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# Methods of Improving the Handwriting Ability of Commercial Students in Order to Meet the Demands of Various Vocations

D. Clyde Beighey

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METHODS OF IMPROVING THE HANDWRITING ABILITY OF  
COMMERCIAL STUDENTS IN ORDER TO MEET THE  
DEMANDS OF VARIOUS VOCATIONS

BY

D. GLYDE BEIGHEY



A DISSERTATION SUBMITTED TO THE GRADUATE COMMITTEE IN  
PARTIAL FULFILLMENT OF THE REQUIREMENTS  
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CHAPTER I  
INTRODUCTION

Importance of this study.

"Handwriting is the life and soul of commerce and correspondence; by the practice of it we manage our affairs at the greatest distance, with all the secrecy and satisfaction imaginable. It is the messenger of the thoughts and the key to the liberal arts and sciences. Speaking, in short, is vocal thought only; thinking is nothing more than silent speech; but writing is the image or character of them both."--Anonymous.

The above quotation expresses in a striking manner the importance of handwriting as a means of expression of ideas. It is, of course, evident that handwriting is used almost as universally for expressing thought as is speech. The utilitarian value of handwriting to every individual in the home, in school, and in the business office ranks it of major importance among the school subjects. Handwriting also plays an essential part in almost every subject that is taught in the public

schools. Its value as a tool in school is even greater than in the business world or society because of its constant use and wide application to other school subjects. In the business office it does not undertake to compete with the typewriter or other mechanical appliances since these are intended primarily for volume production. Mechanical appliances do, however, accomplish the desired object--that of legibility and speed. The lack of these essentials in handwriting results in a loss of time in reading and writing on the part of both teacher and pupil.

A good style of handwriting seems to be in greater demand today than ever before, notwithstanding the many mechanical appliances which are intended to take its place, but which have in reality only relieved it of its drudgery. From present indications, a good, rapid style of handwriting will be in even greater demand in the future than it is today. Many large corporations are stressing plain, practical handwriting; they are also endeavoring to show their employees why carelessness on their part in writing figures might result in serious losses.

Hoffhines (1) states;

"You will be interested in knowing that between 12 and 15 per cent of those who apply for positions are rejected because they cannot write legibly. Between 15 and 20 per cent of the people that are employed are good penmen."

In the business world, the loss of time can be measured in dollars and cents. The Indianapolis Post Office officials stated that illegible handwriting is the cause of approximately one-fourth of the total number of dead letters. (Dead letters are made up of three classes: (1) those with no address; (2) those with insufficient address; and those (3) with illegible addresses.) The Dead Letter Department of the Indianapolis Post Office requires the entire time of seven clerks whose annual salaries total approximately \$14,000. Much of this waste of time and money could be eliminated by proper instruction on the fundamentals of handwriting.

Statement of the problem.

The problem involved in this investigation is that

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(1) Hoffhines, Glenn, Harris Trust and Savings Bank, Chicago, Ill., "Practical Penmanship from a Practical Point of View", Report of the National Association of Penmanship Teachers and Supervisors, Chicago, Illinois, April 25, 1928, p. 31.

of providing a scientific method of improving the handwriting ability of commercial students in order to meet the demands of the various vocations. Much time is wasted in handwriting instruction through the common method of teaching the subject, instead of teaching the special activities through which skill in handwriting is developed. In a typical classroom, the pupils exhibit a wide range of ability in handwriting. The question naturally arises: Why should we instruct the student, day after day, in general handwriting, without recognizing and providing for the overcoming of individual faults?

It is clearly a waste in education to require pupils to reach standards of excellence beyond those which are demanded by business executives as being reasonable and adequate. If reasonable standards have been attained, there is then some justification for the promotion of pupils to a higher class in handwriting or for exempting them from further formal lessons in handwriting. On the other hand, if the handwriting of commercial students is below the required standard, intensive exercises and drills should be given, in order to bring the handwriting up to the standards demanded by business executives.

In providing methods for improving the handwriting ability of commercial students to meet the demands of various vocations, a radical departure has been made from the ordinary method of conducting handwriting classes. Faults of individual students have been analyzed and an effort has been made to overcome these defects.

Source of data.

Since no standards of handwriting have ever been established for the different vocations, the only method of approach lies in getting the opinions of office and employment managers as to the quality of handwriting that is necessary for holding successfully the various positions under their control.

With this object in mind, a questionnaire was prepared and presented to the executives of forty-eight representative firms of the city of Indianapolis, Indiana, whose employees had duties the nature of which required much handwriting with pen or pencil. Many facts were obtained by this questionnaire which might be used as a basis for establishing adult standards in handwriting which would conform with the requirements of both high school students and office employees. Specimens of

handwriting were also received which were intended to represent the average type of handwriting of the various positions being considered.

Handwriting tests were given to all beginning high school commercial students. The specimens of handwriting of these tests were analyzed in order to determine the difficulties of each student. These difficulties were recorded on a chart (for sample copy see Appendix, page 88) and the results of this analysis served as a basis for the remedial work which was to follow.

In order to judge more intelligently the special abilities and needs of individual students, it was necessary to determine the amount of training they had received in handwriting before entering high school, where the training had been received, certificates and medals received, age, and, if possible, the actual cause of the handwriting's being good or poor. This information is revealed by a questionnaire (for sample copy see Appendix, page 90) which was filled out by each student. It was thought that the questionnaire would present many useful facts and opinions which would aid in providing remedial exercises for both class and individual instruction.

An independent investigation was conducted by the writer, during the school year of 1927-28, while engaged as Director of Handwriting in the elementary grades of the Indianapolis Public Schools. The aim of this independent investigation was to determine the status of handwriting ability of pupils in the Seventh and Eighth Grades. It was believed that if beginning high school commercial students received their elementary training in the public schools of Indianapolis (this information could be obtained from the questionnaire previously referred to), the status of handwriting in the Seventh and Eighth Grades would throw some light upon the status of handwriting of beginning high school commercial students.

#### Procedure.

The material and findings of this investigation in handwriting are the result of experimentation and study with one hundred and thirty-eight (138) beginning commercial students of the Emmerich Manual Training High School of Indianapolis, Indiana, and covers a period of one semester, from September, 1928, to February, 1929. At the beginning of school in September, 1928, all students were given a formal handwriting test. The specimens of

handwriting of this test were scored with the Ayres Handwriting Scale (2), by five different teachers of handwriting. Since the wide-spread belief exists that students do not write as well in other written lessons as they generally do in formal handwriting lessons, the cooperation of the English teacher was enlisted and essays or compositions were collected from every student whose handwriting was being considered. These papers were likewise scored by the same scorers, and medians were obtained for both sets of papers from the standpoint of speed (rate of writing) and form.

The kind of instruction during the period of this investigation varied somewhat from the usual method of instruction in the ordinary handwriting class. After faults had been determined, each student was told what his chief difficulties were; students were then grouped in rows in classrooms according to the predominant errors found, and a remedial program was set up which was designed to remedy different kinds of defects. Attention was constantly directed toward defects in handwriting

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(2) Ayres, Leonard P., "Measuring Scale for Handwriting", Russell Sage Foundation, New York, 1915.



through blackboard illustrations. The length of time devoted to handwriting practice was forty-five minutes each day, five days per week. Part of each day's lesson, generally the last ten minutes, was correlated with spelling by practicing upon the most frequently misspelled words taken from the 100% Speller (3). This list of words is taken from the 1,000 most commonly used words as determined by Ayres (4). It was believed that if the most frequently malformed letters and combinations (pairs of letters) could be determined from students handwriting, these letters and combinations would likewise appear very frequently in the lists of most commonly used words, which had been determined by scientific research. Accordingly, time spent on these words should also improve ability in spelling, and instruction would become more effective. This remedial work was carried on because of the wide range of ability that exists in the average handwriting class. Some students display extraordinary skill in one or more of the special skills which make up the total of

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3. Cody, Sherwin, "100% Speller", Revised Edition, The Business Ability Institute, Rochester, N. Y., 1922, 94 p.
  4. Ayres, Leonard P., "Measuring Scale for ability in Spelling", Russell Sage Foundation, N. Y. City, 1915.

handwriting ability, while they are equally poor in certain other skills. Healey (5) thinks that the high school writing teacher should do a great deal of work with individual students in order to find out each pupil's needs and then prescribe the proper exercises to fit those needs.

An analysis was then made in order to determine the particular letters which are malformed, or poorly made, as well as the comparative frequency of these malformations, with a view to adapting group or individual instruction toward those letters which are definitely known to interfere with legibility. It was thought that the evidence received from this analysis would be helpful in the way of concentrating instruction on those confusing forms which each student habitually makes over and over again.

After pupils had received remedial instruction for one semester, samples of handwriting were again obtained (about February 1, 1929), both in the formal handwriting class and in the English class. Papers from the formal handwriting class were again scored by the same scorers for speed (rate of writing) and quality. The other

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5. Healey, Horace G., "Penmanship in Business High Schools", N. E. A. Proceedings, 1916, p 165.



elements which are intended to improve speed and quality were not considered. These elements referred to are shown in the Chart for Analyzing Faults in Handwriting, in the Appendix, and are the direct cause of the increase or decrease in speed or quality, if such an increase or decrease is shown. Handwriting of the English papers was scored for quality only, since English teachers did not time the writing of the papers, and students did not know that a test was being taken. The quality of handwriting would therefore be a true test of ordinary, everyday handwriting. Medians were obtained for speed and quality of the papers from the formal handwriting classes, and comparisons were made with the medians found in September, 1928. Comparisons were also made with standards that had been previously set up by the executives of the forty-eight representative firms, in establishing standards for vocational purposes.

Literature on the subject.

Many scientific reports dealing with handwriting have appeared in the leading educational magazines since 1910. These reports deal chiefly with psychological and pedagogical problems such as the following:- Lefthandedness, arm movement, proper position, speed of handwriting,

rhythm, influence of speed upon quality, influence of quality upon speed, acquisition of motor control, size of handwriting, experiments in supervision, vertical writing and manuscript or print writing. Numerous articles have also appeared explaining the methods employed in the construction of scales, the results of surveys, and the establishing of correct standards. While these articles are intended to establish correct habits in handwriting, they do not furnish any evidence which is directly related to the problem involved in this investigation.

An experimental application of a diagnostic plan in handwriting has been made by West (6). This plan was applied in practical school situations under rigid experimental conditions and was found to be remarkably effective. As a result of this application of a diagnostic plan, the author states:

"There is a wide-spread conviction that much more time is commonly spent on handwriting than the results justify, and that much of the teaching energy put forth is relatively fruitless. The saving of

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(6) West, Paul V., "An Experimental Application of a Diagnostic Plan in Handwriting", *Journal of Educational Research*, Vol. 14, p. 187-98, Oct., 1926.

time which is insured by the proper use of a diagnostic plan, will be welcomed by administrators and instructors." (7)

Another investigation has been made by Pressey and Pressey (8) of the illegibilities that occur in the handwriting papers of three hundred school children of Grades III to VI from three different schools in two different school systems, one hundred and fifty papers from Grades VII and VIII of a junior high school, and approximately two hundred papers from college students. In this report the authors state that most of the elementary school papers came from schools using the Natural System of Penmanship. Since all of the most widely used systems of penmanship have been in use before the first scientific investigation was begun along the line of handwriting by Thorndike in 1910 (9), it is doubtful if any safeguards have been set up in the earlier systems of penmanship to prevent the malformation of letters. A careful exam-

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- (7) West, Paul V., "Remedial and Follow-up Work", Public School Publishing Co., Bloomington, Ill., 1926.
- (8) Pressey, Luella C. and Pressey, Sydney L., "Analyses of Three Thousand Illegibilities in the Handwriting of Children and of Adults", Educational Research Bulletin, Ohio State University, September 28, 1927, p 270-273.
- (9) Thorndike, Edward L., "Handwriting", Teachers College Record, Columbia University, Vol. II, 1910, p 57.

ination of the most widely used systems now in use, (the Zaner System (10) published in 1906, the Palmer System (11) published in 1908, and the Graves System (12) published in 1920) does not reveal that any safeguards have been set up to prevent illegibilities other than to call attention to particular parts of letters which seem difficult to execute. The investigation carried on by Pressey and Pressey arrives at definite conclusions in regard to letters which are most frequently malformed, after elementary school children have practiced from the Natural System of Penmanship. The authors state:

"A comparison of the different systems and methods of teaching handwriting in regard to the extent to which they prevent illegibilities would also seem advisable. Many of these malformed letters were in pairs of letters which in combination caused trouble." (13)

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- (10) Zaner Method Writing, "Compendiums for Grades I to VIII", The Zaner-Bloser Co., Columbus, O., 1906.
  - (11) Palmer Method of Business Writing, "Writing Lessons for the Grades", A. N. Palmer Co., Cedar Rapids, Iowa, 1908.
  - (12) Muscular Writing, "Course of Study for Grades I to VIII", W. S. Benson Co., Austin, Texas, 1920.
  - (13) Pressey, Luella C. and Pressey, Sydney L., op. cit.

Since the Graves System of Muscular Writing (14) is the system of handwriting which was officially adopted for use in the elementary schools of Indiana and which has been in use since 1924 (15), this investigation would afford the opportunity of determining whether differences in pupil's handwriting, after their practicing from different systems, is a contributing factor in causing and preventing different malformation of letters. This would be determined by noting the differences in the frequencies of the malformed letters. It would also afford the opportunity of determining what pairs of letters used in combinations caused the most trouble.

