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The relationship between written knowledge of the alphabet and spelling ability at the fourth grade level

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THE RELATIONSHIP BETWEEN WRITTEN KNOWLEDGE OF THE ALPHABET AND SPELLING ABILITY AT THE FOURTH GRADE LEVEL

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TABLE OF CONTENTS

CHAPTER PAGE

TABLES

LIST OF CHARTS

CHAPTER I

THE PROBLEM AND DEFINITION OF TERMS

Introduction

Profound differences in theory are never invented; they grow out of conflicting elements in a genuine problem. The problem of spelling is not new; it has existed since the first crude attempts at written communication. From the earliest symbol to the complex alphabets used in spelling today, the written word has been the method by which mankind has expressed himself and recorded his discoveries.

I. THE PROBLEM

Statement of the Problem

In most schools today spelling instruction is based upon the assumption that each pupil has written knowledge of the alphabet. This study will attempt to test that assumption and to determine whether or not a relationship exists between knowledge of the alphabet and spelling ability in a sample of fourth grade pupils.

Purpose of the Study

Spelling is an individual matter in the same sense as is reading. Every normal child can learn to spell the words he needs. Since the fact is recognized that every

child has individual needs, it would seem most sensible to discover them in spelling.

The fact that poor spelling has been termed "the reproach of American schools" and the attention that spelling is now receiving from schools of all grades, shows the importance that is attached to this subject.[1] Magazine and newspaper articles with such titles as, "We Are a Nation of Poor Spellers," indicate a need for basic research in the field of spelling.[2]

Although many spelling investigations have been carried out in the past half century or more, the results achieved have not been satisfactory when measured by the effectiveness with which children spell in situations that call for written expression.[3] The various explanations which have been advanced for spelling abilities and disabilities are hardly convincing.[4]

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[1]Rupert P. SoRelle and Charles Kitt, Words; Their Spelling and Pronunciation (New York: Gregg Publishing Company, 1911), p. 3.

[2]Ernest S. Clifton, "We Are a Nation of Poor Spellers," Texas Outlook, Vol. 39 (September, 1955), pp. 18-19.

[3]Arnie E. Richmond, "Children's Spelling Need and the Implications of Research," Elementary English Journal (December, 1956), p. 500.

[4]Edna L. Furness, "Mispronunciation, Mistakes, and Methods in Spelling," Elementary English Journal (December, 1956), p. 508.

Many different systems of instruction have been tried, but little has been done on the basic level. Spache approached the fundamental problem when he observed, "Vocabulary knowledge is a more significant determiner of spelling success than intelligence.[5]

II. DEFINITION OF TERMS

The word alphabet is derived from the first two letters of the Greek alphabet, alpha and beta, and denotes an ordinary series of letters, symbols, or syllables which form the elements of a written language. An alphabet is a highly developed artificial form of writing.[6] Throughout this study, knowledge of the alphabet will be interpreted to mean that which consists of the proper formation of the written letters of the alphabet in the correct order.

Spelling is the formation of words by the proper letters of an alphabet. In this study, spelling ability will consist of that which is measured by the Morrison-McCall Spelling Scale.

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[5]George Spache, "Spelling Disability Correlates; Factors Probably Causal in Spelling Disability," Journal of Educational Research, Vol. 34 (April, 1941), pp. 561-586.

[6]Walter Yust (ed.), "Alphabet," The Encyclopedia Britannica, Vol. I (Chicago: The Encyclopedia Britannica Corp., 1947), pp. 677-684.

There are perhaps as many definitions of intelligence as there are authors on the subject. Binet subscribed to the idea that intelligence consisted of a global or general ability. Thorndike believed intelligence was the ability to act effectively under given conditions, while Terman defined intelligence as the power of abstract thinking.[7] For this study, intelligence will be interpreted to mean that which is measured by the Primary Level, Form C, Detroit Intelligence Test.

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[7]Charles E. Spearman, The Nature of Intelligence and the Principles of Cognition (New York: Macmillan and Company, 1957), pp. 1-17.

CHAPTER II

HISTORY OF SPELLING AND THE ALPHABET

Spelling

Until the Sixteenth Century spelling corresponded more or less adequately to pronunciation; however, the development of the printing press forced the standardization of spelling. Unfortunately, the English language was still undergoing phonetic changes and, as a result, today almost every letter in the English alphabet is represented by two or more sounds.[1]

The subject of phonics in spelling is very old. A man by the name of Ickelsamer is credited with having originated the phonic method of spelling in 1534.[2] In 1768 Benjamin Franklin advocated changing the alphabet and respelling words phonetically. Noah Webster, in 1792, revolutionzed instruction in America by introducing the teaching of the sounds of letters.[3]

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[1]Gertrude H. Hildreth, Teaching Spelling (New York: Henry Holt and Company, 1955), p. 4.

[2]Emmett A. Betts, "Phonics: Practical Considerations Based on Research," Elementary English, Vol. 33 (October, 1956), pp. 357-365.

[3]Noah Webster, Dissertations on the English Language (Boston: I. Thomas and Company, 1789), p. 408.

Around 1890, Rebecca Pollard brought an elaborate method of phonetics to great heights of popularity. Later these systems broke down under their own complexities.[4] Since then phonics has been used by those seeking a simple method of improving spelling instruction.

During the early history of New England, primers followed the general plan of ABC books. The letter was assumed to be the means of recognition; hence, the pupil was required to learn the alphabet first. This method in various forms is still in existence.

Many changes in spelling are directly attributable to the development of typography. It was the printer, more than the scholar, who directed the course of English spelling in its early history. We write cooperation or co-operation instead of coöperation because the dieresis requires one more type-channel in the typesetting machine.

No nation lives entirely isolated from others; therefore, no language is free from foreign elements. English spelling has been subject to extraneous but influential factors and forces, such as French-derived endings in words.

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[4]Betts, loc. cit.

According to evidence presented today, it is indisputable that British and American usages are steadily approximating common ground. This is a major phenomenon in the history of the English language.[5]

Many persons have advocated the reform of English spelling, but the practical difficulty of getting everyone to change at once, and to agree on the form of words, has prevented simplification.[6] In 1906 President Theodore Roosevelt subjected the project of simplification to a practical test. He issued an executive order directing the public printer to use in all papers sent out from the White House the three hundred simplified spellings recommended by the Simplified Spelling Board. Congress refused to have these changes made, and in December, 1906, the order was rescinded.

One conclusion of any unbiased study of English spelling must be that improvement is possible, and is actually under way, but that any attempt to change

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[5]A. H. McDannald (ed.), "Spelling," The Encyclopedia Americana Vol. 25 (New York: Americana Corporation, 1943), p. 388.

[6]Arthur I. Gates, Diagnostic and Remedial Spelling Manual (New York: Bureau of Publications, Teachers College, Columbia University, 1918), p. 6.

conventionally-accepted spelling by law would be met with mass resistance. The spelling process is not one so much of reform as of growth.

Alphabet

Hieroglyphs, the forerunner of the English alphabet, was invented sometime after 1500 B. C. Pictographs and hieroglyphs are forms of writing, the characters of which bear an essential relationship to what they are intended to represent. About 1000 B. C. the Phoenicians had a workable alphabet and wrote from right to left.[7] Since the days of the Phoenicians there have been some four hundred different alphabets. Some authorities maintain that the Egyptians invented the alphabet; others credit its origin to Cretan and Aegean lands. It appears the Phoenicians borrowed their alphabet from Egypt, while the Hebrews and the Greeks likely received theirs second-hand from the Phoenicians. The Latin alphabet is a form of Greek, an offshoot of Euboean origin, introduced into Italy in the Eighth Century, B. C. Many modern alphabets with their numerous modifications, or additions, are derived from the Latin, including the English

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[7]Guy S. Ford (ed.), "Alphabet," Compton's Pictured Encyclopedia (Chicago: F. E. Compton and Company, 1957), Vol. 1, p. 188.

alphabet.[8] It is estimated there are forty-two sounds in the English language and only twenty-six letters to represent them. The English alphabet is both defective and redundant. The original Latin alphabet, as it is found in the oldest inscriptions, consisted of twenty-one letters; namely, the vowels a, e, i, o, and u and the consonants b, c, d, f, g, h, k, l, m, n, p, q, r, s, t, and x. Z disappeared at an early period and g took its place. The Nagari alphabet, used in writing Sanskrit, is one of the most remarkable in the world. As now used, it has fourteen characters for the vowels and diphthongs and thirty-three for the consonants, besides two other symbols.

