathematics	.37	.41
Language	.33	.46
History and English	.45	.27

This, they maintain, indicates that intelligence tests cannot be depended upon with any degree of accuracy for predicting achievement in specific subjects. In fact, they conclude that elementary school records offer better prediction than test results for high school success.

Stedman[14] found the correlation between I.Q. and achievement in typewriting very low, indicating that the intelligence test as a whole cannot be relied upon to indicate typing success.

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12. Limp, Charles E. "Some Scientific Approaches Toward Vocational Guidance", Journal of Educational Psychology, Vol.20, Oct. 1929 pp.530-536.

13. Ross, C. C., and Hooks, W. T. "How Shall We Predict High School Achievement?" J. Educational Research 22: 184-95; 1930.

14. Stedman, M. B. "A Study of the Possibility of Prognosis of School Success in Typewriting", Journal of Applied Psychology,XIII, pp.505-75.

In this study, arithmetic correlated higher with typewriting than did a test of spelling and, if developed further, arithmetic tests may have some value as a means of predicting ability to type. Why this should be true is not clear. Miller[15] found that the correlations between the I.Q. and the standardized typewriting test scores were too low to justify the use of intelligence tests alone in predicting success in typewriting. Bradford[16] concluded that there is no relationship between typing ability and mental ability as revealed by a Terman Group Test of Mental Ability and the tendency to make errors. Ackerson,[17] George,[18] and Johnson[19] all agree that mentality does not seem to insure typewriting ability. Johnson also found that quick

15. Miller, M. A. "Relation of the I.Q. to Success in Learning Typewriting", Curriculum Study and Educational Research Bulletin, III, 3, pp.135-40.

16. Bradford, Lilah, "Does Typing Ability Depend on Mentality or Dexterity?" The Journal of Business Education, Dec. 1930, p.23.

17. Ackerson, Luton, "A Correlational Analysis of Proficiency in Typing", Archives of Psychology, Columbia University, 1926, No. 82.

18. George, Guy G. "The Prognostic Typewriting Tests Have Not Always Succeeded". The Trethaway Publishing Co., April, 1931.

19. Johnson, C. L. The Validity of Certain Tests to Prognosticate Typewriting Ability. Master's Thesis, 1925, State University of Iowa.

motor action (native) is not essential to successful learning to type and that low correlation seems to exist between spelling ability and typing ability. George[20] reported a minus correlation in his study of maze learning to discover the prognostic value, if any, for the learning of typewriting.

Probably the easiest and most economical measure to obtain is chronological age. The only test to which it must be put is its reliability. Maller[21] found scholastic success in high school can be predicted from age at entrance with as much reliability as from intelligence measured by standard tests. Likewise, Flemming[22] has obtained correlations of approximately .30 between age and class standing in secondary school. As a direct contradiction to this, Davis[23], who made a survey of commercial education in the St. Louis high schools, in 1924, was unable to see any prediction, at least for typewriting, from chronological age.

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20. George, Guy G. The Relationship Between Maze Learning and Typewriting Learning. Master's Thesis, 1930, Stanford University.

21. Maller, J. B. "Age Versus Intelligence as a Basis for Prediction Success in High School". Teachers College Record 33: 402-15; 1932.

22. Flemming, Cecile W. "A Detailed Analysis of Achievement in High School". Contributions to Education, No. 196. Teachers College, 1926. 209p.

23. Davis, H. H. "Measurement in Commercial Education in the St. Louis Schools", University of Iowa Monographs in Education, First Series, No. 7, University of Iowa, July 1926, p.43.

(3) PREDICTION IN STENOGRAPHY:

The only research found in the field of stenography was a study made by Grace H. Callanan[24] of the Waltham Senior High School, Waltham, Massachusetts. In this study she analyzed scientific methods of predicting success and determining vocational guidance of commercial students. Regarding stenographic prediction, Miss Callanan explains that her aim was to see if it were possible to ascertain, by means of a series of tests, the probable success or failure of a pupil in shorthand previous to his election of the subject. All the girls in the commercial department were given the Terman Group Test of Mental Ability[25] and the Hoke Prognostic Test for Stenographic Ability[26]. From the English department the results of the Tressler[27] test were obtained. By using these test results in conjunction with the sophomore marks in English and typewriting, Miss Callanan states that she was able to eliminate those who would be most likely to fail in shorthand.

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24. Callanan, Grace H. "Procedure for Determining the Course for which Sophomore Pupils are Best Fitted", The Balance Sheet, March, 1937, p. 306-307.

25. Terman, L. M. "Terman Group Test of Mental Ability" (Yonkers, N.Y.: World Book Company).

26. Hoke, E. R. "Prognostic Test of Stenographic Ability" (New York: Gregg Publishing Company).

27. Tressler, J. C. "Grammar Minimum Essentials Mastery Test" (Boston: D. C. Heath & Company).

Although this was done in 1931, the real work of obtaining a prediction began in 1933. At that time Miss Callanan gave certain tests to the girls in the senior shorthand class in order to establish a criterion which included typewriting speed, typewriting accuracy, five-minute solid-matter dictation, letter dictation, transcription speed, spelling, and punctuation. Miss Callanan says that this criterion was tested with the actual marks given these pupils in shorthand, and with the estimated success in stenography as given by the senior shorthand teacher and was found to be reliable.