Restatement of the problem.

The problem involved in this investigation is that of providing a scientific method of improving the handwriting ability of commercial students in order to meet the demands of various vocations. This problem arises because of (1)the demands of business executives for better handwriting and (2)the apparent failure of the public schools

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(14) Muscular Writing, op. cit.

(15) Minutes of the State Board of Education, Vol. 9, p. 59, May 26, 1924, Office of the State Sup't. of Public Instruction, Indianapolis, Indiana

to provide sufficient training to meet those demands. Methods have been provided in this investigation for individual instruction which have not hitherto been given.



CHAPTER II  
DETERMINATION OF STANDARDS OF HANDWRITING  
FOR VOCATIONAL PURPOSES.

To determine the standards of handwriting for vocational purposes, questionnaires (for sample copy see Appendix, page 89) were received from forty-eight executives of forty-eight representative firms of the city of Indianapolis, Indiana. Executives were very willing to cooperate. Specific answers were received which serve to help establish standards. The statement was frequently made that the handwriting of many of their best employees was not satisfactory, but that they were being retained in spite of their poor handwriting because of other good qualities which they possessed, or because it is impossible to get other well qualified employees to take their places. Considering these statements alone, it appears that the presence of persons employed in different vocations is not always positive proof that their

handwriting is sufficient for their particular vocations.

The particular types of business executives who were interviewed ranged from retail and department store managers to office managers of large manufacturing companies. The Ayres Handwriting Scale (1) was shown to each executive who then expressed his opinion as to the style of handwriting that was necessary for holding successfully the various positions under his control. A total of 1804 papers was received which represented the handwriting of all of the various vocations. The quality of the handwriting of each paper was determined by finding the quality of handwriting on the Ayres Scale which most nearly corresponded with that of the sample being scored. Papers of a quality between any two scores on the Ayres Scale were given a middle value; e.g., those better than 20 but not equal to 30 were given a value of 25. After all the papers had been scored, it was found that

2 papers had a value of 95,  
5 papers had a value of 90,  
18 papers had a value of 85,

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(1) Ayres, Leonard P., "Measuring Scale for Handwriting", Russell Sage Foundation, New York City, 1915.

42 papers had a value of 80,  
 110 papers had a value of 75,  
 131 papers had a value of 70,  
 200 papers had a value of 65,  
 237 papers had a value of 60,  
 310 papers had a value of 55,  
 250 papers had a value of 50,  
 177 papers had a value of 45,  
 151 papers had a value of 40,  
 97 papers had a value of 35,  
 47 papers had a value of 30,  
 23 papers had a value of 25,  
 4 papers had a value of 20.

A distribution of these scores is shown by Figure 1.

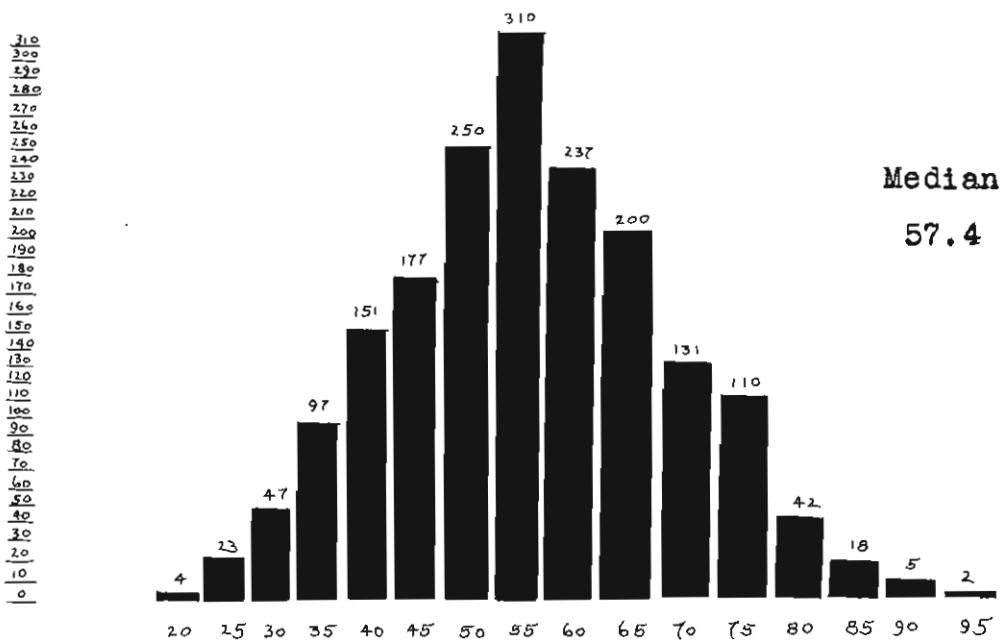


FIGURE 1.

THE DISTRIBUTION OF SCORES OF 1804  
 HANDWRITING PAPERS RECEIVED FROM  
 VARIOUS VOCATIONS, SCORED FOR QUALITY.

Table I shows the median of quality that was desired for each vocation and the number of people employed in the various vocations. Differences in the median of quality for the entire group, 60.9, as shown in Table I, and the median of quality for the entire group, 57.4, as shown in Figure 1, page 19, are to be expected, since executives usually set a higher standard for work than that which is actually received.

TABLE I  
SHOWING MEDIAN OF QUALITY DE-  
SIRE FOR EACH VOCATION.

Vocation	Replies rec'd. on each voca- tion.	People Employed	Median of Quality Desired.
Hand Addressers	39	60	80
Accountants	33	39	76
Bank Clerks	7	138	70
Cost Clerks	13	34	68
General Clerks	39	312	66
Stock Clerks	26	47	65
P. O. Clerks	10	224	64
Invoice Clerks	43	172	62
Salesmen	19	58	60
Dep't. Store Clerks	4	680	56
Telephone Operators	33	62	52
Messengers	42	68	46
<b>Totals</b>	<b>308</b>	<b>1894</b>	<b>60.9 Median</b>

The amount of speed necessary for handwriting is found to vary with the particular type of vocation. A rapid rate of speed was required of department store clerks, telephone operators, hotel clerks, railway clerks, employed in the shipping department, and post office employees in the money order department. A rapid rate of speed seemed necessary in almost all cases where the employee met the public. Only a moderate rate of speed was required of accountants, bank clerks, cost clerks, and hand addressers. It was generally agreed that speed is an important element in handwriting. Slow writing was condemned as being a waste of time and money. In the majority of cases, executives agreed that a moderate rate of speed is adequate, providing the quality is good. Quality was desired in preference to speed.

The proportion of hand and machine writing varies with different types of business, as well as in different departments of the same concern. The work of sales clerks, telephone operators, and hand addressers is hand work entirely. Auditing departments and invoice clerks use machines in the majority of cases. In summarizing the opinions of all the executives for every

department of their organization, it is found that the amount of writing done by hand and by machine is almost equally divided. Business letters, were not considered machine writing.

Pen and ink are used in nearly all banks, hotels, accounting offices, and post offices. The pencil is used extensively in railway shipping departments, express company offices, and department stores. Telephone girls use the pencil for all their work where handwriting is required. The kind of writing is made up principally of figure making. Many executives stated that figures are poorer in quality than letters. The indelible pencil is used for permanent records by railway and express company employees. A comparison of the amount of work done with pencil with that done with the pen, shows that the pencil was used for 62%, and the pen for 38%, of the work. The inference which may be drawn from this is that both pen and pencil should be used in the handwriting class.

Twenty executives said that they "would not consider letters of application of poor writers for positions requiring handwriting". Twelve thought that handwriting was an indication of fitness when applying for a position.

Three firms give tests to applicants for positions and to employees for promotion, and score papers for quality and speed. The manager of one large department store stated that "retail sales clerks are required to print the first letter of the customer's first and last names", and "when your writing is poor, you should learn to print". All the executives indicated that good handwriting is very necessary, and that poor handwriting resulted in confusion and loss of time and money.

Summary:- The main purpose of this chapter has been to show: (1) the different types of business executives that were interviewed and the number of each type; (2) the median of quality (standard) desired by executives for the various vocations; (3) the distribution of scores of 1804 handwriting papers received from various vocations; (4) the amount of speed necessary for handwriting in the various vocations; (5) the proportion of handwriting to machine writing; (6) the use of pen and ink compared with that of pencil; and (7) the importance which business executives attach to handwriting.

## CHAPTER III

PRELIMINARY TEST AND ANALYSIS OF  
FAULTS IN HANDWRITING.

The two elements of handwriting, degree of legibility, referred to as quality, and rate of writing, referred to as speed, determine the degree of excellence of handwriting. A comparison of the results of elementary school surveys (1) shows that a high or low degree of quality may accompany either a high or low rate of speed. Speed may be developed at the expense of quality, and vice versa. Freeman (2) states;

"We cannot assume that low speed is always accompanied by good quality or that high speed always accompanies poor quality. There is no constant relationship between the two characteristics of writing".

- 
- (1) Wilson, G. M., "The Handwriting of School Children", *Elementary School Teacher*, 1911, Vol. 11, p. 540-543.
  - (2) Freeman, Frank N., "The Teaching of Handwriting", Houghton, Mifflin Co., New York, 1914, p. 120.



These two elements, speed and quality, were measured by the Ayres Handwriting Scale (3) in order to determine the handwriting ability of high school commercial students in formal handwriting classes and in English classes. One hundred and thirty-eight papers were collected from the handwriting classes and an equal number from English classes. The quality of the handwriting of each paper was determined by finding the quality of handwriting on the Ayres Scale which most nearly corresponded with that of the sample being scored. After each paper had been scored by two different teachers, the average of these scores was taken as the correct value. The speed of each paper was determined by counting the actual number of letters written during the two-minute test, and then finding the average number of letters written per minute. The scores for speed and quality are shown by Figures 2 and 3, page 26, and Figure 4, page 27.

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(3) Ayres, Leonard P., "Measuring Scale for Handwriting", Russell Sage Foundation, New York, 1915.

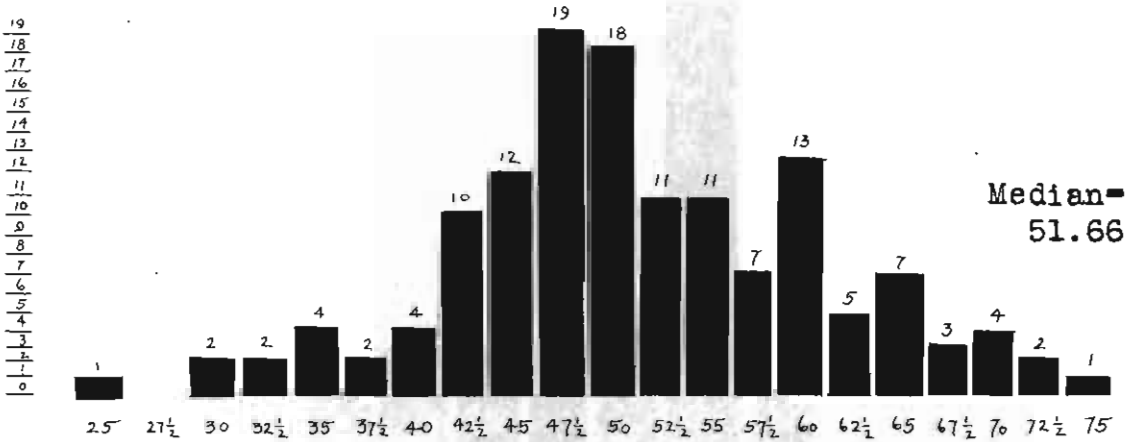


FIGURE 2.

DISTRIBUTION OF SCORES OF 138  
PAPERS FROM FORMAL HANDWRITING LESSONS, SCORED  
FOR QUALITY. (PRELIMINARY TEST)

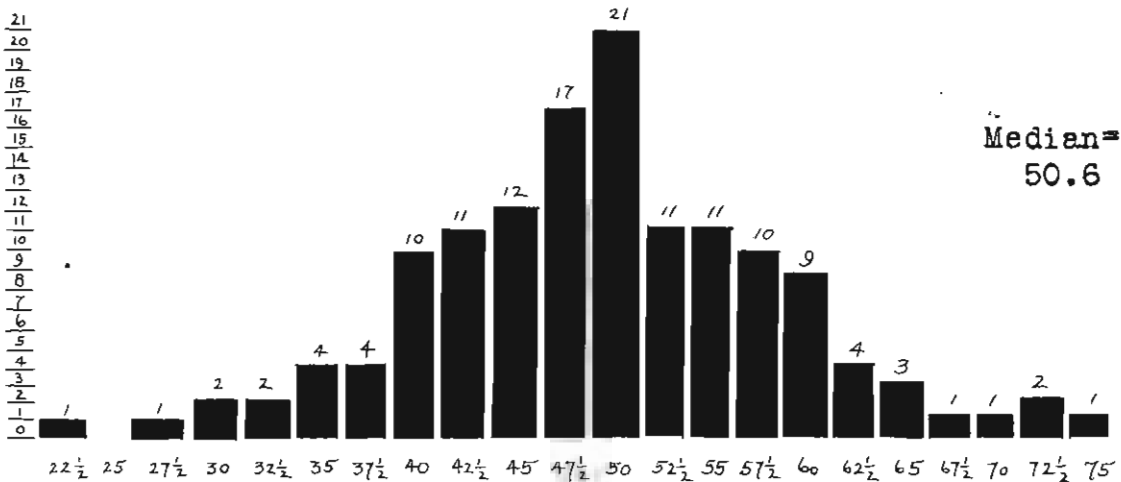


FIGURE 3.