Today there are more than fifty different alphabets in use, but none of them are perfect. Ideally an alphabet should indicate one sound for each symbol and one symbol for each sound. Spanish and Italian approach this, but in English the fundamental sounds are represented by about five hundred symbols (for example, the sound k is represented by c, ck, qu, ch, x).[9] This is the result of inadequacy of symbols, of Saxon, Norman, Dane, Celt, and Latin influences, and of attempts to render various pronunciations in standardized spelling.

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[8] McDannald, op. cit., p. 438.

[9] McDannald, op. cit., Vol. 10, p. 2135.

Scientific alphabets have been devised in an attempt to simplify spelling by providing a symbol for every sound, with each sound invariably denoted by the same symbol. Such an alphabet was proposed in 1877 by the American Philological Society. In 1884 reform associations presented certain changes to simplify the language. The resistance encountered prevented any real advancement in that direction.

Spelling and the Alphabet Today

There is a frequent complaint that the children in our schools spell badly. In this there is nothing new. Children spell just as well now as they did a generation or generations ago.[10]

Next to reading inability, poor spelling is to the public the surest sign that one is not educated. The lay critic, forgetting his own youthful errors, readily thinks that the children of his own generation were better taught; he then criticizes the teachers of his own children. Ill-founded or not, the criticism is terrifying.

In the past, teaching spelling consisted of primarily looking for errors which it promptly assumed to correct through drill. Now teachers realize spelling drill is one of the clumsiest tools we have in the field of education.[11]

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[10]Thomas R. Lounsbury, English Spelling and Spelling Reform (New York: Harper and Brothers, 1909), p. 337.

[11]Henry Suzzallo, The Teaching of Spelling (New York: Houghton-Mifflin Company, 1911), p. xi.

Today, in teaching spelling, the aim is to get rid of error by anticipating and preventing it through a watchful supervision of first impressions and associations; hence, the significance of shortened spelling lists, the elaborate development of the meaning and form of words. Correction no longer stops with a check mark, but it inquires into the cause and makes certain that recovery is complete.[12]

Recently there has been a growing interest in the possibility that teaching sound-to-letter relationships might help spelling ability. Many large claims have been made concerning the contributions of phonics to spelling. Unfortunately phonics cannot be used on a large portion of spelling in the English language because of the peculiarities of the language. One letter may have several sounds, and the same sound may be given by different combinations of letters. This is easily demonstrated with the initial sounds f (fed, physical), k (cat, keep), j (gem, jump), and s (city, sat).

Horn stated:

> Children who have had training in phonics do not show, according to the rather meagre evidence which is available, any significant superiority in spelling.[13]

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[12] Ibid., p. 10.

[13] Ernest Horn, "A Child's Early Experience With the Letter A," Journal of Educational Psychology (Baltimore: Warwick and York, Inc., March, 1929), Vol. 20, p. 161.

The fact is we do not have adequate evidence for making a confident decision as to how much and in what way the teaching of phonics can increase efficiency in spelling instruction.

Trowbridge advocated the learning of spelling rules in a meaningful manner as a solution to spelling difficulties and cited the failure of memorizing as a method of study.[14] Too often the child is required to memorize a rule without having enough practice on its application to make the rule itself meaningful. The early and subsequent investigations have shown the great need for basic research in solving the problems in spelling.

In this complex atomic and pre-space age the importance of written communication of ideas becomes more evident than ever before. Spelling is now an integral part of life.

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[14]Cornelia R. Trowbridge, "Spelling by Rule," Journal of Educational Psychology (Baltimore: Warwick and York, Inc., March, 1929), p. 211.

CHAPTER III

RELATED RESEARCH

Early Research

Teaching procedures in the field of spelling have been under criticism and investigation ever since Rice made his famous pronouncement on the futility of the spelling grind in 1897.[1] One of Rice's conclusions was that much of the time given to formal spelling in that day was wasted. A few years later Cornman concluded that results in spelling were independent of the methods of instruction.[2] Shortly thereafter Wallin completed a study in which the findings disproved this and said, "Teaching spelling exclusively by a well organized drill gives more satisfactory results than teaching it exclusively by the incidental method."[3] These conclusions brought forth a decade of verbal war on the

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[1]J. M. Rice, "The Futility of the Spelling Grind," The Forum, Vol. 23 (New York: The Forum Publishing Company, 1897), pp. 163-172.

[2]Oliver P. Cornman, Spelling in the Elementary Schools: An Experimental and Statistical Investigation (Boston: Ginn and Company, 1902) from A Basic Life Spelling Vocabulary by James A. Fitzgerald (Milwaukee: Bruce Publishing Company, 1951), p. 1.

[3]J. E. Wallin, Spelling Efficiency in Relation to Age, Grade, and Sex, and the Question of Transfer (Baltimore: Warwick and York, Inc., 1911), pp. 82-83.

superiority of drill versus incidental teaching of spelling, and gave impetus to the investigation of spelling problems.[4]

The first of four great studies to identify the words most commonly used in different sorts of English writing was done by the Reverend J. Knowles in London, England, in 1904. Passages were taken from the English Bible and from various authors. A list was made of the 353 words which occurred most frequently, and the number of times each occurred was noted.[5]

In 1911 a study was made by Eldridge of Niagara Falls, and the results were published in a pamphlet entitled "Six Thousand Common English Words." It consisted of an analysis of the vocabularies of 250 different articles taken from four issues of Sunday newspapers published in Buffalo, New York. Eldridge found that they contained a total vocabulary of 6,002 different words, which with their repetitions made an aggregate of over 43,000 words.[6]

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[4]Robert Thompson, Effectiveness of Modern Spelling Instruction (New York: Bureau of Publications, Teachers College, Columbia University, 1930), p. 3.

[5]Leonard P. Ayres, A Measuring Scale for Ability in Spelling (New York: The Russell Sage Foundation, 1915), p. 5.

[6]Ibid., p. 6.

A third study was concluded by Ayres in 1913, and the results were published by the Division of Education of the Russell Sage Foundation in a monograph entitled "The Spelling Vocabularies of Personal and Business letters." Tabulation was made of 23,629 words from 2,000 short letters written by 2,000 different people. The total vocabulary used was found to consist of 2,001 different words, and the number of appearances of each was reported. Ayres earlier had discovered that of the 414 words of the National Education Association spelling list, 70% did not appear, even once, in 2,000 business and personal letters which were analyzed.[7]

The last of these four studies was done by Cook and O'Shea, and the results were presented in 1914 in a book entitled The Child and His Spelling published by the Bobbs-Merrill Company. This study consisted of the tabulation of some 200,000 words taken from the family correspondence of thirteen adults. The total vocabulary was found to consist of 5,200 different words, and the number of times each occurred was reported.[8]

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[7] Ibid., p. 7.

[8] Ibid., p. 7.

There was one characteristic common to all of these studies: the cumulative evidence that a few words do most of the work in writing. In every one of the studies it was found that about nine words recur so frequently that they constitute in the whole one-fourth of the total number of words written, while about fifty words, with their repetitions, constitute one-half of all the words written.[9] Thus, in 1915, it seemed reasonable to argue that it would be well to find out which words constitute the foundation vocabulary used in ordinary English writing and teach them in the schools so thoroughly that the children by every-day use would permanently master them. One trouble arose from the fact that few authors could agree on the number of words necessary for this foundation; another arose from the realization that the reliability of any list decreases with its length. A list may be constructed to include the fifty commonest words and probably the 500 commonest words with possibilities extending it to include the 1,000 commonest, but not the 2,000 commonest. Long before this point was reached, the identity of the most frequently used words varied according to the subject under consideration.

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[9] Ibid., p. 8.