With this criterion as a basis, correlations were made with each separate part of the Terman and Hoke tests, and with the complete Tressler test. Then combinations of tests were worked on in order to get a battery which would show the highest correlation with the criterion. The battery finally chosen, which gave a correlation of ± .772 with the criterion, consisted of the following tests:

Test	Correlation with Criterion by Products Moments Method
Terman 3. Best Answer	± .48
Terman 7. Analogies	± .44
Terman 8. Mixed Sentences	± .45
Terman 9. Classification	± .31
Terman 10. Number Series	± .27
Hoke 1. Motor Reactions	± .11
Hoke 4. Speed of Reading	± .73
Hoke 2. Speed of Writing	- .41

To make sure that this battery was successful, several sophomores whose predictions were poor were allowed to elect shorthand that year. But, while these pupils were seniors this year, Miss Callanan obtained, by means of the rank differences method, a correlation

of ± .80 between the actual prediction from this battery and the ranking of the senior shorthand teacher. As these tests had been administered while the pupils were sophomores and before they had studied shorthand, shorthand being begun in the junior year, Miss Callanan feels that she has undoubtedly secured a measure of prognosis which is accurate in determining the probable success of a person who undertakes the study of shorthand.

(4) SUMMARY:

The general lack of research material specifically along stenographic lines proves rather conclusively that much work remains to be done. The apparent lack of unity in the conclusions reached by those who have made studies makes one hesitate to accept these verdicts as reliable or even satisfactory. The amount of work and expense necessary to carry out Miss Callanan's method makes further study seem imperative. Isn't there some one test reliably prognostic to be a sole determinant of one's ability to take stenography? Might not the Hoke Prognostic Test be the solution to the problem? It seems worthy of consideration and study.

CHAPTER III

STATEMENT OF PROBLEM AND SUMMARY OF PROCEDURE

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(1) Problem: In order to understand just what was attempted in this study, and hence better appreciate the methods which were employed in an attempt to reach a conclusion, the problem is here stated specifically:

> "Should the Commercial Department of the Brattleboro High School determine the elegibility of pupils to take Stenography solely on the results of the Hoke Prognostic Test as published by the Gregg Publishing Company? If not, are there any better factors which could be used?"

(2) Subjects: The students whose records are used in this thesis are members of the graduating classes of 1940, 1941, and 1942 at the Brattleboro High School who, at some time during their secondary education, were enrolled in the Sophmore Stenography Course at the high school. Generally speaking, these students took the course during 1936, 1937, and 1938. They were predominately girls ranging in age from 13 to 17 years. The majority of them came from middle class homes, and, with a very few exceptions, were children of American-born parents. Approximately 93 pupils were subjects in this study.

(3) High School which Subjects Attended: Brattleboro High School situated in a residential Vermont

town of around eleven thousand people and surrounded by a large rural, agricultural area has a yearly enrollment of around five hundred students. Its personnel is made up largely of Protestant boys and girls as a separate Catholic high school is maintained in the town. Five main courses are offered, namely: College Preparatory, Commercial, General, Home Economics, and Agriculture. The Commercial department absorbs about one third of the total school enrollment. However, students from other departments may elect commercial subjects in addition to their own major requirements. Beginning Stenography, with which this study is concerned, is taught to the Commercial majors during their sophomore year. Others may elect it during their sophomore, junior, or senior years.

(4) Material: The material used in this study was obtained from two main sources:

(a) The Brattleboro High School Registers yielded a record of the pupils' marks, I.Q.'s and chronological ages.

(i) The I.Q.'s obtained were a result of the scores achieved on the Otis Self-Administering Gamma Test which the school had previously given to the entire student body.

(b) The Hoke Prognostic Test published by the Gregg Publishing Company, a sample of which will be found in Appendix A, was given as a pretest to all those planning to take Sophomore Stenography during 1936, 1937, and 1938 and graded according to the test specifications.

(5) Procedure: It was the purpose of this study to determine whether the grade obtained on the Hoke Prognostic Test or the grades attained on the various Grade 9 subjects satisfactorily predict one's ability to do Sophomore Stenography; hence, it is necessary that the grades of the several students in any given subject be compared in some manner with the respective grades of those students in Sophomore Stenography. Therefore, it became essential that all the desired marks of each individual concerned be assembled in such a way that the identity of each individual's scores could be maintained and readily examined.

(a) Collection of Data: A separate data card was kept, therefore, for each student who took Stenography during 1936, 1937, and 1938 and on these cards all the necessary information was recorded from the cumulative record of each pupil which was found in the Principal's office at the Brattleboro High School. A sample of these data cards will be found in Appendix B.

(b) Method of Grouping the Students for Study: Each class was separately studied in the same manner and then the three classes were combined and restudied.

(c) Technique of Comparison: Since the study was concerned with finding some measure or measures of predictive value, the study was naturally interested in relationships since prediction is dependent upon the relationship existing between two or more different factors.

As the coefficient of correlation is one of the most exact measures of relationship, this method was used in this thesis. A more lengthy description of the procedure will be found in Chapter IV.

CHAPTER IV

SUMMARY OF THE DATA

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SUMMARY OF THE DATA

In order to arrive at the best predictive factor or factors for Sophomore Stenography, the various grades and average grades of all school subjects which seemed, in any way, to have any bearing or relationship to Stenography were each correlated with the Sophomore Stenography mark.[1] The sophomore class of 1940, the junior class of 1940, and the senior class of 1940 were each treated separately. Then, as it was felt that perhaps the small classes might incorrectly color the results, the three classes were grouped together and treated as a whole. All of the subjects were also grouped two at a time in all possible combinations and the multiple correlation of each of these combinations with Sophomore Stenography was determined. The results of each of these correlations are presented in the following pages. The results of the various zero order intercorrelations which were necessary in computing the multiple correlations are listed in Appendix E.