DISTRIBUTION OF SCORES OF 138 PAPERS FROM  
ENGLISH LESSONS SCORED FOR QUALITY. (PRELIMINARY TEST)

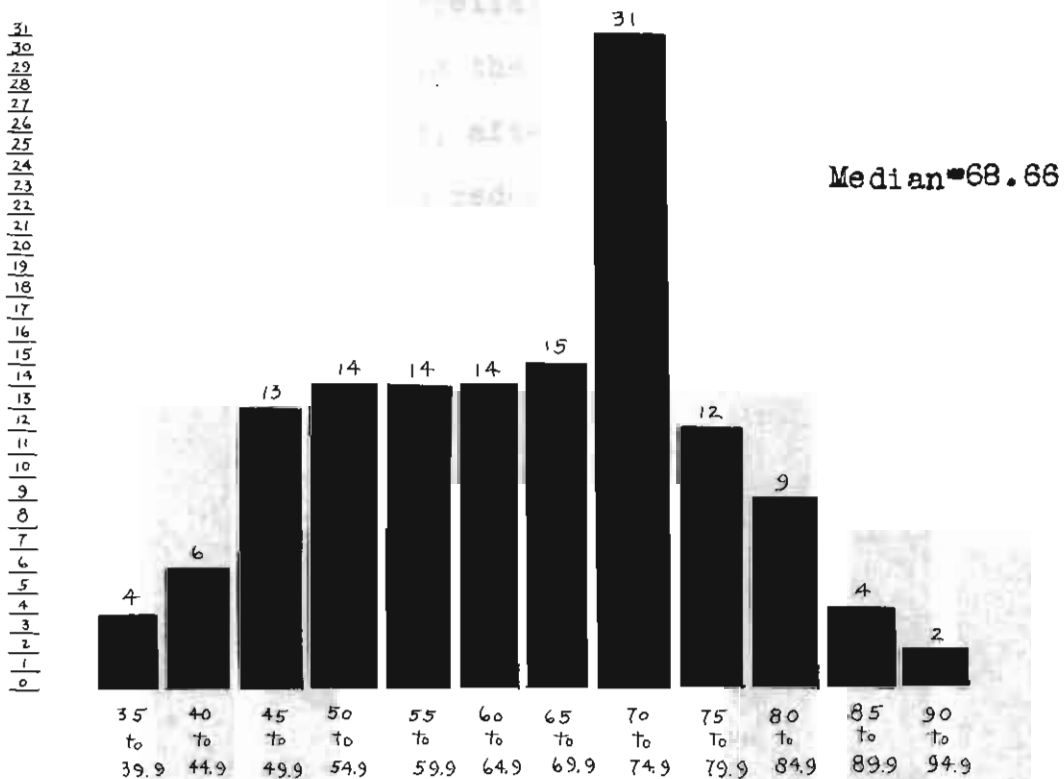


FIGURE 4.

DISTRIBUTION OF SCORES OF 138  
PAPERS FROM FORMAL HANDWRITING LESSONS, SCORED  
FOR SPEED. (PRELIMINARY TEST)

Handwriting papers received from English teachers were not scored for speed since many of them had been written outside of school.

Since medians are given by the Ayres Scale (4) for the elementary grades only, and those obtained

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(4) Ayres, Leonard P., "Scale for Measuring the Handwriting of School Children", Bulletin No. 113, Russell Sage Foundation, N. Y., 1917.

from papers in this preliminary test are low, comparisons may be made with the nearest corresponding median on the Ayres Scale, after the two scales for speed and quality have been reduced to a corresponding measurement.

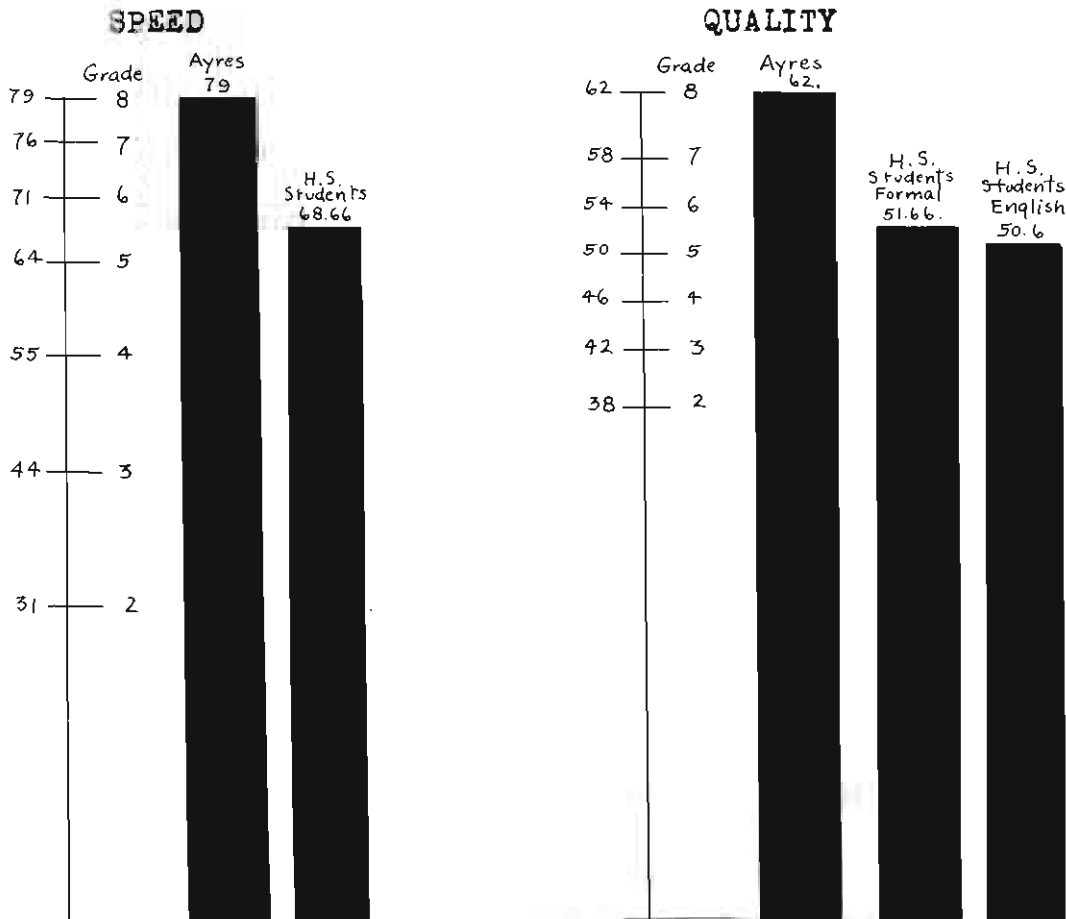


FIGURE 5.

COMPARISON OF MEDIANS OF  
PRELIMINARY TEST WITH MEDIANS OF THE AYRES SCALE.

The difference between the medians of the papers

from the formal handwriting class and the English Class is very slight (1.06). Since the written matter from both lessons compares very favorable, it may be taken as an indication of accurate scoring.

It is interesting to note that quality and speed of handwriting papers of the preliminary test progress in about the same corresponding ratio as in that of the Ayres Scale, and that medians of quality and speed of the same papers are only slightly higher than medians of the Fifth Grade according to the Ayres Scale. A comparison of the median for quality obtained from English papers (50.6) with the median of 1804 papers received from various vacation (57.4) also reveals that handwriting of beginning commercial students is far below standards of the various vacations. This inferiority is still more noticeable when a comparison of the median for quality obtained from English papers (50.6) is made with the median that is desired by business executives (60.9).

If a determined effort is to be made to bring the medians of the preliminary tests up to that of the various vocations, an analysis must be made of the handwriting, and defects must be corrected.

The principal defects influencing speed and quality that have been considered are: (a) variations in form; (b) differences in alignment; (c) differences in proportions; (d) differences in slant; (e) differences in coordination; (f) differences in amount of motor control; (g) variations in amount of emphasis on unit strokes; (h) variations in spacing between letters and between words; and (i) variations in the passage between words. These defects are explained in detail in order to show their effect upon speed and quality. Reproductions of actual defects found in handwriting papers are shown by Figures 6 to 14 inclusive, in order to make the defects more understandable; the remedy for correcting each defect is also given.

(a) Poor forms may be due to the lack of a fixed image or a definitely wrong image. Inconsistency in the poor formation of the same letter shows that there is a lack of a fixed image, while consistency in the poor formation of the same letter shows that the wrong image has been definitely formed. Wrong images result in the malformation of letters and decrease legibility. The time consumed in making poorly formed letters may also be either more or less than that of normal speed.

Letters that are unmistakable too large or too small, may also be difficult to read. They may, on account of their size, also require more or less time for their execution than fixed standards. Defects in form may be corrected by constant reference to a correct model close at hand, or by tracing the correct form until new habits are formed. Unless constant reference is made to the correct form for each retracing, students are likely to retrace their own poorly made letters.

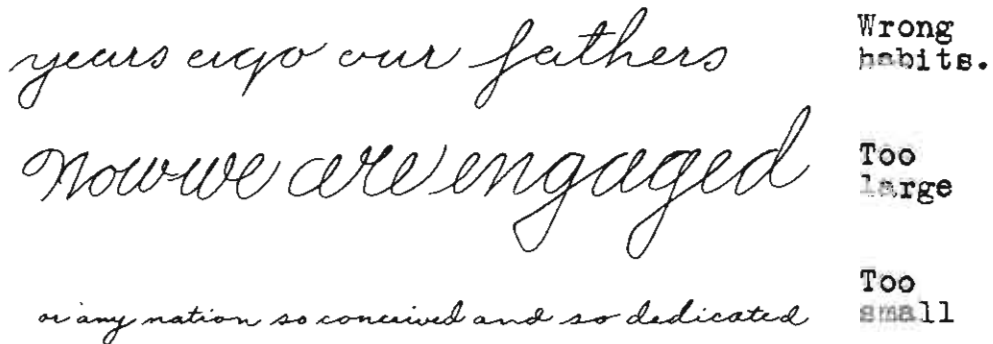


Figure 6.

Defects in Formation of Letters.

(b) Alignment of letters is the comparison of heights of letters measured from the base line. Words containing letters which increase or decrease in size, or change rapidly in height, cannot be recognized as readily as words containing letters of uniform height. The time con-

sumed in making them may also vary from the normal speed of letters of even height. Defects in alignment may be determined by drawing horizontal lines along the tops and bottoms of the letters in a word or sentence. The fault may be corrected by the use of horizontal guide lines. Practice of this sort should not be prolonged until the speed is decreased.

*Four score and seven years*

Figure 7.

Defects in Alignment.  
(Dotted line shows amount of defect)

(c) Proportion of letters is the comparison of the relative heights of the three different types of small letters measured from the base line. Examples of the three different types are a, d, and l. Unless proper heights and proportions are maintained, these letters may become malformed and affect legibility. The time consumed in making them may also vary from the normal speed of letters in the proper proportion. Faults in proportion of letters may be corrected by the use of guide lines for the three different types of letters.



*fathers brought forth upon*

Figure 8.

Defects in Proportions  
of Letters.

(d) Slant is the inclination of strokes, in a letter, from a line drawn perpendicular to the line of writing. Definitely wrong slant in the variation of the slope of succeeding strokes from that which has been determined by scientific investigators as best for ease and quickness of movements. McAllister (5) states that a slant of  $48^{\circ}$  to the right of a perpendicular permits the most rapid writing, and the greater the slant to the right, the more rapid will be the writing. Mixed slant is the changing from one type of slant to another, either in a word or sentence; no particular slant prevails. Slant writing, which is universally used, is the natural result of placing the paper on the desk so that the lower left hand corner points toward the

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(5) McAllister, Cloyd N., "Researches in Movement", Studies from Yale Psychological Laboratory, Vol. 8, p. 21-63, 1900.

center of the body. No scientific comparisons have been made of vertical and slant writing as they affect legibility, but there is no doubt but that lack of uniformity of slant affects legibility. Defects in slant may be corrected by drawing straight lines through the main part of the downward strokes of letters and comparing them with the correct slant of the copy, or by writing on specially ruled paper having guide lines drawn at the proper slant.

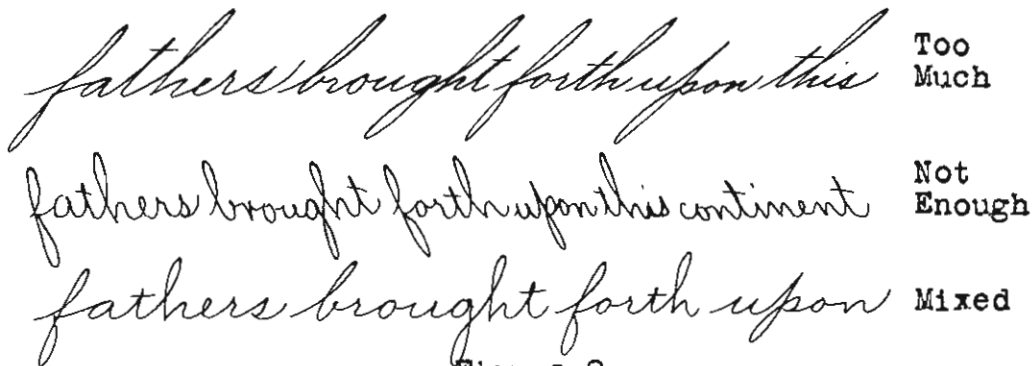


Figure 9.