In 1916 Ayres finally selected a list of 1,000 commonest words from a total of 368,000 words taken from combining the results of the four earlier studies and from business and personal letters written by some 2,500 different persons.

Pearson published a speller for grades two through eight which represented an attempt to teach only the essential words of the written vocabularies of children. It consisted of 2,000 most important words used frequently by the majority and a supplement of 1,000 less important words. Thousands of children's compositions from the Horace Mann School and other schools were examined. Use was made of previous vocabulary studies by Jones, Ayres, Pryor, Eldridge, Smith, Woolfolk, Cook and O'Shea, and Chancellor.[10] The words were carefully graded on the basis of their use in the written compositions. A review was provided with the more difficult words being reviewed more often than the easier ones. This speller represented a scientific approach to the spelling problem.

One thousand most common words with their repetitions make up 89 per cent of running words; 2,000 words make up

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[10]Henry C. Pearson and Henry Suzzallo, Essentials of Spelling (New York: American Book Company, 1919), p. iii.

95.05 per cent of the running words in adult writing; 4,000 words make up 97.8 per cent; and 10,000 words make up 99.4 per cent.[11] These figures throw some doubt on the wisdom of teaching more than 3,000 or 4,000 words.

Spelling difficulty of a word was at one time held to be the most important criterion in determining its grade placement. This idea conflicts somewhat with that of grading a word to the child's present needs. Many words are difficult to spell but are used with great frequency by children in all grades in the elementary school. The fact that certain often-used words are difficult is all the more reason for helping children learn to spell them.

In 1918 Hollingworth made a study of the relative spelling difficulty of successive letters of words. She tabulated the number of errors in the first letter of words, in the second letter, and so forth.[12]

In contrast to teaching spelling today, it is interesting to note Pearson's statement in 1919:

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[11] Ernest Horn, "Teaching Spelling," What Research Says to the Teacher (Washington: Department of Classroom Teachers, American Educational Research Association of the N. E. A., January, 1954), p. 6.

[12] James E. Mendenhall, An Analysis of Spelling Errors (New York: Teachers College, Columbia University, 1937), p. 20.

> Psychological evidence now shows clearly that correct spelling results chiefly from appropriate and continuous drill. . . . No artificial means are needed to awaken interest through pictures or other devices.[13]

Later Research

In 1928 Gates started the experimental and statistical work for his monograph. A list of 3,876 most commonly taught words was selected by determining the frequency with which the words appeared in twenty-five spelling textbooks and state and large city spelling lists. This limitation to 3,876 words was arbitrary. No claim is made that these are the best words to teach but only that the list includes the 3,876 words most frequently taught in the American classrooms. Exercises were made up from this list and given to pupils in the New York City area until a satisfactory, reliable, and stable grade placement was obtained for each. Evidence was then gathered concerning the characteristics of errors in spelling. In many cases a single misspelling was common. In other cases the difficulty was localized in a definite part of the word. Significantly, only a small percentage of the words showed neither common errors nor a special locus of difficulty.[14]

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[13]Pearson and Suzzallo, op. cit., p. iv.

[14]Arthur I. Gates, A List of Spelling Difficulties in 3,876 Words (New York: Teachers College, Columbia University, 1937), p. 7.

Horn earlier showed that after about 2,000 words are learned, the returns for learning additional words diminished very rapidly. As a result, the general trend is to learn fewer spelling words than before.[15]

Mendenhall published the results of a study in 1930 involving 2,300 words which substantiated the facts cited by Hollingworth. In four-letter words the greatest difficulty appeared in the fourth letter; in five-letter words the greatest difficulty appeared in the third letter; and so forth.[16]

Related Research

Spelling has been taught in conjunction with reading, as incidental to major subjects, and as a major subject in itself. The discussion of spelling disability factors is divided into the areas of the physical, the intellectual, the temperamental, the subject matter, and the miscellaneous.

Several writers believe that visual perception is an important factor in spelling. Gates and others have investigated and failed to find a single case in which poor general visual perception was associated with poor spelling.[17]

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[15]Horn, op. cit., "Teaching Spelling," p. 6.

[16]Mendenhall, op. cit., p. 24.

[17]George Spache, "Spelling Disability Correlates II--Factors That May Be Related to Spelling Disability," Journal of Educational Research, Vol. 35, pp. 119-137.

Many experimenters have studied the significance of mixed hand-eye dominance in spelling. Some data indicated a slightly greater incidence of left-eye preference among the poorer performers, but the general conclusion was that the results were insignificant.[18]

Surveys have shown that girls are generally superior to boys in spelling. This has been accounted for by the presumption of the lesser conformity and greater aggressiveness of boys and by the biological fact that girls mature earlier than boys and hence perform on a higher level.[19]

Evidence is offered by some research workers that poor performers manifested more school problems, temper tantrums, and day dreaming than other clinic cases. Most writers agree that it is difficult to establish whether these traits antedate, follow, or are coincidental with disability.[20]

A very extensive reading word count was made by Thorndike and Lorge, which included the basic work of two previous "Word Books" and new data based upon three

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[18] Ibid.

[19] Ibid.

[20] Ibid.

tabulations of over four and one-half million words each. A list of 30,000 different reading words was presented.[21]

Hildredth stated:

> Spelling is a process of clearly recalling from memory the appearance, sound, or kinaesthetic movement of a word configuration. . . . This presupposes the ability to write the separate letters correctly.[22]

All of the related studies investigated indicated this same basic assumption of the pupils' complete knowledge of the alphabet. As far as the writer has been able to discover, there has been no comparative study on spelling ability as influenced by knowledge of the alphabet.

Tests of Spelling Ability

Just as there are many spelling lists which contain words which are seldom or never used, there are spelling tests which will not measure spelling ability with the necessary accuracy. Spelling tests may be divided into several categories:

1. Survey tests
2. Classroom tests
3. Diagnostic tests

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[21]James Fitzgerald, A Basic Life Spelling Vocabulary (Milwaukee: Bruce Publishing Company, 1951), pp. 22-23.

[22]Gertrude H. Hildreth, Learning the Three R's (Minneapolis: Educational Publishers, Inc., 1936), p. 196.

The chief value of standard survey tests is found in their use as a screening device and to check up on the general level of progress for the class as a whole. Survey tests determine the pupils' achievement level in spelling compared with children of his age and present grade placement.

Hildreth recommended the following standardized spelling tests:[23]

> Morrison-McCall Spelling Scale, eight forms for grades two through eight. Each form consists of 50 words ranging from simple to difficult in progressive order. Each word is read in a sentence.
>
> Stanford Achievement Test, three levels: primary, intermediate, and advanced. The range of words overlaps in the three levels. Each word is illustrated in sentences.
>
> Metropolitan Achievement Tests, Forms R, S, T, U. Four levels: Primary II, Primary III, Intermediate, and Advanced for grades two through eight. The primary tests are in sentence-completion form.

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[23]Gertrude H. Hildreth, Teaching Spelling (New York: Henry Holt and Company, 1955), pp. 292-293.

All of the spelling tests mentioned on the preceding page are published by the World Book Company, Yonkers-on-Hudson, New York.

CHAPTER IV

METHOD OF THE STUDY

The Sample

One important problem in the statistical work is that of sampling. The sample is the number of cases used from the total number of cases (population or universe). It is rarely possible to work with all the cases available; more than that, it is not necessary. It is only necessary to get a true representation of the population with a reasonably small error.

In the behavioral sciences it is recognized and acknowledged that perfectly random samples of a large population have never been achieved; but by making the necessary assumptions in terms of practical considerations, sound and useful statistics have been generated.[1]

McNemar stated:

> The demonstrated of a difference or effect which is large enough to possess any practical significance will not require large samples.[2]

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[1]Allen L. Edwards, Statistical Analysis for Students in Psychology and Education (New York: Rinehart and Company, Inc., 1946), p. 286.

[2]Quinn McNemar, "Sampling in Psychological Research," Psychological Bulletin, 1940, 37, pp. 331-365.

A fairly simple and practical method of deciding when a sample N is "sufficiently large" is to increase N until the addition of extra cases, drawn at random, fails to produce an appreciable change in those mathematical expressions that describe the sample.