(1) Zero Order Correlations:

(a) Subjects Correlated with Stenography: Inasmuch as the purpose of this thesis was to attempt to test the value of the Hoke Prognostic Test in determining a pupil's ability to take Stenography, it was of

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1. See Appendix C for sample zero order correlation.

prime interest to correlate the grade achieved on the Hoke Prognostic Test with the mark attained in Sophomore Stenography. Since a knowledge of English is indispensable to a stenographer, correlations were made between English and Stenography. Likewise the average grade 9 mark was thought possibly a good indicator of one's stenographic ability, so a correlation between these two subjects was made. Junior Business Training is the only commercial subject open to freshmen, so a correlation was made between the Junior Business Training mark and the Stenography mark to see if this was a determinant. Each pupil in the high school had been given the Otis Self-Administering Intelligence test, so a correlation was made between the pupil's I.Q. and Stenography, since intelligence testing is usually the first thought in educational testing. Finally, it was felt that the chronological age of the pupil might have some bearing on one's stenographic ability, so a correlation between these two subjects was made.

It should be made clear that a correlation must be at least four times its probable error to be reliable[2]. In no case will the study consider a correlation where this is not true.

(b) Sophomore Results (1940)

The results of the zero order correlations in the various subjects for the class who were

2. Rugg, H. O., Statistical Methods Applied to Education, p.256.

TABLE I

Summary of All Correlations of Freshman High School Grades with Grades in Sophomore Stenography. (Sophomore Class)

Variables Correlated with (1) Sophomore Stenography	Coefficient of Correlation		Number of Cases
(3) Average Gr. 9 mark	$r_{1.3} = .62$	.067	38
(2) Freshman English	$r_{1.2} = .60$	.07	38
(4) Jr. Bus. Training	$r_{1.4} = .55$	.10	24
(5) I.Q.	$r_{1.5} = .44$	.088	38
(6) Chronological Age	$r_{1.6} = .42$	.09	38
(7) Prognostic Mark	$r_{1.7} = .40$	.09	38

sophomores in 1940 are found in Table I. Since all of the correlations in Table I satisfy the criterion of reliability, we can say with considerable certainty that if the experiment were repeated all these correlations would be positive. It is to be noted that the lowest correlation in this class, .40, is found to be between the Prognostic Mark and Sophomore Stenography, while the highest correlation between any single subject and Sophomore Stenography is Average Grade 9 Mark, which has a correlation of .62. From Table I it is evident, therefore, that the best single determinants of ability in Stenography for the sophomore class would have been:

(i) Average Grade 9 mark

(ii) Freshman English mark

(iii) Junior Business Training mark

(c) Junior Results (1940)

The results in the various categories for the class who were juniors in 1940 are found in Table II.

TABLE II

Summary of All Correlations of Freshman High School Grades with Grades in Sophomore Stenography. (Junior Class)

Variables Correlated with (1) Sophomore Stenography	Coefficient of Correlation	Number of Cases
(4) Jr. Bus. Training	$r_{1.4} = .653 \pm .088$	21
(2) Freshman English	$r_{1.2} = .62 \pm .08$	30
(3) Average Gr. 9 mark	$r_{1.3} = .59 \pm .08$	30
(5) I.Q.	$r_{1.5} = .46 \pm .12$	30
(7) Prognostic Mark	$r_{1.7} = .155 \pm .12$	30
(6) Chronological Age	$r_{1.6} = .026 \pm .06$	30

The highest correlation in Table II is between Junior Business Training and Sophomore Stenography, but the small number of cases is to be noted. Freshman English with a correlation of .62 might be considered more acceptable in view of the increased number of cases. It is to be noted that in this particular class, the correlation between the Prognostic Mark and Sophomore Stenography is not reliable. The correlation between the Average Grade 9 Mark and Sophomore Stenography is again noteworthy, .59, although it is not as high in this class as it was in the sophomore class. The I.Q. correlation, .46, is higher in this class than the previous class by .02.

It is rather surprising to discover that the correlation between the Chronological Age and Sophomore Stenography which was .42 in the sophomore class is not reliable in the junior class, amounting to only .026. From Table II it is evident, therefore, that the best single determinants of ability in stenography for the junior class would have been:

(i) Junior Business Training

(ii) Freshman English

(iii) Average Grade 9 mark

(d) Senior Results (1940)

The results in the various divisions for the class who were seniors in 1940 are found in Table III.

TABLE III

Summary of All Correlations of Freshman High School Grades with Grades in Sophomore Stenography. (Seniors 1940)

Variables Correlated with (1) Sophomore Stenography	Coefficient of Correlation	Number of Cases
(7) Prognostic Mark	$r_{1.7} = .47 \pm .101$	27
(5) I.Q.	$r_{1.5} = .34 \pm .13$	27
(3) Average Gr. 9 Mark	$r_{1.3} = .276 \pm .119$	27
(2) Freshman English	$r_{1.2} = .22 \pm .065$	27
(6) Chronological Age	$r_{1.6} = .094 \pm .001$	27
(4) Jr. Bus. Training	$r_{1.4} = .03 \pm .125$	24

Applying our rule that to be significant a correlation must

be at least four times its probable error and that a correlation of less than .4 is usually not considered, we find that this class shows very little conformity with the other two classes. This class has only one significant correlation and that is between the Prognostic Mark and Sophomore Stenography. What makes it most interesting is that in the other classes where this correlation was significant, it was the smallest of several reliable correlations. From Table III it is evident, therefore, that the best single determinant of ability in stenography for the senior class would have been:

(i) Prognostic mark

(e) Combined Sophomore, Junior, Senior Results. (1940)

TABLE IV

Summary of All Correlations of Freshman High School Grades with Grades in Sophomore Stenography. (Combined Sophomores, Juniors, and Seniors 1940)