## Defects in Slant.

(e) Coordination is the ability of muscles to act in harmony in order to control the pen. Lack of coordination results in wavering strokes or angles at the wrong part of the letter. The effect upon legibility is that improper forms are made, while the effect upon speed is

noticeable by the apparent hesitation in lines and uncertainty of movement. The chief remedy for a lack of coordination lies in arm movement drills, which are intended to produce quickness of movement, as well as the proper degree of control. Direct application may then be made to the letter or principle being practiced.

*testing whether that* Wavering  
*all men are created equal* Angular

Figure 10.

Defects in Coordination.

(f) Defects in motor control are recognized by the poor alignment of letters, mixed slant, poor proportions, breaks in the speed of the letter strokes, and the utter lack of ability to adhere to a definite form. Movement may be over-developed at the expense of form, with the result that the movements become uncontrollable, and strokes are carried past their required length. Control may also be under-developed, with the result that strokes are not carried far enough to complete the outline of the letter. These two types of

control either produce excessive or insufficient speed and cause malformation of letters. Lack of motor control is always noticeable in handwriting classes which follow gymnasium classes and other periods of extreme physical activity. The chief remedy for lack of motor control lies in the excessive use of arm movement drills, ranging from simple running ovals, to retracing letters, and in making direct application of the movement drill to the letter itself.

*Now we are engaged* Loose  
*score and seven years* Re-  
 strained

Figure 11.

Defects in Motor Control.

(g) Lack of emphasis on the various unit strokes in a letter, to the extent that some letters are not completed, while others form part of the preceding or following letter, results in malformation of letters as well as in the improper amount of speed necessary to produce well formed letters. This fault may be corrected by the teacher by numbering and illustrating

the different strokes of the letter on the blackboard, and then resorting to counting.

*great civil war testing*

Figure 12.

Defects in Unit Strokes.

(h) By spacing in handwriting is meant the distance between letters and between words. Spacing between lines can be ignored since almost all school paper has ruled lines. If letters in a word are crowded together, speed is not affected as much as legibility; while if they are too far apart, considerable time is lost in writing, and the reader does not recognize words as easily. The same thing is true of words in a sentence. Mixed spacing is the result when no definite habit has been established for either wide or narrow spacing of letters or words. Defects in spacing between letters may be corrected by the use of perpendicular guide lines and by turning the paper sidewise. Poor spacing between words may be corrected by drawing perpendicular lines from the point of the finishing stroke of the last letter to the base line, and then placing the left

side of the following letter against this line.

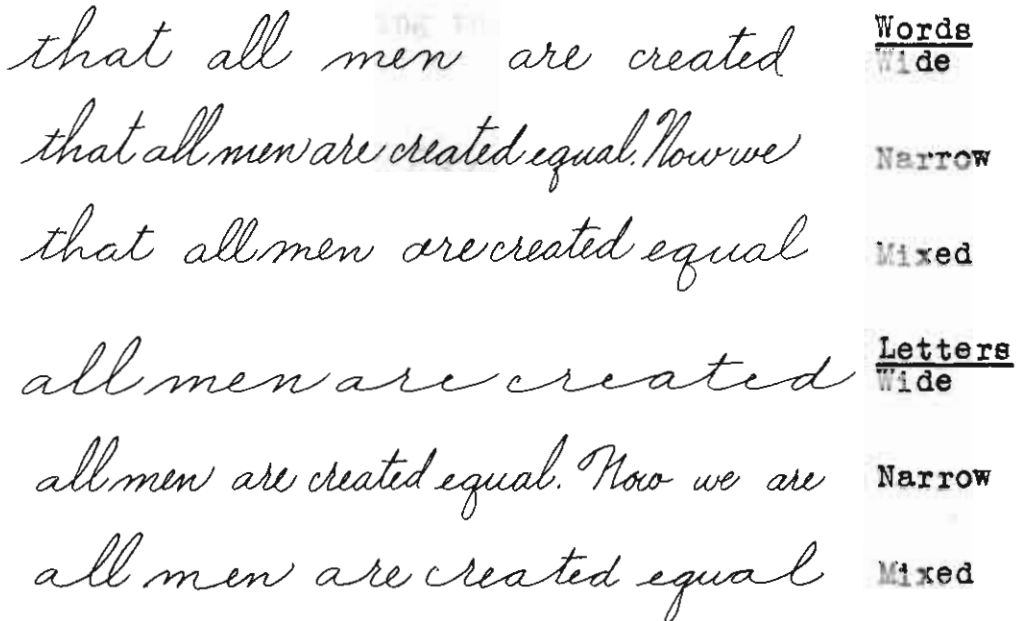


Figure 13.

Defects in Spacing.

(1) Poor passage between words is shown by the reversals of direction of the point of the pen from its regular path and results in a waste of time and motion between words. Lack of emphasis on the beginning and ending strokes of letters in a word results in illegible forms. The crossing and dotting of letters in syllables, before the word is completed also results in a waste of time and motion. This may result in the disjoining of letters in a word to the extent that all

of the letters do not appear as one word. Poor passage between words may be corrected by writing groups of words without lifting the pen.

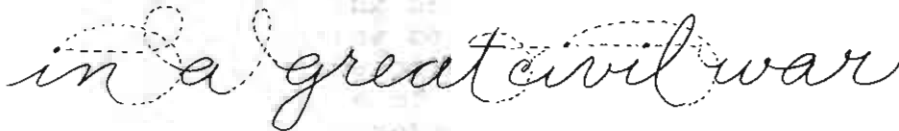


Figure 14.

Poor Passage between Words.  
(Dotted line shows the imaginary path of the pen.)

The various defects which have been described were recorded on a chart (for copy of the chart see Appendix, page 88) which was constructed by the writer. This chart is very much like that constructed by West (6). The percentage of the students having defects in the various elements of handwriting is shown in Table II, page 41.

No defects were found in the various elements of handwriting of the following percentage of students:

letters too small in size, .....	91%
not enough slant, .....	89%
too much slant, .....	87%
loose motor control, .....	82%
wide spacing between letters, .....	79%

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(6) West, Paul V., "Chart for Diagnosing Elements in Handwriting", Public School Publishing Co., Bloomington, Illinois, 1926.

Slight defects were found in the various elements of handwriting of the following percentage of students:

mixed slant, .....	71%;
poor proportions, .....	68%;
mixed spacing between letters, ..	62%;
mixed spacing between words, ....	60%;
poor passage between words, .....	60%;
wrong habits of letter formation,	58%;
poor unit strokes, .....	57%;
poor alignment, .....	45%;
angular coordination, .....	42%.

Serious defects were found in the various elements of handwriting of the following percentage of students:

poor passage between words, .....	34%;
poor proportions, .....	23%;
wrong habits of letter formation,	20%;
poor alignment, .....	19%;
restrained motor control, .....	19%;
mixed spacing between letters, ..	18%;
angular coordination, .....	17%.

Very serious defects were found in the various elements of handwriting of the following percentages of students:

restrained motor control, .....	49%;
angular coordination, .....	25%;
poor alignment, .....	21%;
mixed slant, .....	17%.

It is logical to conclude that attention directed toward those elements which produce the greatest amount of serious and very serious defects, should result in distinct gains in quality and speed of handwriting.



TABLE II  
SHOWING PERCENTAGE OF STUDENTS HAVING  
DEFECTS IN VARIOUS ELEMENTS OF HANDWRITING.

Elements	No Defects	Slight Defects	Serious Defects	Very Serious Defects
<b>Form</b>				
Wrong habits	.151	.581	.203	.068
Too large	.741	.119	.058	.087
Too Small	.913	.051	.017	.021
Alignment	.134	.457	.196	.217
Proportions	.057	.682	.232	.021
<b>Slant</b>				
Too much	.872	.102	.015	.015
Not enough	.898	.058	.021	.021
Mixed	.029	.717	.082	.174
<b>Coordination</b>				
Wavering	.537	.342	.058	.065
Angular	.143	.428	.174	.251
<b>Motor Control</b>				
Loose	.826	.094	.021	.058
Restrained	.187	.133	.196	.491
Unit Stroke	.268	.572	.082	.082
<b>Spacing</b>				
<b>Words</b>				
Wide	.718	.115	.058	.106
Narrow	.732	.106	.115	.044
Mixed	.304	.602	.082	.015
<b>Letters</b>				
Wide	.794	.101	.065	.044
Narrow	.718	.136	.082	.065
Mixed	.082	.623	.188	.106
Passage between words	.029	.601	.342	.029

Summary:- It has been the main purpose of this chapter to show: (1)the distribution of scores of 138 papers from formal handwriting lessons and English lessons scored for quality; (2)the distribution of scores of 138 papers from formal handwriting lessons scored for speed; (3)the comparison of medians of preliminary tests with medians of the Ayres Scale; (4)the method of determining various defects in handwriting, and (5)the percentage of students having defects in the various elements in handwriting.

CHAPTER IV  
SUPPLEMENTARY INFORMATION REGARDING  
PREVIOUS HANDWRITING TRAINING.

Information received from students on the questionnaire (for copy of the questionnaire see Appendix, page 90) explains the reason why the medians were only slightly better than medians of the Fifth Grade. While this information could not be used in a general way in order to give individual help to students, it did reveal many facts relative to the amount and kind of training which were helpful in determining causes of the individual's poor handwriting. Some consideration must be given to the fact that the answers were received from first year high school students, whose judgments pertaining to the training received in each grade and the cause of their poor handwriting, if it was poor, might be questioned. On the other hand, there is no question but that beginning high school students are able to



give accurate information in regard to the schools and cities where the training was received, and the system of handwriting that was studied.

The average age of the 138 students whose handwriting was considered is 14.8 years. 132 students, or 95.6%, were freshmen; the remaining 6, or 4.4% were sophomores, who were repeating the subject because of failures. The medians of the scores of the preliminary test of September 1928, may therefore be considered as finishing medians of the elementary schools, since the handwriting has had time to become neither better nor worse.

The information contained in Table III, page 45, is valuable in determining what systems of handwriting had been studied. In Grades I to IV, 126 students, or 91.3% received their training in Indiana. In Grades V to VIII, 133 students, or 96.3% received their training in the same state. The systems officially adopted by the state during these corresponding years of training, 1919 to 1929, were the Graves and Rogers Systems (1).

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(1) Minutes of the State Board of Education, Vol. 8, p. 112, April 17, 1919, Vol. 9, p. 59, May 26, 1924, State Sup't. of Public Instruction Office, Indianapolis, Indiana

TABLE III  
 SHOWING WHERE ELEMENTARY SCHOOL  
 TRAINING IN HANDWRITING WAS RECEIVED.

Where Training Was Received.	Students Grades I - IV		Per Cent	Students Grades V - VIII		Per Cent
Indianapolis	109		78.9	120		86.9
Another city in Indiana	15		10.8	6		4.3
Indianapolis and an- other city in Ind.	2		1.4	7		5.0
Another state	10		7.2	3		2.1
Another state and Indianapolis	2		1.4	2		1.4
Totals	138		99.7	138		99.7

The facts contained in Table III verify the answers received to the question, "What systems of penmanship have you studied?" in the questionnaire. The Rogers or Graves Systems had been studied by 127 students, or 91%; five students studied the Palmer System; two studied the Zaner System, and four had studied no system. There is therefore some justification for determining the different malformed letters, with the view of comparing the results with the results of the investigation of Pressey

and Pressey (2) in order to determine whether a different system of penmanship is a contributing factor in preventing malformation of letters.

Table IV shows that the average amount of time per week spent on handwriting in the Seventh and Eighth Grades is 48. and 35.1 minutes respectively. If this may be taken as the true condition in these grades, there is then some explanation of the low medians of the preliminary tests.

TABLE IV  
SHOWING AMOUNT OF ELEMENTARY SCHOOL  
TRAINING RECEIVED BY 138 STUDENTS IN HANDWRITING

Grade	Average Lessons Per Week	Average Length Per Lesson	Average Minutes Per Week
I	2.6	14.56	65.9
II	2.76	15.94	67.7
III	3.04	18.51	72.9
IV	2.93	18.76	69.3
V	2.94	21.12	70.1
VI	2.49	20.39	58.1
VII	2.11	19.63	48.
VIII	1.59	19.31	35.1

- (2) Pressey, Luella C. and Pressey, Sydney L., "Analyses of Three Thousand Illegibilities in the Handwriting of Children and of Adults", Educational Research Bulletin, Ohio State University, September 28, 1927, p. 270-273.

Of the total of 138 students, 62, or, 44.9%, had received instruction from both special and regular teachers of handwriting; 72, or 52.1%, had never had supervision; and 4, or 2.9% had never received any instruction whatever.

Twenty-six students stated that they had received help from their fathers and mothers. It is doubtful if instruction received at home would increase the quality of handwriting. If copies were written by parents whose style of handwriting varied from the system taught at school, it would have a tendency to confuse the pupil in the matter of correct forms of letters.

A total of 250 penmanship certificates and awards had been received for reaching standards of the various grades and for making satisfactory improvement in handwriting. This would seem to indicate that the handwriting of pupils was high in quality, or that elementary school standards were low.