The sample in this study consisted of a group of 127 fourth grade pupils from two elementary schools in Las Cruces, New Mexico. The socio-economic status of the neighborhoods in which these two schools were located seemed to be representative of the city; that is, most of the pupils came from middle income homes, while a small percentage came from high income homes and a small percentage came from low income homes. The wage earners of these homes might be classified as semi-professional, skilled, and semi-skilled. Originally, 151 pupils were selected for the sample; but since the I.Q.'s for 21 pupils were not known and three pupils misunderstood the directions, 24 cases were discarded, leaving a total of 127 pupils on whom all the information was available.[11] The fourth grade was selected because pupils at that level have been instructed in written knowledge of the alphabet.

The Tests Used

List 8 of the Morrison-McCall Spelling Scale for grades two through eight was selected as the standard spelling test

used to measure the individual pupil's spelling ability. Eight word lists were available, each consisting of 50 words of graduated difficulty. All the words in each list were selected from Ayres' Spelling Scale and Buckingham's Extension of Ayres' Spelling Scale. In addition, the words were required to appear in Thorndike's Word Book of the 5,000 Most Commonly Used Words. To select the norms for the spelling scale, approximately 8,000 pupils were tested in each grade, except the ninth, in rural and village schools of New York State. Later, to test the eight lists for equivalence, List 1 was applied to 33,299 pupils, List 2 to 10,542 pupils, and List 3 to 13,490 pupils. These pupils were a sampling from grades two to nine in the rural and village schools of New York State. Since the norms of the three lists proved to be "almost exactly identical," it was assumed that all the lists were similarly equivalent since all were constructed in the same manner.[3]

The Primary Level, Form C, Detroit Intelligence Test was used to measure I.Q. This test is in eight pages and is of a fairly traditional type of a group intelligence test. The sub-parts of each test are arranged in the order of

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[3]J. Cayce Morrison and William A. McCall, Morrison-McCall Spelling Scale (New York: World Book Company, 1923), p. 7.

difficulty and are designed to cover the entire range of mental age of the pupils taking the test. The total score earned is converted to mental age. I.Q.'s are then computed by dividing mental age by chronological age and multiplying the quotient by 100. The standardization is based on a population sample sufficiently large to warrant confidence in the usefulness of the test.[4] The mental age norms are based on 39,263 cases, and portions of the subtests are based on as many as 150,000 cases.

Detroit I.Q. scores correlate .810 with the Stanford-Binet I.Q. scores for 200 unselected cases. An alternate Form D of the Primary Level, Detroit Intelligence Test is available which correlates .930 with Form C.[5]

The method devised to test for written knowledge of the alphabet was to have the pupils write the alphabet in regular order. This seemed to be the best and simplest procedure of testing for actual written knowledge of the letters of the alphabet.

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[4]W. Line, Mental Measurements Yearbook (Bridgeport: Braunworth and Company, Inc., 1941), p. 1392.

[5]Harry J. Baker, Manual of Directions (Bloomington: Public School Publishing Company, 1941), pp. 1-16.

The Test Procedures

Each class involved was given the Detroit Intelligence Test by the Elementary School Supervisor as part of the regular school program in 1957.

The tests for spelling ability and knowledge of the alphabet were given by the class teachers during a morning session between the dates of November 11 to 22, 1957. When more than one class was tested at one school, each class was tested simultaneously.

All teachers involved in this study were indoctrinated in the generally accepted procedures of test administration which includes the following:

1. Become familiar with the tests and their directions prior to administration.

2. Anticipate and avoid all distractions while the tests are in progress.

3. Have all necessary materials ready before the test begins.

4. Give no assistance on test items; however, aid in the mechanics of the test if necessary.

5. Check each paper for completion of identifying information at the end of the test.

The Test Instructions

The teachers were given the following instructions:

1. Have the pupils write their name, grade, and date of birth on standard lined school paper. Next, ask them to write the capital letters of the alphabet in regular order. Collect the papers.

2. Have the pupils write their names on a clean sheet of paper. Ask them to write the alphabet in small letters in regular order. Collect the papers.

3. Last, have the pupils write their names on a clean sheet of paper.

NOW SAY:

"This morning we are going to have a spelling test. Will you please try every word. I will give you the number, the word to spell, then the word in a sentence--and again repeat the word you are to spell. If you cannot understand, or forget the word, raise your hand and I will say it again for you."

Administer List 8 of the Morrison-McCall Spelling Scale. Collect the papers.

Scoring

All scoring was done by the author to eliminate a possible teacher-pupil bias.

An alphabet score was obtained by combining the 26 capital and 26 small letters of the alphabet and counting the number which were correct. Both correct order and proper

form were considered. If two letters were transposed, two errors were marked. If a letter was omitted, one error was marked. Since many different degrees of form exist, no letter was marked as incorrect unless the writing clearly showed a confusion on the part of the pupil in forming the letter.

A spelling score was calculated by determining the number of words spelled correctly on the Morrison-McCall Spelling Scale.

The following information was recorded for each case included in this study:

1. Name of the pupil
2. School attended
3. Grade placement
4. I.Q. as measured by the Detroit Intelligence Test
5. Chronological age (verified from school records)
6. Number of words correct on the Morrison-McCall Spelling Scale
7. Number of letters correct for the capital and small letters of the alphabet

Statistical Procedures

Since the validity of any correlation study depends, in part, upon the mathematics involved, all equations used

will be described in detail. The statistical work involved two variables and attempted to describe their relationship.

When the relationship between two variables can be expressed as a linear function, one technique for describing this relationship is the product-moment correlation coefficient. This ratio r_{xy} is simply the average product of all the corresponding x and y standard scores and measures the degree to which two variables are associated.

The coefficient of partial correlation measures the degree of association between two variables while a third variable is held statistically constant. The coefficient of multiple correlation measures the degree of association between one variable and two others combined.

A correlation coefficient may vary from +1.00, through zero, to -1.00. A coefficient of +1.00 indicates a perfect positive relationship between two variables; a zero coefficient indicates no relationship; and -1.00 indicates a perfect negative relationship. Perfect or near-perfect relationships are seldom, if ever, found because of the difficulties of controlling all possible factors which may influence the two variables being studied.[6]

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[6]Edwards, op. cit., p. 80.

Because the sample used was large, time and labor were saved by first arranging the data in the form of a diagram or chart and then calculating the statistic. Along the left-hand margin from bottom to top of a diagram were marked off the class intervals of the alphabet score, expressed as the number of letters correct. Along the top from left to right were marked off the class intervals of spelling ability, measured as the number of words correct. Entry for each pupil in the sample was then made with respect to the alphabet score y and the spelling score x. Thus, each pupil had a tally mark which represented two measurements about his ability. The sums and products of the proper tally marks resulted in a correlation chart.[7]

The validity of the assumed linear relationship of the two variables could be visually determined from the chart while the mean, the standard deviation, and the coefficient of correlation were calculated. The mean, $\bar{X}$, is the arithmetical average obtained by adding all the scores and dividing by the total number of scores. The standard deviation, σ , is the positive square root of the sum of squares of the deviations from the mean divided by the total

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[7]Henry E. Garrett, Statistics in Psychology and Education (New York: Longmans Green and Company, Inc., 1953), pp. 134-139.

number of cases for large N.[8] Thus, σ is a measure of the dispersion or spread of the scores.

Symbolically, if N scores were represented by $x_1, x_2, x_3, - - - - x_n$ the sum of these scores would be $\sum_{i=1}^{N} X_i$. The mean, $\bar{X}_x$, could be written as

$$\bar{X}_x = \frac{\sum_{i=1}^{N} X_1}{N} \qquad (1)$$

and the standard deviation, σ_x, as

$$\sigma_x = \sqrt{\frac{\sum_{i=1}^{N} (X_1 - \bar{X})^2}{N}} \qquad (2)$$

In terms of original measurements, r_{xy} is defined by the equation:[9]

$$r_{xy} = \frac{\sum_{i=1}^{N} (X_1 - \bar{X})(Y_1 - \bar{Y})}{N \sigma_x \sigma_y} \qquad (3)$$

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[8] Ibid., p. 50.