Variables Correlated with (1) Sophomore Stenography	Coefficient of Correlation	Number of Cases
(3) Average Gr. 9 Mark	$r_{1.3} = .64 \pm .04$	93
(2) Freshman English	$r_{1.2} = .52 \pm .06$	93
(4) Jr. Bus. Training	$r_{1.4} = .40 \pm .07$	67
(5) I.Q.	$r_{1.5} = .375 \pm .067$	75
(7) Prognostic Mark	$r_{1.7} = .30 \pm .06$	95
(6) Chronological Age	$r_{1.6} = .21 \pm .04$	94

The results of the zero order correlations in the various subjects for the combined sophomore, junior, and senior class of 1940 are found in Table IV. Undoubtedly the results in Table IV are more reliable than any of the others due to the fact that in all cases the number of pupils is more than four times as many as in the preceding correlation tables. Here we find that the most significant correlation exists between the Average Grade 9 Mark and Sophomore Stenography which has a correlation of .64. Probably Freshman English is the best single subject determinant for we find here that, with 93 pupils, the correlation between the Sophomore Stenography mark and the Freshman English mark is .52 with a probable error of only .06. Junior Business Training with a correlation of .40, while significant, presents a less reliable aspect in that the number of cases available for study were considerably fewer than the two correlations previously mentioned. While the correlations between the I.Q. and Sophomore Stenography, the Prognostic Mark and Sophomore Stenography, and Chronological Age and Sophomore Stenography are reliable from the standpoint that the correlations are four times their probably error, they would not be considered as significant due to the fact that .40 is usually the lowest significant correlation used in prediction.

In summary, taking the three classes together the best single determinants of stenographic ability are:

(a) Average Grade 9 mark ----r = .64

(b) Freshman English --------r = .52

(c) Junior Business Training-r = .40

(2) Multiple Correlations of Two Variables:

TABLE V

Multiple Correlation of Two Variables with Grades in Sophomore Stenography.

Combination of Variables Correlated with Grades in Sophomore Stenography		Coefficient of Correlation
Freshman English	Av. Gr. 9 mark	$r_{1.23} = .68$ *
Av. Gr. 9 mark	Chronological Age	$r_{1.36} = .64$
Freshman English	Chronological Age	$r_{1.26} = .63$
Av. Gr. 9 mark	I.Q.	$r_{1.35} = .627$
Av.Gr. 9 mark	Jr. Bus. Training	$r_{1.34} = .626$
Freshman English	Jr. Bus. Training	$r_{1.24} = .62$
Av. Gr. 9 mark	Prognostic mark	$r_{1.37} = .62$
Freshman English	I.Q.	$r_{1.25} = .61$
Freshman English	Prognostic mark	$r_{1.27} = .606$
Chronological Age	Prognostic mark	$r_{1.67} = .59$
Jr. Bus. Training	I.Q.	$r_{1.45} = .56$
Jr. Bus. Training	Prognostic mark	$r_{1.47} = .56$
Jr. Bus. Training	Chronological Age	$r_{1.46} = .55$
I.Q.	Prognostic mark	$r_{1.57} = .47$
I. Q.	Chronological Age	$r_{1.56} = .44$

* The numbers in the multiple correlation symbol designate the variables according to the following system: 1-sophomore stenography; 2-freshman English; 3-average grade 9 mark; 4-junior business training; 5-I.Q.; 6-Chronological age; 7-prognostic mark

Table V lists the multiple correlations of all possible combinations of the predictive factors, taken two at a time, with Sophomore Stenography. We find that Freshman English and Average Grade 9 mark when combined with Sophomore Stenography has a slightly higher correlation than the highest zero correlation. Combinations of Average Grade 9 mark and Chronological Age and Freshman English and Chronological Age combined with Sophomore Stenography, are no higher than the highest zero order correlation. From Table V it is evident, therefore, that the highest correlations are found to be:

(a) Freshman English and Average Grade 9 mark-r = .68

(b) Average Grade 9 mark and Chronological Age-r= .64

(c) Freshman English and Chronological Age ----r= .63

However, since we have discovered that the zero order correlation between Average Grade 9 mark and Sophomore Stenography is .64 and the highest multiple correlation is .68, it is doubtful if it is worthwhile to consider multiple correlations in prediction of stenographic ability.

A condensed summary of the entire findings will be found in Chapter V.

CHAPTER V

SUMMARY OF PROBLEM AND CONCLUSIONS

CHAPTER V

SUMMARY OF PROBLEM AND CONCLUSIONS

1. Purpose of Study: The purpose of this study was to attempt to see if the Hoke Prognostic Test was, in any way, an indicator of a student's ability to take Sophomore Stenography in the Brattleboro, Vermont high school, and, if not, if there were any other factors which could reliably be used as an indicator.

2. Best Single Factors: The several zero order correlations between the various possible factors and Sophomore Stenography were listed in Chapter IV (Tables I-IV). These considered each of the three classes (Sophomores of 1940, Juniors of 1940, and Seniors of 1940) individually and then as a combined whole. From the zero order correlations we conclude that the best single factors in the prediction of success or failure in Sophomore Stenography are those listed in Table VI.

TABLE VI

Best Single Factors in Prediction or Success or Failure in Sophomore Stenography.

Predictive Factors	Coefficient of Correlation with (1) Sophomore Stenography	Number of Cases
(3) Average Grade 9 mark	$r_{1.3} = .64 \pm .04$	93
(2) Freshman English	$r_{1.2} = .52 \pm .06$	93
(4) Junior Bus. Training	$r_{1.4} = .40 \pm .07$	67

3. Best Combination of Several Factors: In order to determine whether any combinations of these factors have greater predictive value than any single factor, multiple correlations were computed, correlations of all the factors being taken two at a time with Sophomore Stenography.

TABLE VII

Best Combinations of Two Factors in Prediction of Success or Failure in Sophomore Stenography.