Answers received regarding the use of arm movement in other daily written lessons show that 33.3% used arm movement; 23% did not use arm movement; and 43.6% "do sometimes" or "try to."

The answers pertaining to the cause of the handwriting being poor, if it is poor, express what is believed to be the true conditions. These answers have been tabulated and grouped under fourteen headings and are shown in Table V.

TABLE V  
SHOWING STUDENTS OPINIONS AS TO THE  
CAUSE OF THEIR POOR HANDWRITING

Cause	Number of Cases
Not enough practice with arm movement	29
Insufficient practice	25
Lack of control	17
Did not know	17
Not taught properly	12
Carelessness	10
Did not consider it poor	8
Nervousness	4
Consider it good	3
Did not try hard enough	3
Mind is more on what is being written	3
Family moved too often	3
Lefthandedness	2
Did not hold the pen properly	2
Total	138



Summary:- The chief purpose of this chapter has been to show; (1)where the elementary school training was received; (2)the amount of elementary school training in handwriting; (3)the cause of poor handwriting. Also other facts and opinions are given here, as revealed by the questionnaire, which may prove helpful in determining the cause of poor handwriting.

CHAPTER V  
MALFORMATION OF LETTERS AND COMBINATIONS  
WHICH AFFECT LEGIBILITY.

The information and data given in this chapter deal with malformations and the particular letters and combinations (pairs of letters) most commonly involved therein which affect legibility. It was hoped that definite malformations would be determined through an analysis of faults of handwriting and the carrying out of a remedial program, and that a procedure might be developed which would make instruction more effective. Comparison of the results could also be made with other similar investigations with the view of determining whether these malformations are the result of an insufficient number of safeguards set up by the various systems of handwriting.

The data of this investigation has been gathered

from the 138 English papers and 138 handwriting test papers of September 1, 1928 previously used in measuring quality and speed, and show that 3740 letters and 2347 combinations were found which interfere with legibility. The great number of malformations found in handwriting test papers is probably due to the fact that time is an element in this test.

After tabulation has been made of the 3740 malformed letters, it is found that thirteen letters occur more than one hundred times. These thirteen letters account for 3044, or 81.4%, of the total number of malformations. The entire distribution of the frequencies is shown in Table VI, page 52.

The identification of all of the malformed letters, together with the actual number of malformations found, the comparative rank in frequency, and the per cent of the total represented by each malformed letter is shown in Table VII, page 54.

The results show that capitals give much less trouble than small letters. The reason is probably due to the fact that they are not used as often, and that their forms are not as similar as those of small letters. In ordinary writing, capitals are not joined

to other capitals, and the possibility of confusion is not as great.

TABLE VI  
SHOWING DISTRIBUTION OF FREQUENCIES  
OF 3740 MALFORMED LETTERS.

Interval	Frequency of malformed letters.	Actual number of malformed letters.
450--500	2	919
400--449	1	430
350--399		
300--349		
250--299	2	582
200--249		
150--199	2	366
100--149	6	747
90-- 99		
80-- 89	2	171
70-- 79	1	70
60-- 69	1	68
50-- 59	1	59
40-- 49	2	83
30-- 39	1	31
20-- 29	3	69
10-- 19	9	118
0-- 9	4	27
Totals	37	3740

The only capital which gives a great amount of trouble is I. While many other capitals were found

which did not adhere to correct form, they were at least legible to a marked degree and are therefore not considered as being malformed. The only reason which can be offered for the many varieties of forms of capital letters is that they are due to the variety of styles of letters of different systems of handwriting. The inference which may be drawn from this is that a standardized alphabet should eliminate malformations to some extent, and the reader would become accustomed to only one particular style of letter.

A comparison of small letters shown in Table VII, page 54, shows that the most troublesome letter is r, whose total, 461, is 12.36% of the total of all malformed letters. This is probably due to the common use of two different styles of r. The next in frequency is e, which occurs 458 times, which is 12.24%, and n, 430 times, or 11.49% of the total. These three letters account for 36.08% of all malformed letters. The next in frequency are d, a, and o, whose total account for 20.74% of the entire total. These six letters account for 56.82% of all the malformed letters. In fact, the thirteen small letters, r, e, n, d, a, o, l, h, t, c, s, v, and m, account for 81.4% of all malformed letters.

TABLE VII  
 SHOWING ANALYSIS AND FREQUENCIES OF  
 3740 MALFORMED LETTERS.

Malformed letter	Rank in Frequency	Frequency	Per Cent of all Malformations
a	5	286	7.647
b	14	88	2.352
c	10	130	3.475
d	4	296	7.914
e	2	458	12.246
f	21	31	.828
g	16	70	1.871
h	8	145	3.877
i	18	59	1.577
j	23	21	.561
k	19	43	1.149
l	7	172	4.599
m	13	108	2.887
n	3	430	11.497
o	6	194	5.187
p	17	68	1.818
q	26	14	.374
r	1	461	12.360
s	11	116	3.101
t	9	135	3.609
u	24	20	.534
v	12	113	3.021
w	22	28	.748
x	27	13	.347
y	20	40	1.069
z	26	14	.374
A	30	9	.240
B	33	5	.133
F	28	11	.294
I	15	83	2.211
L	31	7	.187
M	27	13	.347
N	29	10	.267
S	25	16	.427
T	25	16	.427
U	28	11	.294
V	32	6	.160
Total 37		3740	100.009

An analysis of specific malformations, which is of chief interest, is shown in Table VIII, page 56. The similarity of the malformed letter with another letter or letters and the frequency of each malformation are shown in detail. Many of these will be recognized as familiar trouble makers, by individuals who are critical of their own handwriting. A comparison of these specific malformations shows that the form which causes the most trouble is e made like i without a dot, or closed. Five forms

e closed,        r like i,        n like u,  
d like cl, and o like a,

account for 30% of the total. If the next five in order of frequency are included,

a like o,        n like \*r,        a like ci,  
l like e, and t like l,

the ten forms account for 46% of the total. In some papers many minor errors were found in letters, but since this was a distinct peculiarity of the individual's handwriting, they were not listed. Only such malformed letters having a frequency of three or more were included.

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\* Style which starts like n.

TABLE VIII  
 SHOWING DETAILED ANALYSIS AND FREQUENCIES  
 OF 3740 MALFORMED LETTERS.

Malfor- mation	Fre- quency	Total	Malfor- mation	Fre- quency	Total
a like o	153		*r like v	62	
a like ci	112		r like ei	53	
a like u	21	286	r like u	46	
b like li	51		r like s	31	
b like f	32		*r like x	17	
b like l	5	88	r like G	10	
c like i	86		*r like ie	8	461
c like a	28		s like o	68	
c like e	16	130	s like i	25	
d like cl	193		s like r	15	
d like I	66		s like S	8	116
d like a	37	296	t like l	103	
e closed	341		t no cross	32	135
e like c	73		u like n	10	
e like l	44	458	u like w	7	
f like b		31	u like oi	3	20
g like cj		70	v like n	57	
h like li	98		v like *r	45	
h like p	24		v like i	11	113
h like l	19		w like m	15	
h like b	4	145	w like u	13	28
i like e		59	x like *r		13
j no dot		21	y like ij		40
k like h		43	z various		14
l like e	104		A like O		9
l like t	68	172	B like R		5
m like ni	89		F like T		11
m like x	19	108	I like cl	39	
n like u	198		I like d	25	
n like *r	134		I like J	19	83
n like v	94		L like S		7
n like s	4	430	M like W		13
o like a	158		N like W		10
o like u	30		S like L	10	
o like r	6	194	S like s	6	16
p like js		68	T like F		16
q open		14	U like W		11
r like i	234		V like U		6
					Total -- 3740

\* Style which starts like n.



The findings of this investigation on malformed letters may now be compared with the results of the investigation by Pressey and Pressey (1). The summary of the investigation by Pressey and Pressey is as follows:

"From this detailed analysis of factors interfering with the legibility of handwriting, there appeared a total of 2,736 malformations. Of these 2,736 illegibilities, 12% involved the letter r. The seven letters, r, n, e, a, o, d, and t, accounted for over half of these difficulties in reading."

The writer has, from their findings, determined the per cent of the total of illegibilities that each malformed letter represents and the rank in frequency of each letter. A comparison of their results with those of this investigation is shown by Table IX, page 58. Of the seven most troublesome letters referred to by Pressey and Pressey, the first six are also found to be the most troublesome in this investigation.

Similar percentages are found to occur in the letters

a, b, c, k, m, p, q, r, x, z, and T.

However, wide differences occur in the letters

e, f, i, l, n, s, t, u, v, w, y, and I.

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(1) Pressey, Luella C. and Pressey, Sydney L., "Analyses of Three Thousand Illegibilities in the Handwriting of Children and of Adults", Educational Research Bulletin, Ohio State University, September 28, 1927, p. 270-273.

TABLE IX  
 SHOWING COMPARISON OF THE MOST FREQUENTLY  
 MALFORMED LETTERS OF THIS INVESTIGATION  
 WITH THOSE OF PRESSEY AND PRESSEY.

Let- ter.	Pressey and Pressey			This Investigation		
	Rank in Frequency	Total Illegi- bilities	Per Cent of all Illegi- bilities	Rank in Frequency	Fre- quency	Per Cent of all Malfor- mations
a	4	198	7.236	5	286	7.647
b	13	75	2.741	14	88	2.352
c	10	105	3.835	10	130	3.475
d	6	167	6.103	4	296	7.914
e	3	206	7.529	2	458	12.246
f	16	65	2.375	21	31	.828
g	18	58	2.119	16	70	1.871
h	9	134	4.897	8	145	3.877
i	11	101	3.691	18	59	1.577
j	25	4	.146	23	21	.561
k	21	30	1.096	19	43	1.149
l	12	76	2.777	7	172	4.599
m	15	69	2.521	13	108	2.887
n	2	230	8.406	3	430	11.497
o	5	172	6.286	6	194	5.187
p	20	34	1.242	17	68	1.818
q	26	1	.036	26	14	.374
r	1	336	12.280	1	461	12.360
s	8	147	5.372	11	116	3.101
t	7	148	5.409	9	135	3.609
u	14	74	2.704	24	20	.534
v	19	51	1.864	12	113	3.021
w	17	65	2.375	22	28	.748
x	24	8	.292	27	13	.347
y	22	22	.804	20	40	1.069
z	25	4	.146	26	14	.374
I	19	51	1.864	15	83	2.211
T	23	11	.402	25	16	.427
Other Capi- tals		94	3.435		88	2.349
Totals		2736	99.983		3740	100.009

In determining the malformed letters, two principal facts were observed:- (1) That in many cases, two letters occurring together were both malformed to such an extent that the context of the sentence had to be known in order to determine the word; (2) that the letters which made up the combination were the ones which were most frequently malformed. In view of this, there is then some justification for determining the malformed combinations which most seriously affect legibility.

The same papers were used in determining the malformed combinations which were used in determining the malformed letters. Even though the element of time did not enter into the writing of the English papers, these papers showed more errors than the papers of the formal handwriting class. This is reflected in the comparison of the medians for quality of the two different classes, as has been shown in Figure 5, page 28. Malformations were found in both letters of 2347 combinations. This total is represented by 188 different combinations, which have a range in frequency from one to sixty. Of this number, eleven occurred forty or more times. These eleven combinations account for 22.8% of the total. The entire distribution of frequencies is shown in Table X, page 60.

TABLE X  
 SHOWING DISTRIBUTION OF FREQUENCIES OF  
 2347 MALFORMED COMBINATIONS.

Interval	Frequency of malformed combinations,	Actual number of malformed combinations.
60----65	1	64
55----59	1	56
50----54	3	158
45----49	2	96
40----44	4	163
35----39	3	110
30----34	3	95
25----29	7	189
20----24	15	322
15----19	18	294
10----14	34	409
5----9	37	254
0----4	60	137
Totals	188	2347

A detailed analysis of all the errors shows that the eleven malformed combinations, which account for 22.8% of the total, are:

er, re, te, in, en, st, ar, an, on, ea, and se.

If six more are added,

th, he, at, io, or, and ra,

these seventeen combinations account for 31.6% of the total. Table XI, pages 61 and 62, shows 188 different malformed combinations that were found and the frequencies of each.

TABLE XI  
 SHOWING MALFORMED COMBINATIONS  
 AND FREQUENCIES OF EACH

Malformed Combi- nation.	Fre- quency.	Malformed Combi- nation.	Fre- quency.	Malformed Combi- nation.	Fre- quency.
ab	3	de	22	hi	13
ac	14	di	18	ho	15
ad	16	do	10	ht	9
af	2	dr	4	ia	12
ag	4	ea	40	ic	14
ai	16	ec	2	id	14
ak	3	ed	26	ie	10
al	20	ee	19	ig	3
am	6	eg	2	il	13
an	42	ei	3	im	1
ap	14	el	16	in	52
ar	47	em	1	io	33
as	21	en	52	ir	26
at	36	ep	1	is	5
au	2	er	64	it	28
av	6	es	24	iv	2
ay	12	et	14	iz	1
ba	10	ev	3	ja	2
be	26	ex	2	je	2
bl	6	fa	8	jo	3
bo	16	fe	12	ju	9
br	15	ff	1	ke	3
bu	2	fi	9	ki	1
ca	11	fo	4	kn	1
ce	22	fr	4	la	3
ch	20	ga	8	ld	10
ci	2	ge	11	le	29
ck	9	gh	13	li	5
cl	4	go	5	ll	16
co	17	gr	10	lo	17
ct	14	gu	4	lt	12
cu	1	ha	16	ly	22
da	5	he	37	ma	14

TABLE XI (Continued)  
 SHOWING MALFORMED COMBINATIONS  
 AND FREQUENCIES OF EACH.