[9] J. B. Scarborough and R. W. Wagner, Fundamentals of Statistics (Boston: Ginn and Company, 1948), pp. 15-41.

In terms of the correlation chart, a more useful form of equations 1, 2, and 3 was:[10]

$$\bar{X}_x = A.\,O. \pm C_x \qquad (1a)$$

where $C_x = \frac{\Sigma fxdx}{N}$ and A. O. was the arbitrary origin or midpoint of a central score interval.

$$\sigma_x = i\sqrt{\frac{\Sigma fxdx^2}{N} - \left(\frac{\Sigma fxdx}{N}\right)^2} \qquad (2a)$$

where i was the class interval on the chart, fx was the frequency of x, and dx was the deviation of x from A. O.

$$r_{xy} = \frac{\frac{\Sigma fdxdy}{N} - C_x C_y}{S_x S_y} \qquad (3a)$$

where $S_x = \sigma_x \div i$ thus keeping the computation in class-interval units.

The last three forms required the sums of fx, fy, dx, dy, dx^2, and dy^2, all of which were readily available from the correlation chart.

To find the partial correlation coefficient $r_{xy.z}$ between spelling scores x and alphabet scores y when I.Q.

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[10]Lee J. Cronbach, Essentials of Psychological Testing (New York: Harper and Brothers, 1949), pp. 29-41.

scores z was held statistically constant, it was only necessary to evaluate the equation described by Dixon:[11]

$$r_{xy.z} = \frac{r_{xy} - r_{xz}\, r_{yz}}{\sqrt{(1 - r_{xz}^2)(1 - r_{yz}^2)}} \qquad (4a)$$

To calculate the multiple correlation coefficient $R_{x(yz)}$ between spelling scores x and alphabet scores y and I.Q. scores z combined, the following equation described by Dixon must be evaluated.[12]

$$R_{x(yz)} = \left| \sqrt{r_{xy}^2 + r_{xz.y}^2\,(1-r_{xy}^2)} \right| \qquad (5a)$$

The first term on the right represented the proportion of the total variation in x explained by y. The second term represented the proportion of the remaining variation in x explained by z after the effect of y had been determined.

After the statistic was calculated, the reliability must be determined.

A hypothesis which is set up with the possibility of being rejected at some designated level of significance is a null hypothesis. Fisher emphasized that "every experiment

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[11]Wilfred J. Dixon and Frank J. Massey, Jr., Introduction to Statistical Analysis (New York: McGraw-Hill Book Company, 1951), p. 383.

[12]Ibid., p. 396.

may be said to exist only in order to give the facts a chance of disproving the null hypothesis."[13]

To test if the calculated r for two variables was significant, the null hypothesis that the population correlation coefficient $\rho = 0$ was set up. If a significance level of .01 were taken and both tails of a normal distribution were used as the rejection region, the calculated value of r would be significant in a representative sample of N = 127 in a normally distributed population if r were greater than .228 (See Table J).[14]

If this critical value .228 did not exceed the calculated r, the null hypothesis was rejected and the correlation coefficient was significant at the one per cent level of confidence.

The reliability of the partial correlation coefficient can be determined through the same process with one exception. The number of effective observations (degrees of freedom) must be decreased by one for every variable held constant. Thus, for N = 127, when one variable was held statistically constant, a value of $r_{xy.z}$ greater than .229 would be significant at the one per cent level of confidence.

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[13]Ronald A. Fisher, The Design of Experiments (Edinburgh: Oliver and Boyd, 1942), p. 16.

[14]Garrett, op. cit., p. 439.

To test the reliability of the multiple correlation coefficient the same method as for the partial correlation was followed, again with one exception. The number of variables was increased to include the total number of variables studied. Thus, for N = 127, a value of $R_{x(yz)}$ greater than .267 would be significant at the one per cent level of confidence.[15]

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[15] Ibid.

CHAPTER V

RESULTS

Means and Standard Deviations

The children ranged in chronological age from 9 years 0 months to 11 years 3 months with a mean age of 9 years 11 months.

The I.Q.'s, as measured by the Detroit Intelligence Test, ranged from 72 to 135 with a mean of 101.288 and a standard deviation of 12.484. This seemed to be consistent with the statistics reported by Baker.[1]

The spelling scores as measured by the Morrison-McCall Spelling Scale ranged from 5 to 33 with a mean score of 18.594. According to the Morrison-McCall Manual, a mean score of 18.594 corresponds to a chronological age score of 9 years 10 months. This in conjunction with I.Q. scores seemed to justify the assumption of the normalcy of the sample.

The ranges, means, and standard deviations of all the scores are presented in Table I.

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[1]Harry J. Baker, Manual of Directions (Bloomington: Public School Publishing Company, 1941), pp. 1-16.

TABLE I

RANGES, MEANS, AND STANDARD DEVIATIONS

Subject	Limits	Range	Mean	Standard Deviation
I. Q.	72 to 135	63	101.288	12.484
Spelling	5 to 33	28	18.594	5.994
Alphabet	38 to 52	14	45.835	3.338
C.A. (in months)	108 to 135	27	119.500	6.620

Correlation Results

The zero order correlations between spelling scores, alphabet scores, and I.Q. scores were significant in every case at the one per cent level. Only once in 100 trials would a positive r larger than .228 arise through sampling errors.[2] The null hypothesis that $\rho = 0$ was rejected in these three cases.

The correlation coefficient obtained between spelling scores and chronological age was -.075 which was not significant at the one per cent level of confidence.

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[2]Henry E. Garrett, Statistics in Psychology and Education (New York: Longmans Green and Company, 1953), p. 301.

The partial correlation obtained between spelling scores and written knowledge of the alphabet scores holding I.Q. statistically constant was .658 which was significant at the one per cent level of confidence.

The multiple correlation coefficient computed between spelling scores as one variable and alphabet and I.Q. scores as the other variable was .743. This was significant at the one per cent level of confidence.

All zero order correlation coefficient results are shown in Table II.

TABLE II

TWO VARIABLE ZERO ORDER CORRELATION COEFFICIENTS

Variables	r
Spelling and Alphabet	.691*
Spelling and I.Q.	.460*
I.Q. and Alphabet	.284*
Spelling and C.A.	-.075

*Significant at the one per cent level of confidence

It was found that only three pupils out of the 127 studied, or 2.3 per cent, were able to write the total capital and small letters of the alphabet correctly.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Summary

The standardization of English spelling ran parallel to the development of the printing press. Unfortunately, this occurred while the language was still undergoing phonetic changes so that today almost every letter of the English alphabet is represented by multiple sounds. Troublesome inconsistencies in the English language make spelling a difficult subject to master.

Since the turn of the century, spelling investigations have been fairly numerous. Concentrated efforts have been made in the development of word scales, standardized spelling lists, word analyses, tests, and methods of teaching. As a result, spelling scales of about 4,000 words are used in grades two through eight and are based on frequency of use, utility, and the level of difficulty. Tests have proved valuable as a means of classifying pupils and evaluating instruction.

Most spelling instruction is based upon the theory that there is a list of words which the pupils should learn to spell, and they will learn to spell those words by memorizing the letters of the words in the order in which

those letters appear in the words.[1] This was the logical outcome of Ayres' study almost a half century ago. There are few schools today that devote more than 15 or 20 minutes a day to spelling--the maximum recommended by Rice in 1897.

The goal of spelling is the communication of ideas through the written word. The ability to spell correctly gives the writer freedom to concentrate on expressing his thoughts.

The basic problem of this study was to determine whether or not any relationship existed between spelling ability and written knowledge of the alphabet in fourth grade pupils. Children in the fourth grade were tested for I.Q., spelling ability, and knowledge of the alphabet. The sample consisted of 127 fourth grade pupils from Las Cruces, New Mexico. All statistics computed are listed in Tables I and II. The data which produced the statistics are shown in Charts I, II, and III.

The group had a mean I.Q. of 101.288 and a mean spelling age of 9 years 10 months. The mean chronological age was 9 years 11 months. This seemed to justify the assumption of the normalcy of the sample.

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[1]James A. Fitzgerald, A Basic Life Spelling Vocabulary (Milwaukee: The Bruce Publishing Company, 1951), pp. 5-24.