Combination of Two Factors		Coefficient of Multiple Correlation with (1) Sophomore Stenography.
(2) Freshman English-	(3) Average Grade 9 mark	$r_{1.23} = .68$
(3) Av. Gr. 9 Mark -	(6) Chronological Age	$r_{1.36} = .64$
(2) Freshman English-	(6) Chronological Age	$r_{1.26} = .63$

4. Summary of Conclusions: The following generalizations can be made from the two tables listed in this chapter:

(a) The Hoke Prognostic Test can not be used as a reliable measure of one's ability to succeed in Stenography.

(b) In predicting success in Sophomore Stenography, the best single factor is Average Grade 9 Mark; Freshman English is the next best factor, and Junior Business Training is the third choice.

(c) In predicting success in Sophomore Stenography, the best combination of two factors is Freshman English and Average Grade 9 Mark; Average Grade 9 Mark and Chronological Age; and Freshman English and Chrono-

logical Age.

(d) Since the highest single factor in predicting success in Sophomore Stenography was Average Grade 9 Mark with a zero order correlation of .64 and since the only two factor combination with a higher correlation than the highest zero order correlation was Freshman English and Average Grade 9 Mark with a correlation of .68, it would appear that there is little advantage in using two factors instead of one.

APPENDICES

PROGNOSTIC TEST
of Stenographic Ability

Arranged by
ELMER R. HOKE, PH. D.

Name.....Date.....19.....

Age last birthday.....years. Next birthday will be.....19.....

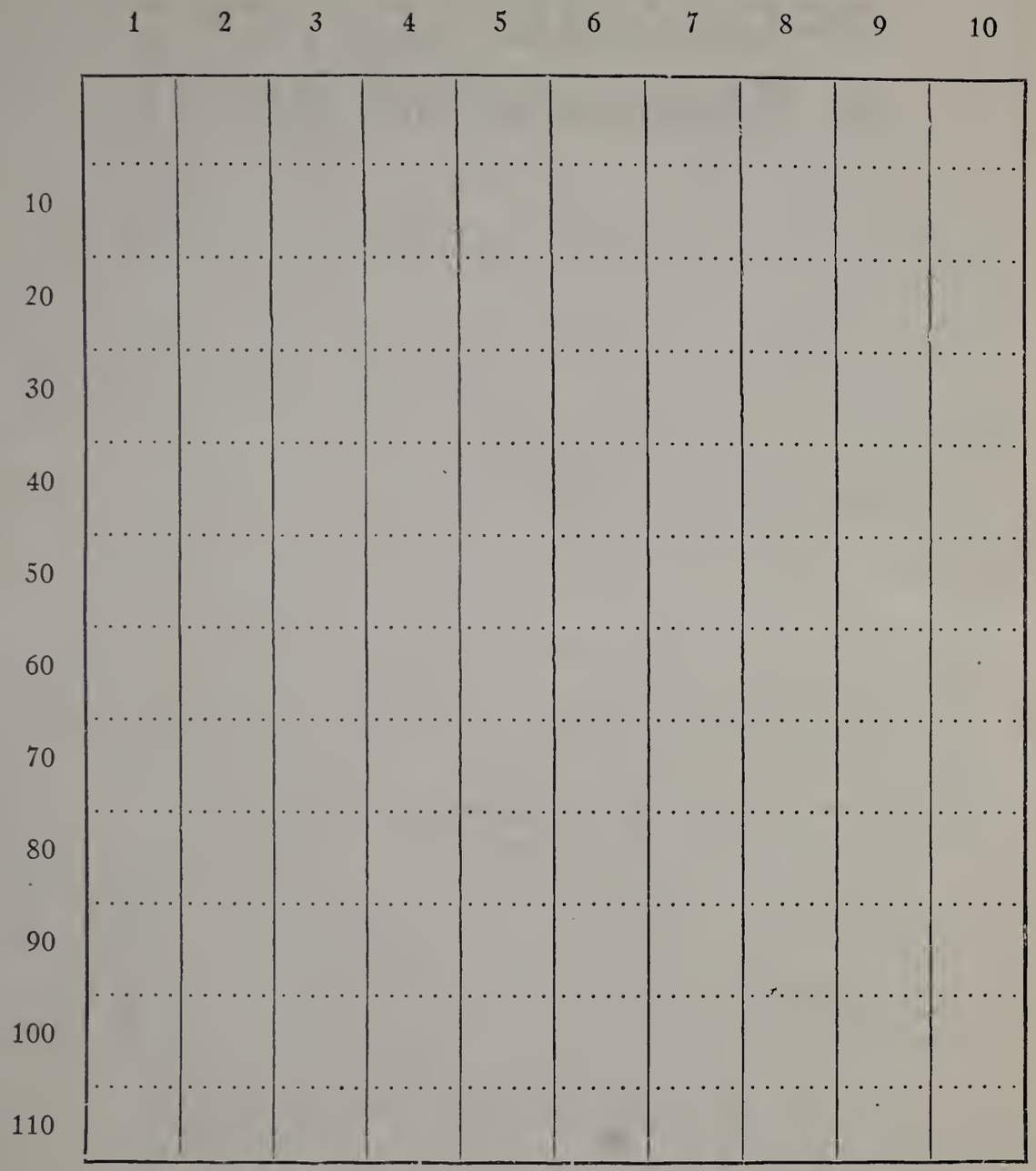
Grade or class.....City.....State.....

School.....Teacher.....

How long have you studied shorthand?.....weeks. Typewriting?.....weeks

Test	Score	Remarks
1. Motor Reaction		
2. Speed of Writing		
3. Quality of Writing		
4. Speed of Reading		
5. Memory		
6. Spelling		
7. Symbols		
Total		

TEST 1



Score 1 (.....)

TEST 2-3

Mary had a little lamb,
Its fleece was white as snow.
And everywhere that Mary went,
The lamb was sure to go.