Malformed Combi- nation.	Fre- quency.	Malformed Combi- nation.	Fre- quency.	Malformed Combi- nation.	Fre- quency.
me	16	pl	1	te	54
mi	6	po	3	tg	1
mo	7	pr	10	th	37
mp	1	pu	1	ti	21
na	4	py	2	tl	12
nc	1	qu	5	tn	3
nd	28	ra	30	to	14
ne	20	rc	10	tr	10
ng	21	rd	14	ts	4
ni	8	re	56	tt	1
nn	5	rg	12	tu	2
no	7	ri	23	ty	1
ns	9	rl	16	va	9
nt	26	rn	9	ve	21
ny	1	ro	13	vi	16
oc	4	rr	12	vo	4
od	4	rs	5	vy	3
ol	11	rt	15	wa	17
on	41	ry	5	we	12
oo	6	sa	6	wh	10
op	1	sc	1	wi	3
or	32	se	40	wo	9
os	9	sh	12	wr	9
ot	7	si	17	ws	3
ou	22	so	22	xp	3
ov	5	ss	3	xt	2
ow	5	st	49	ye	5
oy	2	su	5	yo	5
pa	9	sy	1	ze	1
pe	9	ta	21		

Totals :- Combinations..188. Frequencies.....2347.

A comparison of the eleven most frequently malformed letters,

r, e, n, d, a, o, l, h, t, c, and s,

with the seventeen most frequently malformed combinations,

er, re, te, in, en, st, ar, an, on,

ea, se, th, he, at, io, or, and ra,

shows that with the exception of d, l, and c, these letters make up fifteen of the seventeen most frequently malformed combinations.

This analysis was not completed until several months after the semester had started; consequently, the handwriting classes did not have full opportunity of receiving instruction upon combinations. However, the attention of several classes was directed toward the most frequently malformed letters and combinations, and some time was spent each day in determining the errors of each student. The safety of this method of instruction lies in the fact that an analysis of the most frequently occurring combinations of the 1,000 commonest words in English writing, as determined by Ayres (2), shows that in many cases the most frequently

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(2) Ayres, Leonard, P., "Measuring Scale for Ability in Spelling", Russell Sage Foundation, New York, 1915.

occurring combinations are the ones which have also been most frequently malformed. The results of this analysis of the combinations of the Ayres list of words is shown in Table XII, pages 65 and 66. A total of 4449 combinations was found. This total is represented by 317 different combinations which have a range in frequency from one to one hundred and three. It is only natural that more combinations were found in the Ayres list of words than in the handwriting papers, for the reason that many combinations were not malformed in the handwriting papers.

When a comparison of the eighteen most frequently occurring combinations of the Ayres list of words is made with the same number of most frequently malformed combinations, it is found that fifteen are common to both lists. This comparison is shown in Table XIII, page 67.



TABLE XII

SHOWING COMBINATIONS OCCURRING IN THE AYRES  
LIST OF 1,000 COMMONEST WORDS IN ENGLISH  
WRITING AND THE FREQUENCIES OF EACH.

(Read down. Example:- a is followed by b, 10 times).

	a	b	c	d	e	f	g	h	i	j	k	l	m
a		8	26	15	53	13	10	19	11	2		28	27
b	10				3			1	6				7
c	24		6		39				24				
d	19			4	14				21			15	
e		30	39	39	22	19	22	40	14	3	8	49	40
f	4				12	11			8			4	1
g	8			4	9		1		18				
h			24		1	1	22						
i	30	4	16	20	10	19	6	24			2	22	14
j	1	3											
k	4		10	1	1				2			3	
l	42	17	14		29	2	2	1	23			28	
m	16				21		1		16			1	7
n	47			1	79		1		80		3		
o		14	39	11	1	21	9	23	38	2		24	20
p	15				12				5			1	14
q					1								
r	67	7	4	6	101	6	7	4	23			2	2
s	27	1			52				29		1	2	3
t	57	2	30		22	7	1	15	30			5	
u	8	8	8	4		7	7	7		7		5	2
v	7				14				10			1	
w	5				6							1	
x	1				9				2				
y	25	2	1	5	3			1				15	2
z									4				
<hr/>													
	417	96	217	110	514	106	89	135	364	14	14	206	139

TABLE XII (Continued)

SHOWING COMBINATIONS OCCURRING IN THE AYRES

LIST OF 1,000 COMMONEST WORDS IN ENGLISH

WRITING AND THE FREQUENCIES OF EACH.

(Read down. Example:- n is followed by a, 14 times).

	n	o	p	q	r	s	t	u	v	w	x	y	z
a	14	6	17		29	11	24	4	3	15	1	2	1
b		7				1		7				1	
c	21	9			5	4	2	5			1		
d	36	6			16	3		5		1			
e	34	2	27		103	53	62	10	42	15		5	4
f	4	7			2		1	1		1			
g	30	2			7			11					
h					1	14	58			12			
i	14	3	5		38	28	54	5	11	10			
j	2												
k	2	4	1		3	1							
l	2	17	15		5	1	3	17					
m	1	27			7	1	2	7					
n	6	88			9		1	25		5			
o	17	15	22		32	21	27		3	10		4	
p		14	11		2	11		6			4		
q													
r		52	33		10		23	30		4			
s	9	17	1		9	30	3	22		2		3	
t	56	18	7		28	65	11	15			3	2	
u	5	36	8	3	8	22	11						
v	5	12			2								
w		20			1	1	2					1	
x		1											
y	7	10	3		18	3	9	1	1				
z		1											
<hr/>													
	265	374	150	3	335	270	293	171	60	75	9	18	5
<hr/>													

Total combinations-----4449

Different combinations---- 317

TABLE XIII  
 SHOWING COMPARISON OF MALFORMED COMBINATIONS  
 WITH THE MOST FREQUENTLY OCCURRING  
 COMBINATIONS OF THE AYRES LIST.

Handwriting Papers			Ayres List		
Combi- nation.	Rank in Fre- quency.	Number of times Malformed	Combi- nation.	Rank in Fre- quency.	Number of times Malformed
er	1	64	re	1	103
re	2	56	er	2	101
te	3	54	on	3	88
in	4	52	in	4	80
en	4	52	en	5	79
st	5	49	ar	6	67
ar	6	47	st	7	65
an	7	42	te	8	62
on	8	41	th	9	58
ea	9	40	at	10	57
se	9	40	*nt	11	56
th	10	37	*ti	12	54
*he	10	37	ea	13	53
at	11	36	se	13	53
*io	12	33	*es	14	52
or	13	32	or	14	52
*ra	14	30	le	15	49
le	15	29	an	15	47

\* Not found in the opposite list.

Summary:- The main purpose of this chapter has been to show:- (1)the letters which were found to be malformed and the frequency of each malformed letter; (2)the similarity of the malformed letter with that of another letter or letters and the number of times each occurred; (3)a comparison of the findings with those of a similar investigation by Pressey and Pressey, in order to determine as far as possible the amount of emphasis that had been placed on letters in teaching; (4)the malformed combinations which were found in students handwriting, and the frequency of each; (5)the fact that the most frequently malformed combinations are in many cases the same as those which naturally occur in the 1,000 most commonly used words, as determined by Ayres.

CHAPTER VI  
A SURVEY OF HANDWRITING IN THE  
ELEMENTARY SCHOOLS.

During the school year of 1927-28, the writer, while engaged as Director of Handwriting in the elementary schools of Indianapolis, Indiana, made a survey in handwriting in order to determine the status of Seventh and Eighth Grade students in handwriting ability. Observation of the handwriting of these grades seemed to show that it was below the standards of the other grades. School officials believed that lasting handwriting habits had been formed in the first six grades, and that formal handwriting lessons therefore could be reduced to one lesson per week in the Seventh and Eighth Grades. The curriculum was therefore changed accordingly. This change was no doubt partly due to the crowded curriculum of these grades. The elementary school survey should therefore reveal the cause of the low

medians obtained in quality and speed of beginning high school commercial students, since Table III, page 45, shows that 129 students, or 93.3%, received their upper grade training in Indianapolis. Tests in handwriting were given to all of the pupils of Grades IA to VIIIA inclusive, in eighty-one schools in January, 1928 and in May, 1928. The test papers submitted showed the handwriting of pupils after receiving training in handwriting for periods of five and nine months respectively of the school year. The test in the Seventh and Eighth Grades consisted in having the pupils write the following sentence:- "I can write the words in this sentence within two minutes, with an easy and fluent movement, and with a legibility and speed equal to the standard for the elementary schools".

Specimens of each grade were scored for quality with the various standards developed by Freeman (1). Papers were scored by five supervisors of handwriting. A record of the achievement of pupils of each school

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(1) Freeman, Frank N., "Correlated Handwriting", Teachers' Manuals for Grades I to VIII, The Zaner-Bloser Co., Columbus, Ohio, 1927.

was kept in order to make comparisons and to give supervision where it was needed most. The enrollment of each building was obtained from the Attendance Department of the Indianapolis Public Schools. The per cent of students reaching the standard was then calculated for each of the eighty-one schools.

Table XIV shows that in January, 1928, more pupils of the Second Grade succeeded in reaching the standard than any other grade. Fifty-eight and one-tenth per cent succeeded in reaching the standard for that grade. In the Seventh and Eighth Grades, only 32.5% and 26.7%, respectively, reached the standards for those grades. The average for the eighty-one schools for all the grades was 35.3%.

TABLE XIV  
SHOWING PER CENT OF PUPILS IN EIGHTY-ONE SCHOOLS  
REACHING THE STANDARD IN JANUARY, 1928.

Grade	Enrollment	Number of pupils reaching the standard	Per cent of pupils reaching the standard.
I	7,499	1,382	18.4
II	5,739	3,338	58.1
III	5,403	1,862	34.4
IV	5,476	2,104	38.4
V	5,249	1,924	36.6
VI	4,749	1,990	41.9
VII	4,815	1,568	32.5
VIII	4,640	1,239	26.7
Totals	43,570	15,407	35.3



When the handwriting test was conducted in May, 1928, it was found that a large gain in quality had been made in every grade. These gains are the natural result of four months' additional practice. Table XV shows the results of the May test. More pupils in the Third Grade succeeded in reaching the standard than in any other grade. (78.5%) In the Seventh and Eighth Grades, 51.8% and 51.5%, respectively, reached the standard for those grades.

TABLE XV  
SHOWING PER CENT OF PUPILS IN EIGHTY-ONE  
SCHOOLS, REACHING THE STANDARD IN  
MAY, 1928.

Grade	Enrollment	Number of pupils reaching the standard.	Per cent of pupils reaching the standard.
I	6,718	3,002	44.6
II	5,780	4,485	77.5
III	4,088	3,211	78.5
IV	5,268	3,035	57.6
V	5,111	3,198	62.5
VI	4,858	3,191	65.7
VII	4,568	2,368	51.8
VIII	4,692	2,418	51.5
Totals	41,083	24,908	60.6



A comparison of the per cent of pupils in eighty-one schools reaching the standard in January and May, 1928, is shown in Table XVI.

TABLE XVI  
SHOWING COMPARISON OF PER CENT OF PUPILS  
IN EIGHTY-ONE SCHOOLS REACHING THE  
STANDARD IN JANUARY AND MAY, 1928

Grade	Per cent in Jan. 1928	Per cent in May 1928	Per cent of gain
I	18.4	44.6	26.2
II	58.1	77.5	19.4
III	34.4	78.5	44.1
IV	38.4	57.6	19.2
V	36.6	62.5	25.9
VI	41.9	65.7	23.8
VII	32.5	51.8	19.3
VIII	26.7	51.5	24.8
Averages	35.4	60.6	25.2

The results of the survey can be more readily understood and interpreted by a graphical comparison of the results of the two different tests. This comparison is shown by Figure 15, page 74. While gains are shown in each grade, a comparison of the attainment of the Seventh and Eighth Grades with other grades is especially significant. A smaller per cent of pupils of the Seventh and Eighth Grades succeeded in reaching the standard than of

any other grade, with the exception of the First. The rapid decrease in quality of the handwriting of the Third Grade at the time of the January test, is due to the introduction of ink; the pencil having been used in the First and Second Grades. After handwriting habits have been formed in the Third Grade, there is a gradual increase in quality until the Sixth Grade is reached. The handwriting then decreases in quality in the Seventh and Eighth Grades until it is below the standard of the Third Grade.