Correlation coefficients computed were as follows: spelling with alphabet .691; spelling with I.Q. .460; I.Q. with alphabet .284. These were all statistically significant at the one per cent level of confidence. The correlation coefficient obtained between spelling and chronological age was -.075 which was not statistically significant at the one per cent level of confidence.

The partial coefficient between spelling and alphabet scores holding I.Q. statistically constant was .658. The multiple coefficient between spelling scores as one variable and alphabet and I.Q. scores as the other variable was .743. These were both statistically significant at the one per cent level of confidence.

Conclusions

The findings of this study seemed to indicate the following:

1. At the fourth grade level, pupils who have a good knowledge of the alphabet apparently are able to spell better than those with a poor knowledge of the alphabet.

2. Although intelligence is important to spelling, there is a statistically significant relationship between spelling ability and knowledge of the alphabet which is independent of intelligence.

3. The correlation between spelling ability and chronological age at the fourth grade level is statistically insignificant.

4. At the fourth grade level a knowledge of a student's I.Q. together with his alphabet score would be of limited predictive value concerning his spelling ability.

5. Few pupils at the fourth grade level have any real competence in the written knowledge of the alphabet.

Suggestions for Further Study

1. An effort should be made to determine the relationship of personality factors to spelling ability.

2. Investigation should be done in the field of spelling readiness. This could include such factors as memory for sounds and letters, motor mechanism ability, knowledge of meanings of words, and so forth.

3. A study should be done on the correlation between recall and spelling ability.

4. A comprehensive study should be done on the relation between children's reading, speaking, and writing vocabularies.

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APPENDIX A

CHART I

Alphabet

fd_x^2	fd_y	d_x	f	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	X
		-9																					0 1
		-8																					2 3
147	-21	-7	3			1		II															4 5
108	-18	-6	3				1		1			1											6 7
100	-20	-5	4			1		1		1	1												8 9
48	-12	-4	3					1	1			1											10 11
72	-24	-3	8					1	1	1	II	II	1										12 13
60	-30	-2	15		1	1	1	1	III	1	1	1	II		1	II							14 15
18	-18	-1	18				1	1		1	II	IIII	IIII	II	1	1							16 17
0	0	0	15		1				1	II		IIII	IIII	IIII	1			1					18 19
20	20	+1	20						II		1	IIII	IIII	1	II	III	III						20 21
48	24	+2	12						1		1	1	1	II	II		1	III					22 23
90	30	+3	10									1	1	1	1	III	II	1					24 25
112	28	+4	7												III	1	1	1	1				26 27
100	20	+5	4											1	1	1		1					28 29
72	12	+6	2												1			1					30 31
147	21	+7	3														1		II				32 33
		+8																					34 35
		+9																					36 37
Σfd_x^2 = 1142		N			2	3	3	7	10	6	8	17	17	11	13	11	8	8	3				f
	Σfd_x = 12	Σfd_y = -21		-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	d_y
	Σfd_y^2 = 1419				-16	-21	-18	-35	-40	-18	-16	-17	0	11	26	33	32	40	18				fd_y
					128	147	108	175	160	54	32	17	0	11	52	99	128	200	108				fd_y^2
$\Sigma fd_{xy}d_y$ = 876		Σfd_{xy} = 12			-2	-14	-9	-29	-15	-11	-12	-13	-3	11	29	16	22	24	18				fd_{xy}
		N = 127			16	98	54	145	60	33	24	13	0	11	58	48	88	120	108				fd_xd_y

Spelling

$$r = \frac{N\Sigma fd_{xy}d_y - [\Sigma fd_x][\Sigma fd_y]}{\sqrt{N\Sigma fd_x^2 - [\Sigma fd_x]^2}\sqrt{N\Sigma fd_y^2 - [\Sigma fd_y]^2}} = \frac{127(876) - [12][-21]}{\sqrt{127(1142) - (12)^2}\sqrt{127(1419) - (21)^2}}$$

$$\sigma_x = \frac{\sqrt{N\Sigma fd_x^2 - [\Sigma fd_x]^2}}{N} = \quad \sigma_y = \frac{\sqrt{N\Sigma fd_y^2 - [\Sigma fd_y]^2}}{N} =$$

r = .691

SE_r = .046

Computed by D. A. Schluter Jr. Date Feb. 20, 1958

X Spelling Alphabet Y

CHART II

I. Q.

fd_x^2	fd_y	d_x	f	64	67	68	71	72	75	76	79	80	83	84	87	88	91	92	95	96	99	100	103	104	107	108	111	112	115	116	119	120	123	124	127	128	131	132	135	136	139	Y
		-9																																						0 1
		-8																																						2 3
147	-21	-7	3							1						1							1																		4 5
108	-18	-6	3										II		1																										6 7
100	-20	-5	4							1										III																					8 9
48	-12	-4	3							1			II																												10 11
72	-24	-3	8													1		III		1			III	1																		12 13
60	-30	-2	15					1					1			II		III		III			III	II																		14 15
18	-18	-1	18					1								IIII		II		II			I	IIII		II		II														16 17
0	0	0	15												1	III		IIII		I			IIII																			18 19
20	20	+1	20												II	I		II		II			IIII	INII		II																20 21
48	24	+2	12												II	II		I		I			I			II																22 23
90	30	+3	10										-		II			I		I				I		II																24 25
112	28	+4	7															I		I				I		I																26 27
100	20	+5	4																																								28 29
72	12	+6	2															I																								30 31
147	21	+7	3																	I			II																			32 33
		+8																																							34 35
		+9																																							36 37
$\Sigma fd_x^2 = 1142$			N					2		3		6		6		13		15		15			19		14		9		9		5		7		1		1		2		f
	$\Sigma fd_x = 12$		$\Sigma fd_{xy} = -27$	-9	-8			-7		-6		-5		-4		-3		-2		-1			0		+1		+2		+3		+4		+5		+6		+7		+8		+9	d_y
			$\Sigma fd_y^2 = 1243$					-14		-18		-30		-24		-39		-30		-15			0		14		18		27		20		35		6		7		16			fd_y
								98		108		150		96		117		60		15			0		14		36		81		80		175		36		49		128			fd_y^2
$\Sigma fd_{xy}d_y = 544$	$N = 127$		$\Sigma fd_{xy} = 12$					-3		-16		-19		2		-10		-2		-11			-3		3		14		22		11		11		0		5		8			Σfd_{xy}
								21		96		95		-8		30		4		11			0		3		28		66		44		55		0		35		64			Σfd_{xy}^2

Spelling

$$r = \frac{N\Sigma fd_{xy}d_y - [\Sigma fd_x][\Sigma fd_y]}{\sqrt{N\Sigma fd_x^2 - [\Sigma fd_x]^2}\ \sqrt{N\Sigma fd_y^2 - [\Sigma fd_y]^2}} = \frac{127(544) - [\ 12\ ][-27\ ]}{\sqrt{127(1142) - (12)^2}\ \sqrt{127(1243) - (27)^2}}$$

$$\sigma_x = \frac{\sqrt{N\Sigma fd_x^2 - [\Sigma fd_x]^2}}{N} = \qquad \sigma_y = \frac{\sqrt{N\Sigma fd_y^2 - [\Sigma fd_y]^2}}{N} =$$