Score 2. Speed (.....)

Score 3. Quality (.....)

TEST 4

The word "efficient", as commonly used, is such an (declare, elastic) term that perhaps Webster's view of it may help (an, us) in formulating a standard of comparison in the present (remember, discussion). His definition of "efficient" is: "Causing effects; producing results; (not, six) inactive, slack or incapable; characterized by energetic and useful (relative, activity)."

In order to understand fully the conditions which confront (did, the) stenographer who would be classed among the "efficient", let (my, us) consider for a moment the present-day demands.

As (American, remember) business has grown in complexity, under the influence of (wonderful, expansion), from trade of a purely local nature to that (us, of) world-wide extent, the demands laid upon stenographers have (land, also) increased in complexity, and the efficient stenographer of today (must, come) include in his equipment far more than was required (ten, you) or even five years ago. And it may be (themselves, mentioned) in passing that while expansion of trade was inevitable (go, to) a people imbued with the spirit of enterprise as (Americans, statement) are, yet it has been greatly facilitated and hastened (through, arrange) the instrumentality of modern shorthand and the typewriter. Business (men, bad) of executive ability and imagination have been able to (although, multiply) themselves through the aid of these twin arts, and (it, to) handle to-day a volume of business that would have (been, good) impossible with the old-time methods.

Business men were (crowd, quick) to appreciate the value of the stenographer, and have (been, firm) responsible for his development from a sort of "luxury" (at, or) "fad" into one of the most efficient aids in (a, I) modern business organization. The stenographer of today is not (progress, occupied) wholly with typing out the letters which the firm (sends, since) to the outside world, though of course this comprises (a, an) large part of his daily work, but the interhouse (difficulty, correspondence) in which the heads of this business dictate orders (try, and) instructions to its various branches, and to its traveling (sales. await) force, calls for a technical knowledge of the business (that, fern) goes far outside the mere business of writing shorthand (can, and) typing it on the machine. A large part of (these, never) instructions are made up from form books; they require (it, a) checking and following up and a collecting of material (into, that) lays upon the stenographer duties calling for ability of (in, a) different kind from that of merely following orders. As (the, out) stenographer's ability to grasp details from a few meager (instructions, president) increases, his importance and value to the firm also (increases, conference).

The really efficient stenographer in modern business to-day can (handle, really) a great deal of the correspondence from a few (beginning, directions) from his employer. He becomes acquainted with the policy (of, do) the house, studies his employer's way of handling problems (service, through) correspondence, is able to give the personal touch to (the, say) firm's correspondence that the head of the firm himself (would, judge) give. His work becomes truly "characterized by energetic and (intend, useful) activity." He must be acquainted with the new card (enclose, records) filing systems, and office practice generally, and this involves (is, a) far more intricate knowledge than is commonly supposed.

Recent (consider, economic) influences have brought about also vast changes in the (methods, receive) of record keeping and in handling the transactions of (business, feature), with which the efficient stenographer must be thoroughly familiar, (because, support) they require his services.

Typewriter companies have added new (government, attachments) to their machines which make them far more useful, (but, red) which also make necessary more knowledge and greater technical (child, skill) on the part of the stenographer. Brief as are (these, could) references, they give an idea of the complexity of (too, the) commercial stenographer's need for special knowledge to enable him (to, a) render efficient service.

Score 4. A-2W (.....)

TEST 5

Score 5. (.....)

TEST 6

1.	develope	develop	31.	discussion	discusion
2.	proceed	procede	32.	expierence	experience
3.	judgment	judgement	33.	mere	mear
4.	victim	victum	34.	majority	majarity
5.	arrangment	arrangement	35.	examination	examanation
6.	recommend	reccommend	36.	particular	perticular
7.	sacrament	sacriment	37.	convenient	convennient
8.	beginning	begining	38.	especialy	especially
9.	improvment	improvement	39.	committee	committie
10	alledge	allege	40.	emmergency	emergency
11.	preliminary	preliminery	41.	extream	extreme
12.	sincerly	sincerely	42.	considuration	consideration
13.	foreign	foriegn	43.	elaborate	elaberate
14.	Difference	differance	44.	desicion	decision
15.	session	sesion	45.	cordially	cordialy
16.	vollume	volume	46.	referrence	reference
17.	opinion	oppinion	47.	abscence	absence
18.	disapoint	disappoint	48.	entitle	entitel
19.	seperate	separate	49.	official	oficial
20.	aggrement	agreement	50.	divide	devide
21.	neither	niether	51.	asociation	association
22.	ambition	embition	52.	relief	releif
23.	consern	concern	53.	fineally	finally
24.	wheather	whether	54.	circumstence	circumstance
25.	aplication	application	55.	circuler	circular
26.	unfortunate	unfourtunate	56.	afair	affair
27.	goverment	government	57.	certian	certain
28.	believe	beleive	58.	marrage	marriage
29.	organization	orgenisation	59.	serrious	serious
30.	atheletic	athletic	60.	principle	principel

Score 6. (.....)

TEST 7

1=d 2=g 3=x 4=f 5=j 6=c 7=k 8=m 9=b 0=r

1..... 2..... 3..... 4..... 5..... 6..... 7..... 8..... 9..... 0.....

2..... 3..... 0..... 5..... 8..... 4..... 6..... 9..... 1..... 7.....

7..... 5..... 1..... 2..... 0..... 3..... 6..... 4..... 8..... 9.....

4..... 3..... 9..... 6..... 0..... 1..... 5..... 2..... 7..... 8.....

0..... 2..... 8..... 4..... 6..... 3..... 7..... 5..... 1..... 9.....

8..... 1..... 7..... 9..... 4..... 2..... 0..... 6..... 5..... 3.....