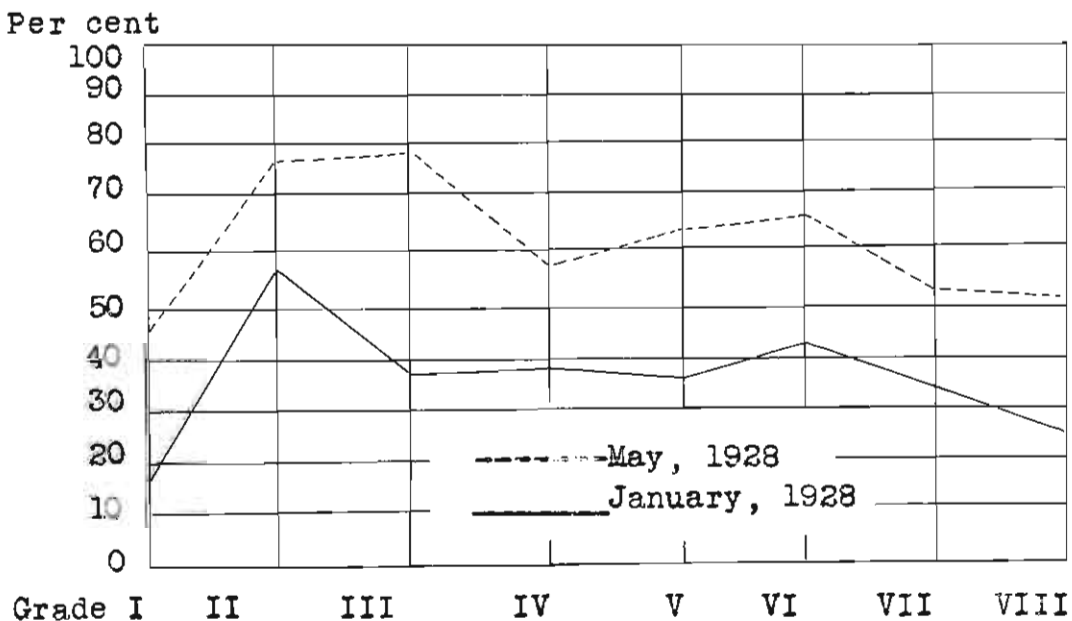


FIGURE 15

COMPARISON OF PER CENT OF PUPILS  
REACHING THE STANDARD IN JANUARY, 1928,  
AND IN MAY, 1928.

Summary:- The chief purpose of this chapter has been to show the results of a survey in the elementary schools of Indianapolis, Indiana. The results of this survey show:- (1)the per cent of pupils in eighty-one schools reaching the standard in January, 1928; (2) the per cent of pupils reaching the standard in May, 1928; (3)a comparison of per cent of pupils in eighty-one schools reaching the standard in January and May, 1928; (4)the cause of the low medians of quality and speed made by beginning high school commercial students.

CHAPTER VII  
FINAL TEST AND COMPARISONS.

The results of the final test, February 1, 1929, show that, in spite of the poor quality of the handwriting at the beginning of the semester, decided gains have been made in both speed and quality of handwriting of formal handwriting lessons and English lessons. The distribution of the scores for quality, for both classes is shown in Figures 16 and 17, page 77. The median for quality of the formal handwriting lessons, (60.15) is again higher than the median of the handwriting of the English papers. (58.39) The difference between these medians, (1.76) is only slightly greater than that of September, 1928. (1.06) This seems to indicate that the skill derived from the handwriting lessons has been carried over into the written English lessons.

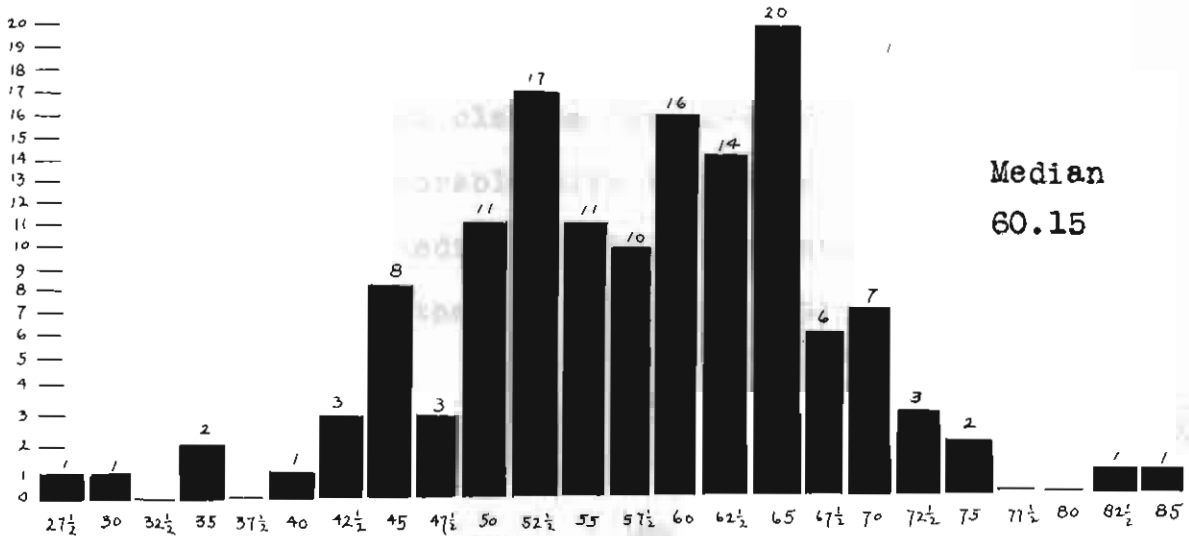


FIGURE 16

DISTRIBUTION OF SCORES OF 138 PAPERS FROM  
FORMAL HANDWRITING LESSONS, SCORED FOR QUALITY.

FINAL TEST.

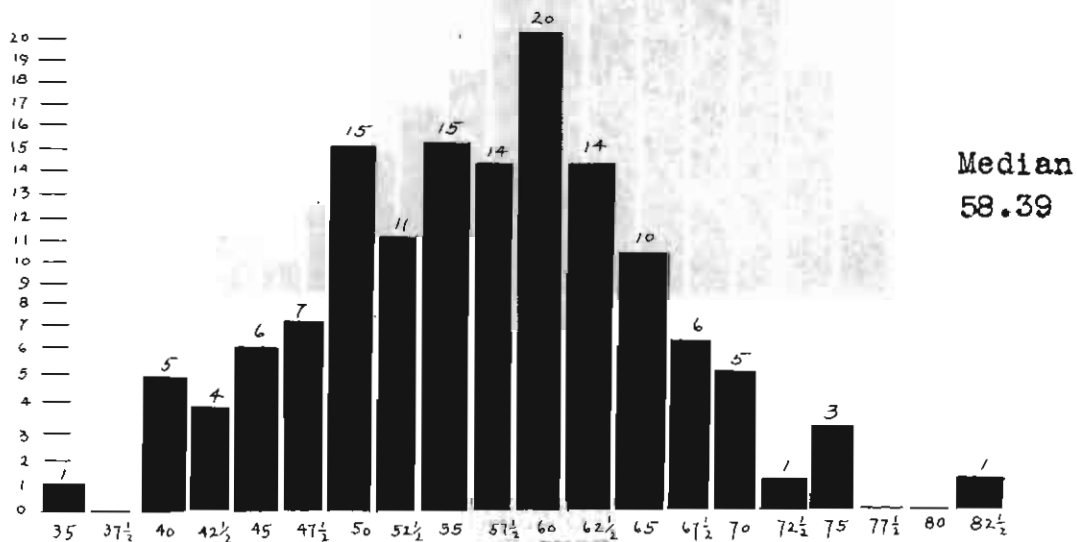


FIGURE 17

DISTRIBUTION OF SCORES OF 138 PAPERS FROM  
ENGLISH LESSONS, SCORED FOR QUALITY. FINAL TEST.

The distribution of scores, after papers of the formal handwriting classes have been scored for speed, compares very favorably with the normal curve of distribution. The median, 81.19, is greater than the Ayres median for the Eighth Grade. (79)

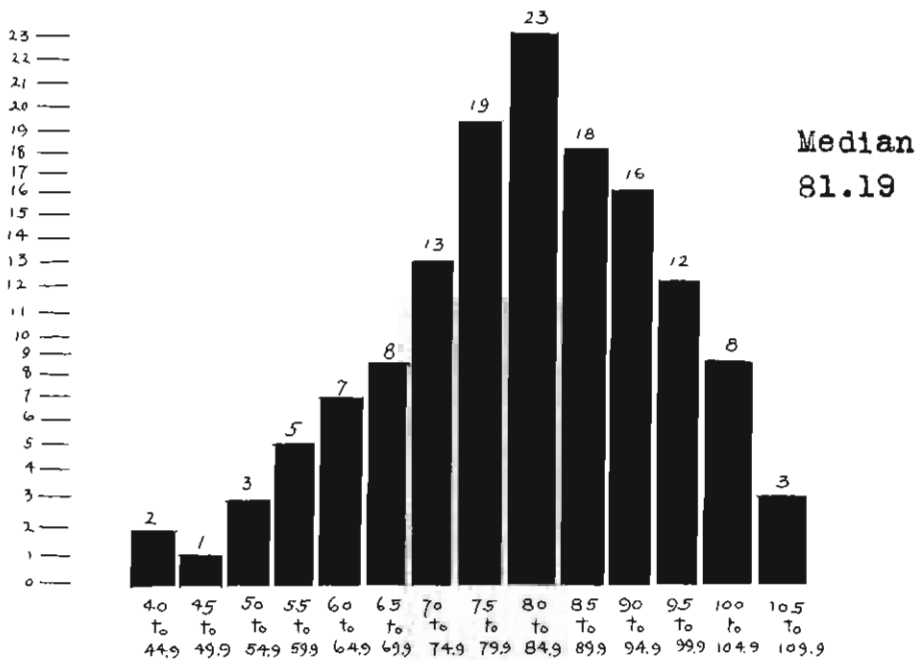


FIGURE 18

DISTRIBUTION OF SCORES OF 138 PAPERS  
FROM FORMAL HANDWRITING LESSONS, SCORED  
FOR SPEED. FINAL TEST.

Figure 19 shows that, by comparing the medians of the two periods, Sept. 1, 1928, and Feb. 1, 1929, there has been a gain of 8.49 in quality of the formal handwriting lessons. This gain is more than the difference in two school grades on the Ayres Scale. The median at Feb. 1, 1929, (60.15) is slightly below that of the Eighth Grade, (62.) as shown on the Ayres Scale; however, it is higher than the median of 1804 handwriting papers received from the various vocations. (57.4, Figure 1, page 19)

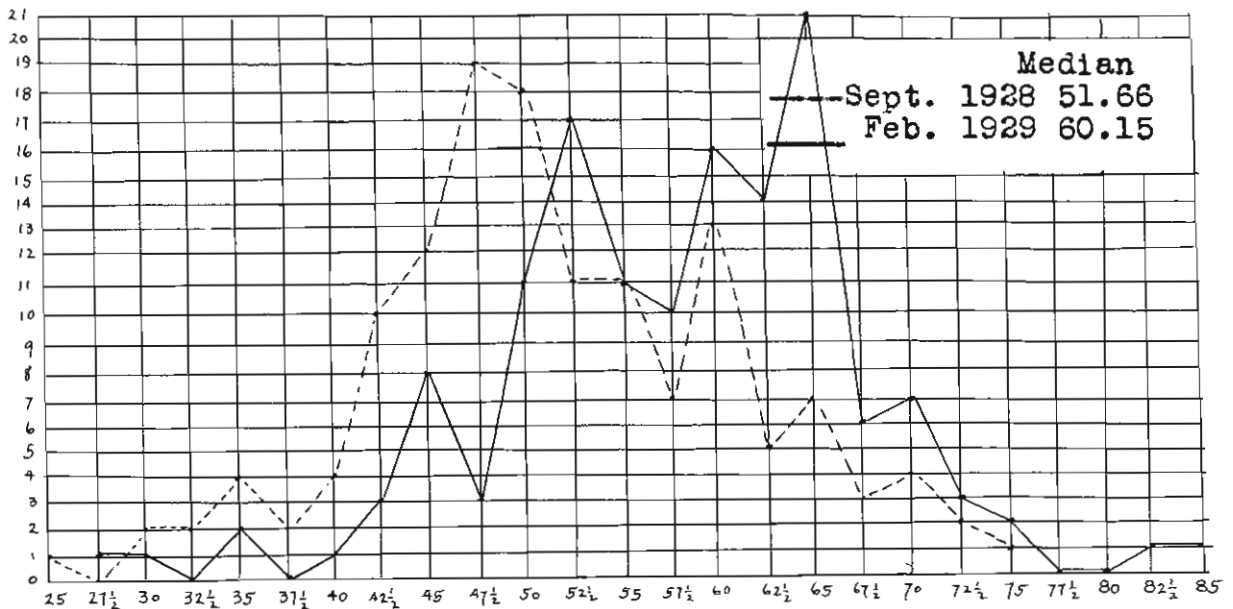


FIGURE 19

COMPARISON OF DISTRIBUTION OF SCORES OF  
138 PAPERS FROM FORMAL HANDWRITING LESSONS,  
SCORED FOR QUALITY.

A comparison of the medians of the two periods for quality of the handwriting of the English papers, shows that a gain of 8.39 has been made. This gain is almost equal to that shown by the formal handwriting papers, and is also more than the difference in two school grades on the Ayres Scale.