X Spelling
Y I. Q.
$r = .460$
$SE_r = .071$

Computed by D.A. Schluter Jr. Date Feb. 21, 1958

CHART III

I. Q.

fd_x^2	fd_y	d_x	f	64	67	68	71	72	75	76	79	80	83	84	87	88	91	92	95	96	99	100	103	104	107	108	111	112	115	116	119	120	123	124	127	128	131	132	135	136	139	X
		-9																																							37
128	-16	-8	2														I	I																								38
147	-21	-7	3															I		I	II																					39
108	-18	-6	3												I		I			I																					40
175	-35	-5	7							II							I		I	I	I				I																41
160	-40	-4	10					I					II		I					I	III			I	I																42
54	-18	-3	6														I	III		I	I			I																	43
32	-16	-2	8							I								I		I	II			II							I										44
17	-17	-1	17										II					I		I	IIII			II	I			II		I		II									45
0	0	0	17														II	III		III	IIII			IIII				II		I		II							I		46
11	11	+1	11												I		IIII	I			I				I			I							I						47
52	26	+2	13					I							II		II	I		I				I	II			I													48
99	33	+3	11										II		I			I		I	I			II				I													49
128	32	+4	8																	II	I			I	II			I													50
200	40	+5	8														I	II		I	I				I			II													51
108	18	+6	3																		I			I							I										52
		+7																																							53
		+8																																							54
		+9																																							55
			N					2		3		6		6		13		15		15	19		14		9		9		5		7		1		1		2			f
$\Sigma fd_x^2 = 1419$	$\Sigma fd_x = -21$		$\Sigma fd_y = -27$	-9	-8	-7	-14	-6	-18	-5	-30	-4	-24	-3	-39	-2	-30	-1	-15	0	0	+1	+1	+2	+2	+3	+3	+4	+4	+5	+5	+6	+6	+7	+7	+8	+8	+9		d_x
						98	98	108	108	150	150	96	96	117	117	60	60	15	15	0	0	14	14	36	36	81	81	80	80	175	175	36	36	49	49	128	128		fd_x	fd_x^2
$\Sigma fd_y^2 = 1243$																																									
$\Sigma fd_{xy}d_y^+ = 380$	$N = 127$		$\Sigma fd_y^+ = -21$			-2	-14	-12	-72	-4	-20	-2	-8	-9	-27	-9	-18	-10	-10	-24	0	-1	-1	8	16	18	54	10	40	7	35	1	6	3	21	5	40		fd_{xy}	Σfd_{xy}^2

$$r = \frac{N\Sigma fd_{xy}d_y^+ - [\Sigma fd_x][\Sigma fd_y]}{\sqrt{N\Sigma fd_x^2 - [\Sigma fd_x]^2}\sqrt{N\Sigma fd_y^2 - [\Sigma fd_y]^2}} = \frac{127(380) - [-21][-27]}{\sqrt{127(1419) - (21)^2}\sqrt{127(1243) - (27)^2}}$$

$$\sigma_x = \frac{\sqrt{N\Sigma fd_x^2 - [\Sigma fd_x]^2}}{N} = \qquad \sigma_y = \frac{\sqrt{N\Sigma fd_y^2 - [\Sigma fd_y]^2}}{N} =$$

$$S.E._r = .283$$

$r = .284$

X Alphabet

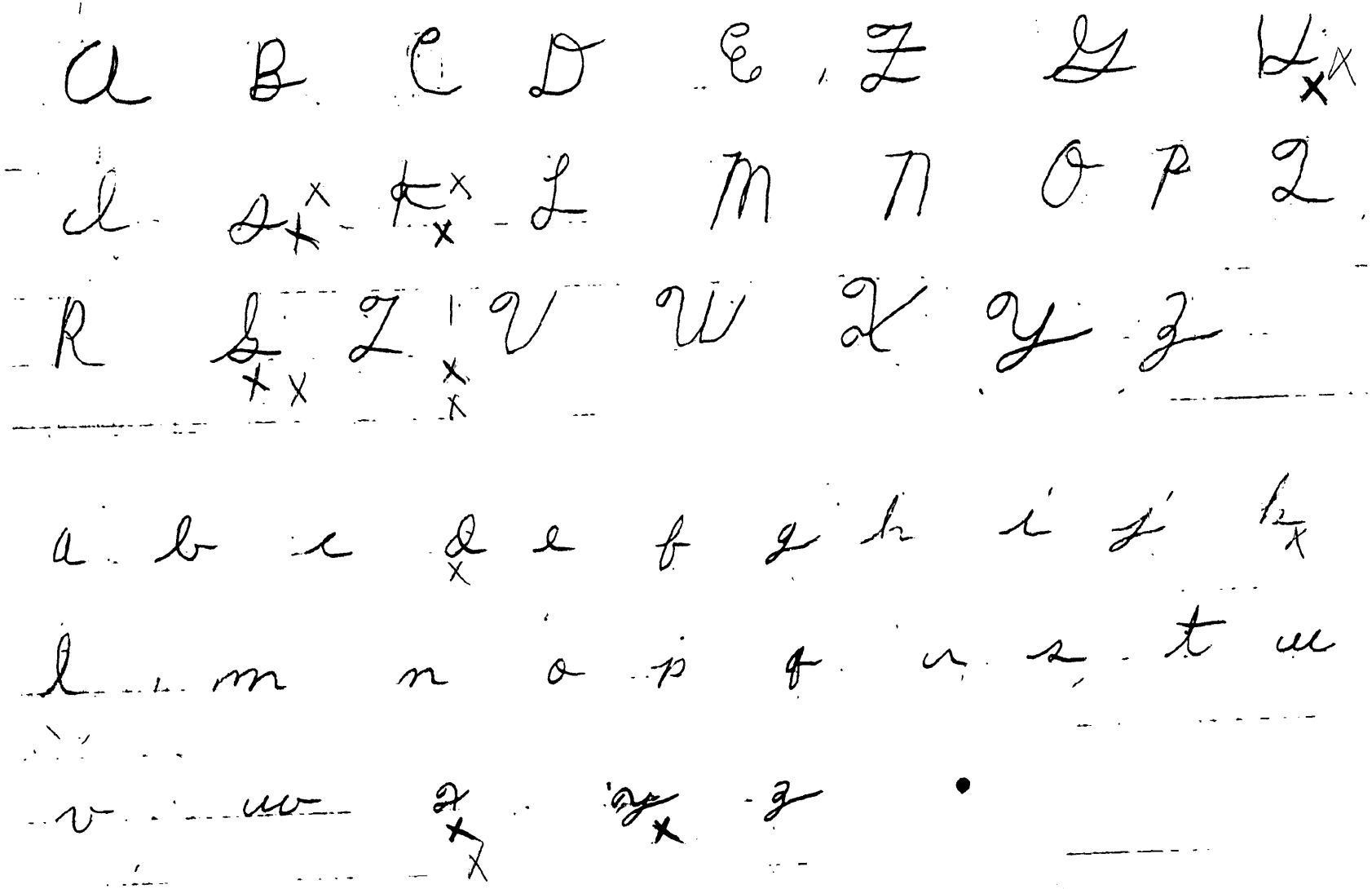
Y I.Q

Computed by D. A. Schluter Jr Date Feb. 22, 1958

Alphabet

APPENDIX B

ALPHABET TEST



SPELLING LIST

1.	go	You may go home.
2.	up	Put up the window.
3.	my	My head aches.
4.	time	What time is it?
5.	street	What street is this?
6.	live	Where do you live?
7.	soft	The ice cream is soft.
8.	five	I have five cents.
9.	spent	I spent all my money.
10.	river	This river is small.
11.	deep	The river is deep.
12.	stay	Stay in the house.
13.	upon	The Indians were upon them.
14.	could	Could you mend the toy?
15.	track	The track is six miles long.
16.	buy	Please buy me some candy.
17.	provide	I will provide for the future.
18.	goes	He goes away today.
19.	center	Point to the center of the circle.
20.	death	His death was very sad.
21.	retire	It is time to retire.
22.	objection	Have you any objection?
23.	proper	Is this the proper heading?
24.	rapid	His work was rapid.
25.	carried	I carried the banner.

26.	property	The property is mine.
27.	convict	The convict has escaped.
28.	visitor	We have a visitor.
29.	drown	Do not drown the kittens.
30.	wreck	There was a sad wreck today.
31.	supply	The supply is exhausted.
32.	affair	It was a gala affair.
33.	accident	It was an accident.
34.	associate	I will not associate with them.
35.	political	There is a political meeting tonight.
36.	probably	Probably we shall be late.
37.	application	You must file your application.
38.	ascending	I was ascending the stairs.
39.	extremely	We are extremely thankful to you.
40.	leisure	We spent our leisure time fishing.
41.	emergency	I reached for the emergency brake.
42.	foreigners	They are all foreigners.
43.	development	The development was perfect.
44.	intelligent	She is an intelligent child.
45.	seized	The man seized the falling child.
46.	orchestra	The orchestra played well.
47.	syllables	Pronounce the syllables distinctly.
48.	mortgage	The mortgage is due.
49.	persistence	Her persistence was amazing.
50.	incessant	The talking was incessant.