3..... 7..... 4..... 0..... 1..... 9..... 6..... 8..... 2..... 5.....

9..... 6..... 1..... 4..... 8..... 0..... 3..... 5..... 2..... 7.....

2..... 4..... 9..... 5..... 7..... 1..... 6..... 0..... 3..... 8.....

5..... 8..... 3..... 0..... 2..... 4..... 9..... 1..... 7..... 6.....

6..... 1..... 7..... 4..... 9..... 2..... 5..... 3..... 0..... 8.....

1..... 9..... 5..... 3..... 8..... 4..... 6..... 2..... 7..... 0.....

4..... 2..... 0..... 7..... 3..... 9..... 1..... 5..... 6..... 8.....

6..... 8..... 1..... 9..... 2..... 5..... 3..... 0..... 4..... 7.....

0..... 2..... 7..... 6..... 4..... 9..... 3..... 1..... 5..... 8.....

3..... 6..... 8..... 5..... 2..... 7..... 9..... 1..... 0..... 4.....

9..... 3..... 5..... 2..... 8..... 0..... 1..... 4..... 6..... 7.....

5..... 3..... 0..... 7..... 2..... 6..... 8..... 4..... 9..... 1.....

7..... 0..... 2..... 6..... 3..... 9..... 8..... 4..... 1..... 5.....

2..... 6..... 3..... 8..... 0..... 5..... 1..... 4..... 7..... 9.....

Score 7. (.....)

APPENDIX A

Sample Hoke Prognostic Test

APPENDIX B

Sample Data Card

(Pupil Number 1)

I.Q.----------119

Prognostic Mark----------518.5

C.A.----------14

Average Grade 9 Mark----------94

Freshman English----------93

Junior Business Training-------93

Sophomore Stenography Mark-----93

APPENDIX C

Sample Zero Order Correlation[1].

Scatter Diagram

Sophomore Stenography

Average Grade 9 Mark

	60	64	68	72	76	80	84	88	92	f	d	fd	fd^2	Exy
93							II		III	5	4	20	80	64
90						II		IIII	I	8	3	24	72	51
87						I	II	II	I	6	2	12	24	30
84				IIII	IIII	IIII	IIIII	I		21	1	21	21	17
81			I	IIII	IIII	IIII	III			18	0	0	0	0
78	I		I	IIII	I	II	IIII		I	14	-1	-14	14	-4
75			I	III	II			I		7	-2	-14	28	4
72			I	III	II	I	I	I		9	-3	-27	81	-3
69			I	I				I		3	-4	-12	48	8
66		I	I							2	-5	-10	50	60
f	I	I	6	19	15	15	19	11	6	93		0	418	227
d	-4	-3	-2	-1	0	1	2	3	4		Summations			
fd	-4	-3	-12	-19	0	15	38	33	24	72				
fd^2	16	9	24	19	0	15	76	99	96	354				

1. Tiegs, Ernest W. and Crawford, Claud C. "Statistics for Teachers" Houghton Mifflin Company (1930) vii + 212, Correlation, pp156-162. Boston.

APPENDIX C

(Continued)

Formula and Computations

$$cx = \frac{72}{93} = .774$$

$$cx^2 = .599$$

$$cy = \frac{0}{93} = 0$$

$$cy^2 = 0$$

$$cxcy = 0$$

$$\sigma x = \sqrt{\frac{354}{93} - .599} = 1.79$$

$$\sigma y = \sqrt{\frac{418}{93} - 0} = 2.12$$

$$\sigma x \sigma y = 3.80$$

$$r = \frac{\frac{\Sigma xy}{n} - cxcy}{\sigma x \sigma y}$$

$$r = \frac{\frac{227}{93} - 0}{3.80}$$

$$r = .64$$

$$P.E. = \frac{.6745\ (1-r^2)}{\sqrt{n}}$$

$$P.E. = \frac{.6745\ (1-\ (.64)^2)}{\sqrt{93}}$$

$$P.E. = .04$$

APPENDIX D

List of Zero Order Intercorrelations Used in Multiple Correlations

Variables Correlated	Correlation Coefficient	Prob. Error
(2) Freshman English ----- (3) Average Gr. 9 mark	$r_{2.3}$ = .84	.0328
(2) Freshman English ----- (4) Jr. Bus. Training	$r_{2.4}$ = .77	.060
(2) Freshman English ----- (5) I.Q.	$r_{2.5}$ = .56	.07
(2) Freshman English ----- (6) Chronological Age	$r_{2.6}$ = .06	.11
(2) Freshman English ----- (7) Prognostic Mark	$r_{2.7}$ = .55	.0768
(3) Average Gr. 9 mark ----- (4) Jr. Bus. Training	$r_{3.4}$ = .785	.0554
(3) Average Gr. 9 mark ----- (5) I.Q.	$r_{3.5}$ = .587	.07
(3) Average Gr. 9 mark ----- (6) Chronological Age	$r_{3.6}$ = -.131	.107
(3) Average Gr. 9 mark ----- (7) Prognostic Mark	$r_{3.7}$ = .57	.0745
(4) Jr. Bus. Training ----- (5) I.Q.	$r_{4.5}$ = .62	.0882
(4) Jr. Bus. Training ----- (6) Chronological Age	$r_{4.6}$ = -.27	.13
(4) Jr. Bus. Training ----- (7) Prognostic Mark	$r_{4.7}$ = .53	.104
(5) I.Q. ---------- (6) Chronological Age	$r_{5.6}$ = -.407	.0913
(5) I.Q. ---------- (7) Prognostic Mark	$r_{5.7}$ = .56	.075
(6) Chronological Age (7) Prognostic Mark	$r_{6.7}$ = .223	.104