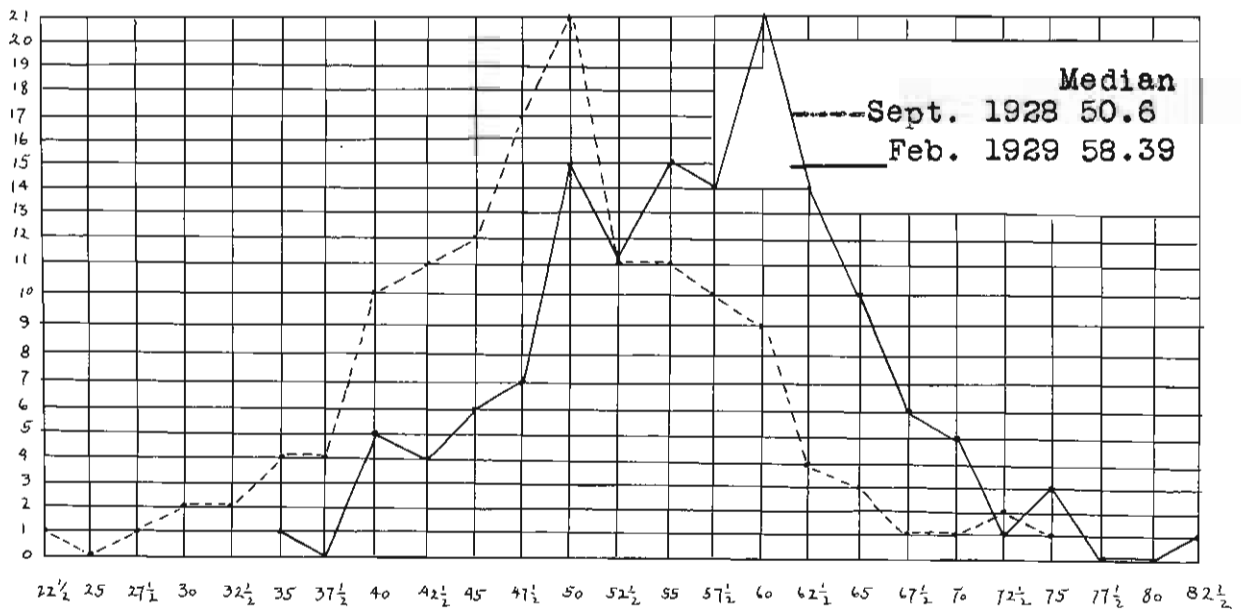


FIGURE 20  
 COMPARISON OF DISTRIBUTION OF SCORES OF  
 138 PAPERS FROM ENGLISH LESSONS,  
 SCORED FOR QUALITY.



When the curves for the distribution of scores for speed for the two periods are compared, it is found that the curve representing the scores at February 1, 1929, more nearly approaches the normal curve of distribution. This seems to indicate that the fast writers have slowed down in speed and are centering their attention on quality, while the slow writers have increased their speed.

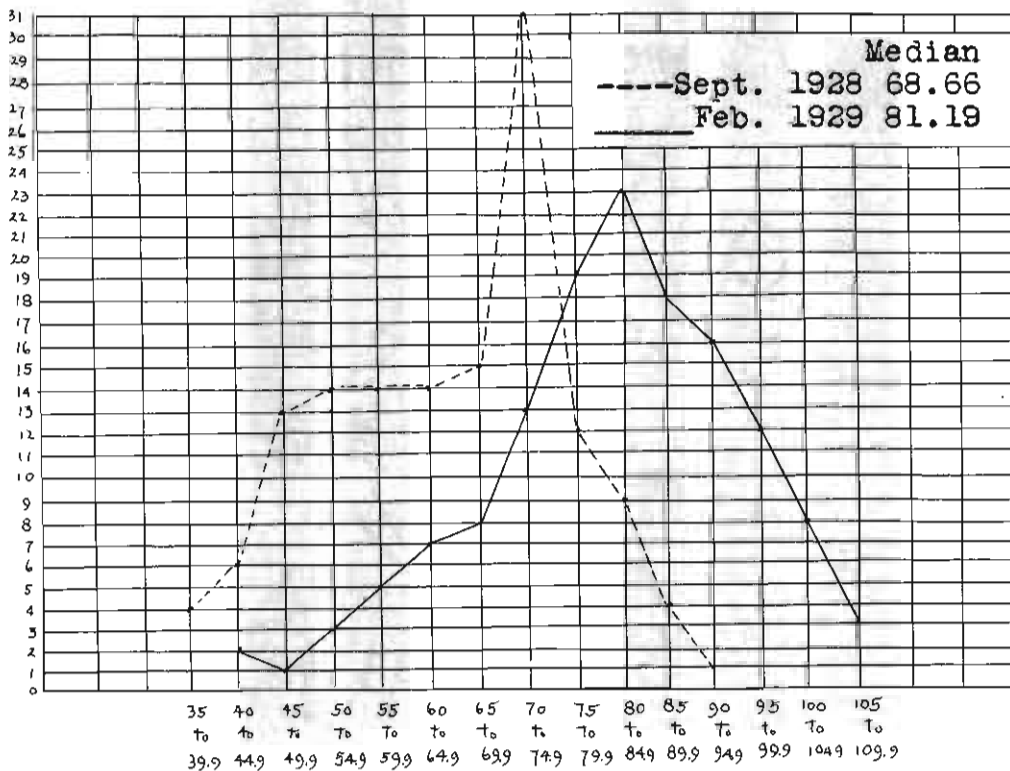


FIGURE 21

COMPARISON OF DISTRIBUTION OF SCORES OF  
 138 PAPERS FROM FORMAL HANDWRITING LESSONS,  
 SCORED FOR SPEED.

Figure 22 shows a comparison of all medians of the final test with those of the Ayres Scale, after scores for quality and speed have been reduced to a corresponding measurement. Comparisons may also be made with the nearest corresponding grade on the Ayres Scale.

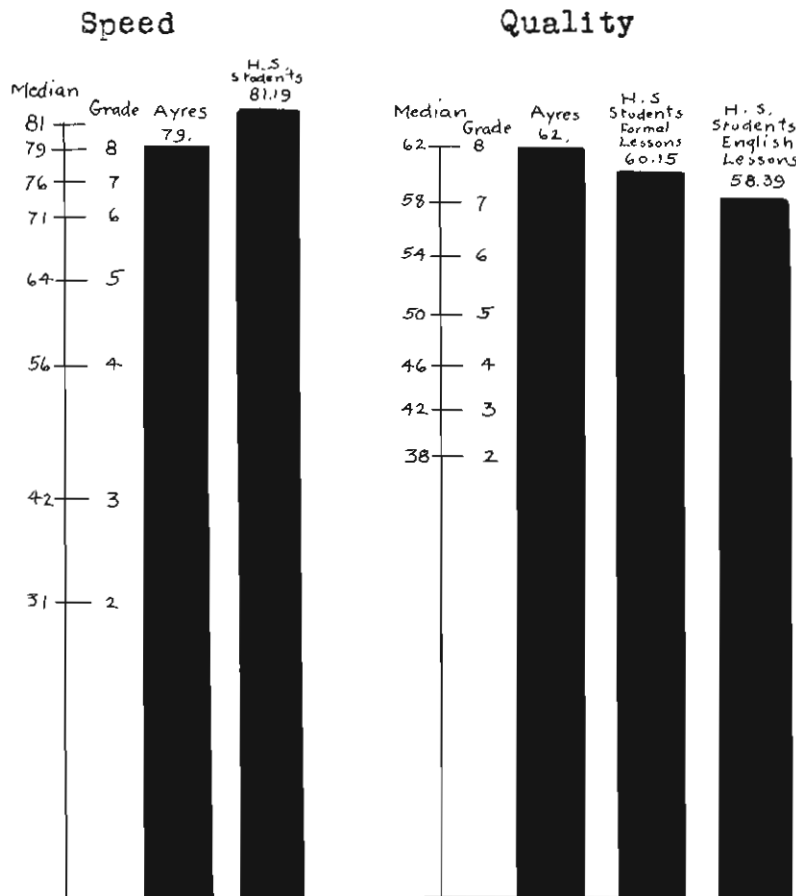


FIGURE 22  
COMPARISON OF MEDIANS OF THE  
FINAL TEST WITH MEDIANS OF THE  
AYRES SCALE.

Summary:- The chief purpose of this chapter has been to show the results derived in teaching, after the various elements which affect legibility have been diagnosed for each student and an effort has been made to overcome defects in these elements as well as in the malformation of letters and combinations. The results obtained from this method of instruction have been illustrated by figures and graphs and show:- (1) the distribution of scores of 138 papers from formal handwriting lessons and 138 papers from English lessons, after these papers have been scored for quality; (2) the distribution of scores of 138 papers from formal handwriting lessons, scored for speed; (3) a comparison of the distribution of the scores made September 1, 1928, and February 1, 1929, for both speed and quality of the formal handwriting papers, and for quality of the English papers; (4) a comparison of all medians of the final test with those of the Ayres Scale, after scores for quality and speed have been reduced to a corresponding measurement.

## CHAPTER VIII

## CONCLUSIONS.

The material contained in the foregoing pages warrants the following conclusions:

1. Handwriting should continue to be included in the commercial curriculum of high schools, because of greater demands of business executives, and the impracticability of machine writing to meet all the demands of modern business.

2. The handwriting of formal handwriting classes is superior to that of English compositions.

3. The handwriting of beginning commercial students in the Emmerich Manual Training High School (previously shown to be only slightly better than that of the Fifth Grade on the Ayres Scale) is due to the discontinuance of daily formal handwriting lessons in the Seventh and Eighth Grades of the Indianapolis Public Schools.

4. After an analysis has been made of the principal defects in students handwriting, attention directed toward these principal defects, as well as the most frequently occurring combinations of letters as they occur in English writing, should result in greater gains in the quality of handwriting.

5. After beginning high school commercial students have received remedial instruction in handwriting for one semester, the speed of their handwriting is then adequate for vocational purposes, while the quality of their handwriting is only sufficient for some of the less attractive vocations.

6. The degree of legibility of letters is due to some extent to the styles of letters adopted by different systems of handwriting.

7. A standard alphabet should increase the legibility of handwriting.

8. Errors in the formation of letters reflect the amount of emphasis that has been placed upon the correct form in teaching.

## RECOMMENDATIONS.

On the basis of the foregoing conclusions, the following recommendations are offered:

1. That a remedial plan of instruction in handwriting should be substituted for the ordinary method of conducting handwriting lessons.

2. That high school commercial students should, before being recommended for a position requiring a great amount of handwriting, write with a degree of legibility equal to that of 60 on the Ayres Scale.

3. That a standard alphabet should be universally adopted.

4. That daily formal handwriting lessons should be taught in the Seventh and Eighth Grades of the Indianapolis Public Schools.

IZING DEFF

A P P E N D I X

## CHART FOR ANALYZING DEFECTS IN HANDWRITING

School \_\_\_\_\_ Teacher \_\_\_\_\_  
 Grade \_\_\_\_\_ Section \_\_\_\_\_

Pupil Name	1	2	3	4	5	6	7	8	9	10			11
	Rate Letters per minute	Qual- ity Formal lesson English lesson	Form Wrong habits Too large Too small	Alignment	Proportions	Slant Too much Not enough Mixed	Coor- dina- tion Wavering Angular	Motor Con- trol Loose Restrained	Unit Stroke	Words Wide Narrow Mixed Letters Wide Narrow Mixed	Spacing		
	76	55 50	1 0 0	1 1	1 1	0 3 1	1 2	0 2	2	0	3	1 0 3 1	2



(Copy of questionnaire submitted  
to business executives)

89.07

### HANDWRITING QUESTIONNAIRE

#### Determination of Standards for Vocational Purposes

1. Company \_\_\_\_\_
2. Type of business \_\_\_\_\_
3. Name of official \_\_\_\_\_
4. Official position \_\_\_\_\_

5. According to the various specimens of Handwriting exhibited by the Ayres Scale, what quality of Handwriting is necessary to successfully hold the following positions?

Position	No Grade on Ayres Scale	Position	No Grade on Ayres Scale
Dep't. Store clerks	_____	Invoice clerks	_____
Telephone operators	_____	Accountants	_____
Factory cost clerks	_____	Bank clerks	_____
Stock-room clerks	_____	P. O. clerks	_____
Hand addressers	_____	Messengers	_____
General clerks	_____	Salesmen	_____

6. Is speed in handwriting an important consideration?  
Should it be rapid, moderate, or slow? \_\_\_\_\_
7. To what extent is handwriting used in your business? \_\_\_\_\_
8. To what extent is pen and ink used in your business?  
Pencil? \_\_\_\_\_
9. What importance do you attach to handwriting? \_\_\_\_\_
10. In order to determine standards of handwriting for vocational purposes, kindly send at least one specimen of handwriting for every employee whose handwriting is considered in this questionnaire.

Name \_\_\_\_\_ Address \_\_\_\_\_

Age (nearest birthday) \_\_\_\_\_

Check your grade in school Freshman Sophomore Junior Senior

In what cities or schools did you attend grades 1 to 4?  
\_\_\_\_\_

In what cities or schools did you attend grades 5 to 8?  
\_\_\_\_\_

Were you taught handwriting in the following grades?

Grade	Yes or No	Number of lessons per week	Number of minutes for each lesson
1st			
2nd			
3rd			
4th			
5th			
6th			
7th			
8th			

Who taught you handwriting while you were in the elementary grades? Regular or special teacher of handwriting? \_\_\_\_\_

Did you ever receive any outside help in handwriting? \_\_\_\_\_  
If so, who helped you? \_\_\_\_\_

What systems of penmanship have you studied before coming to this school? \_\_\_\_\_

Have you ever received a penmanship certificate or award, for good penmanship? \_\_\_\_\_

Do you write plainly and use arm movement when you write other lessons? \_\_\_\_\_

If you consider your handwriting as being poor, what in your opinion is the cause? \_\_\_\_\_

B I B L I O G R A P H Y

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