APPENDIX E

Sample Multiple Correlation[2] of Two Independent Variables With Sophomore Stenography

(1) Sophomore Stenography	$r_{1.2} = .60$	$r_{1.2}^2 = .36$
(2) English (Freshman)	$r_{1.3} = .62$	$r_{1.3}^2 = .38$
(3) Average Grade 9 mark	$r_{2.3} = .84$	$r_{2.3}^2 = .70$

$$R_{1.23} = \sqrt{\frac{r_{1.2}^2 + r_{1.3}^2 - 2(r_{1.2}\, r_{1.3}\, r_{2.3})}{1 - r_{2.3}^2}}$$

$$= \sqrt{\frac{.36 + .38 - 2\,(\,.60 \times .62 \times .84)}{1 - .7}}$$

$$= \sqrt{\frac{.74 - 2\,(\,.31)}{1 - .7}}$$

$$= \sqrt{\frac{.74 - .62}{.3}}$$

$$= \sqrt{\frac{.14}{.3}}$$

$$= \sqrt{.467}$$

$$= .68$$

2. Croxton, Frederick E. and Cowden, Dudley J. Applied General Statistics, New York Prentice-Hall, Inc. 1939 xviii÷944 Multiple Correlation pp 770-772

BIBLIOGRAPHY

BIBLIOGRAPHY

PART I

ARTICLES

Ackerson, Luton "A Correlational Analysis of Proficiency in Typing", Achives of Psychology, Columbia University, 1926, No. 82.

Andrew, Dorothy "An Analysis of the Minnesota Vocational Test for Clerical Workers". J. Applied Psychology 21: 18-47, 139-72; 1937.

Bills, M.A., and Hammitt, C. "Present Status of Aptitude Testing for Clerical Positions in Industry". National Business Educational Quarterly 4: 26-30; March 1936.

Bradford, Lilah "Does Typing Ability Depend on Mentality or Dexterity?" The Journal of Business Education, December, 1930, p. 23.

Callanan, Grace H. "Procedure for Determining the Course for which Sophomore Pupils are Best Fitted", The Balance Sheet, March, 1937, p.306-307.

Davis, H. H. "Measurement in Commercial Education in the St. Louis Schools", University of Iowa Monographs in Education, First Series, No. 7, University of Iowa, July 1926, p. 43.

Easterbrook, Mabel and Vavra, Minnie A. "Factors Predetermining Success in Typewriting", Public School Messenger (St. Louis: Board of Education, May, 1924).

Flemming, Cecile W. "A Detailed Analysis of Achievement in High School". Contributions to Education, No. 196. Teachers College, 1926. 209p.

George, Guy, G. "The Prognostic Typewriting Tests Have Not Always Succeeded": The Trethaway Publishing Co., April, 1931.

Limp, Charles E. "Some Scientific Approaches Toward Vocational Guidance", Journal of Educational Psychology, Vol. 20, Oct. 1929, pp. 530-536.

Maller, J. B. "Age Versus Intelligence as a Basis for Prediction Success in High School". Teachers College Record 33: 402-15; 1932.

Miller, M. A. "Relation of the I.Q. to Success in Learning Typewriting", Curriculum Study and Educational Research Bulletin, III, 3, pp. 135-40.

Moore, Herbert "The Institute's Clerical Test in the Westinghouse Electrical Company". Human Factor 10: 221-24; 1936.

O'Rourke, L. J. "Scientific Personnel Selection in the United States Civil Service". Occupations 12: 29-39; April, 1934.

Puckett, Cecil "The Rank of the Inferior Student in Typewriting", The Balance Sheet (Cincinnati: South-Western Publishing Co., May, 1930), p. 262.

Ross, C. C., and Hooks, W. T. "How Shall We Predict High School Achievement?" J. Educational Research 22: 184-95; 1930.

Stedman, M. B. "A Study of the Possibility of Prognosis of School Success in Typewriting", Journal of Applied Psychology, XIII, pp. 505-75.

Stedman, M. B. "Factors Influencing School Success in Bookkeeping", J. Applied Psychology, Vol. 14, Feb. 1930, pp.74-82.

Thurstone, L. L. "Standard Tests for Office Clerks", Journal of Applied Psychology, 3: 248-251, Sept., 1919.

BIBLIOGRAPHY

PART II

BOOKS

Allen, Frederick J. Practices in Vocational Guidance (New York, McGraw-Hill Book Company, 1927), Chapter XIV.

Croxton, Frederick E., and Cowden, Dudley J. Applied General Statistics New York Prentice-Hall, Inc. 1939 xviii + 944 Multiple Correlation pp 770-772.

George, Guy G. The Relationship Between Maze Learning and Typewriting Learning. Master's Thesis, 1930, Sanford University.

Johnson, C. L. The Validity of Certain Tests to Prognosticate Typewriting Ability. Master's Thesis, 1925, State University of Iowa.

Munroe, Walter S. Encyclopedia of Educational Research, The Macmillan Company, February 1941.

Rugg, H. O. Statistical Methods Applied to Education p.256, Boston, Houghton Mifflin Co., 1917.

Ruggles, A. W. A Diagnostic Test of Aptitude for Clerical Office Work, p.15 and 18.

Tiegs, Ernest W. and Crawford, Claud C. Statistics for Teachers Houghton Mifflin Co., 1930 vii+212, Correlation, pp156-162, Boston.

BIBLIOGRAPHY

PART III

TESTS

Hoke, E. R. "Prognostic Test of Stenographic Ability" (New York: Gregg Publishing Company).

Terman, L. M. "Terman Group Test of Mental Ability" (Yonkers, New York: World Book Company).

Tressler, J. C. "Grammar Minimum Essentials Mastery Test" (Boston: D. C. Heath).

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