Primary Intelligence Test—C
Harry J. Baker
Grades II, III and IV

Published by the
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Form C

DETROIT PRIMARY INTELLIGENCE TEST

DEVISED BY HARRY J. BAKER

For Grades II, III and IV

To be filled in by pupil or teacher

Name..... Years..... Months.....
First Last

Grade..... School..... City.....

Boy..... Girl..... Home Language.....

Score Record

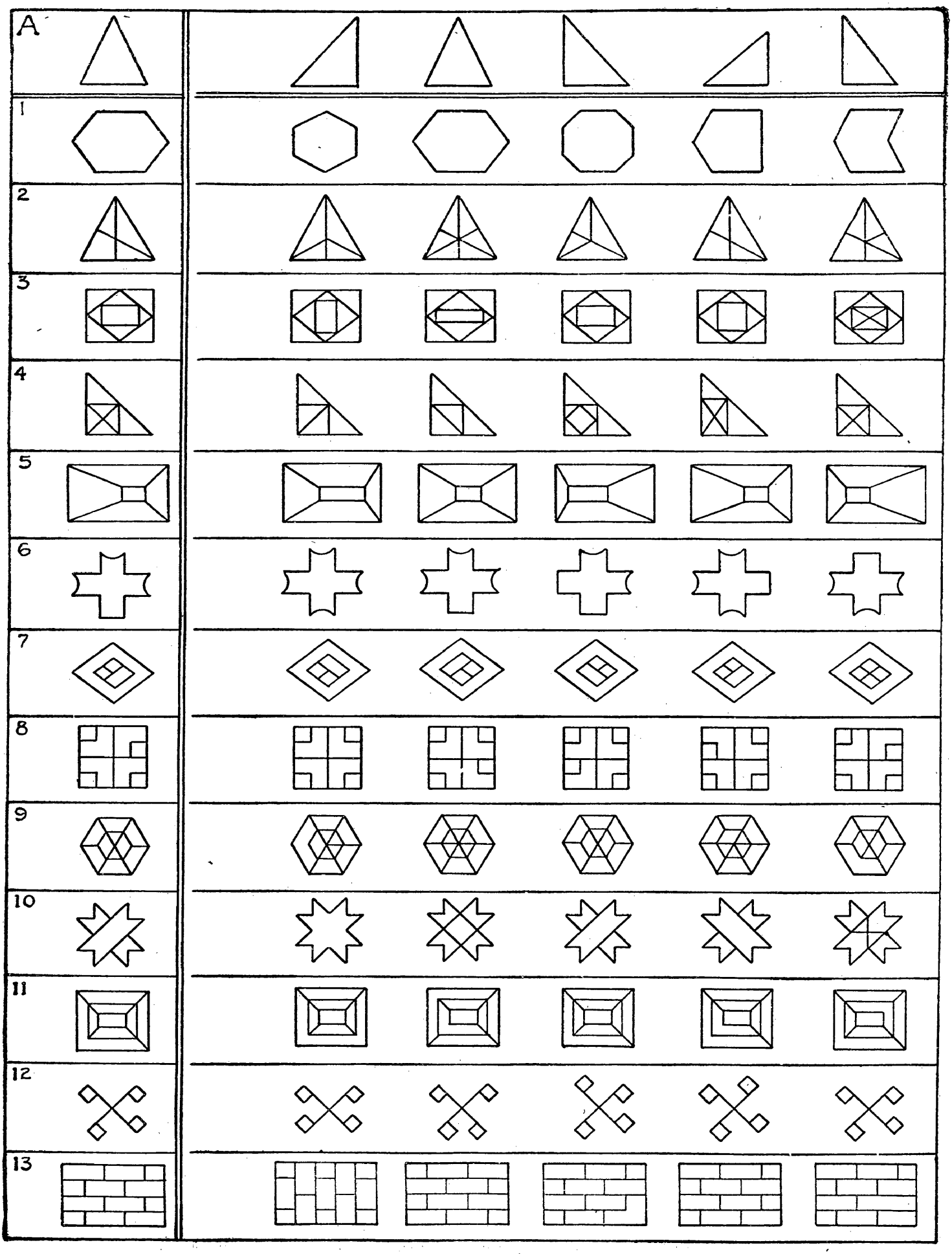
Part No.	Score
1	
2	
3	
4	
5	
6	
7	
Total	

Letter Rating.....

Instruction Group.....

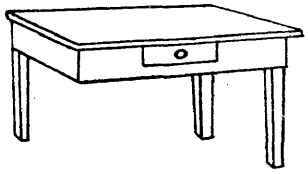
449-Sp

1



Score.....

A



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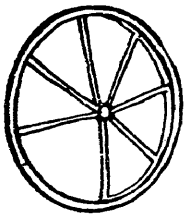

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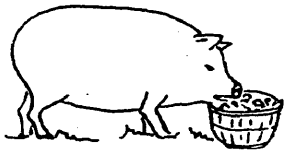

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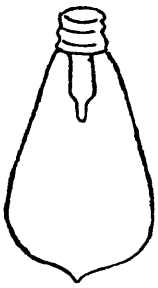

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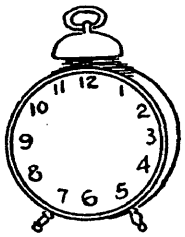

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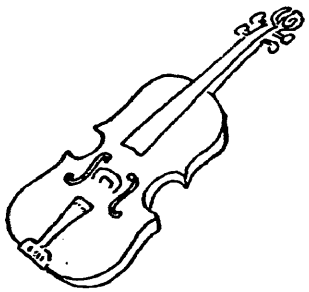

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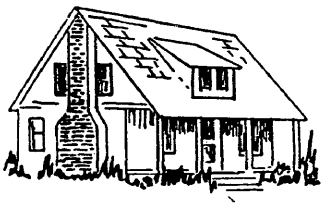

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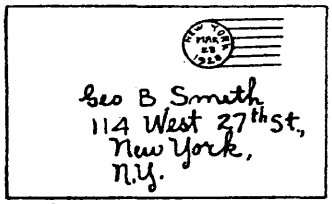

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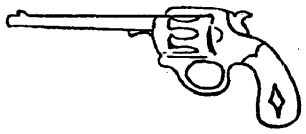

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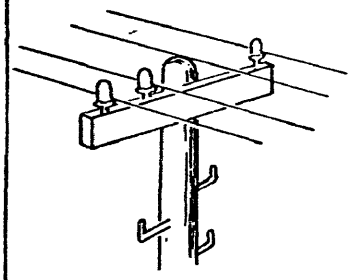

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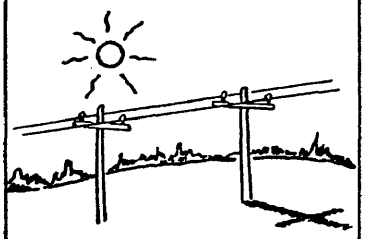

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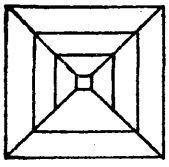

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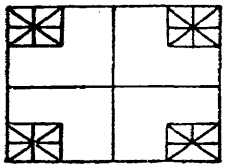

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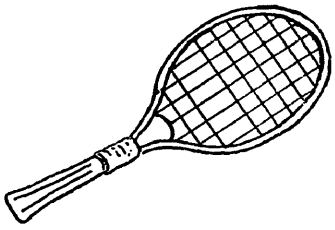

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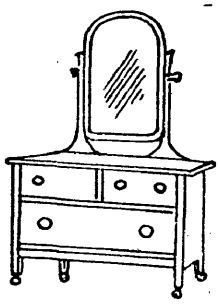

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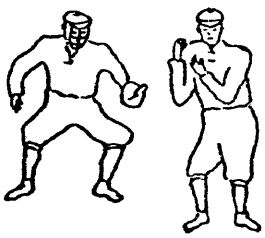

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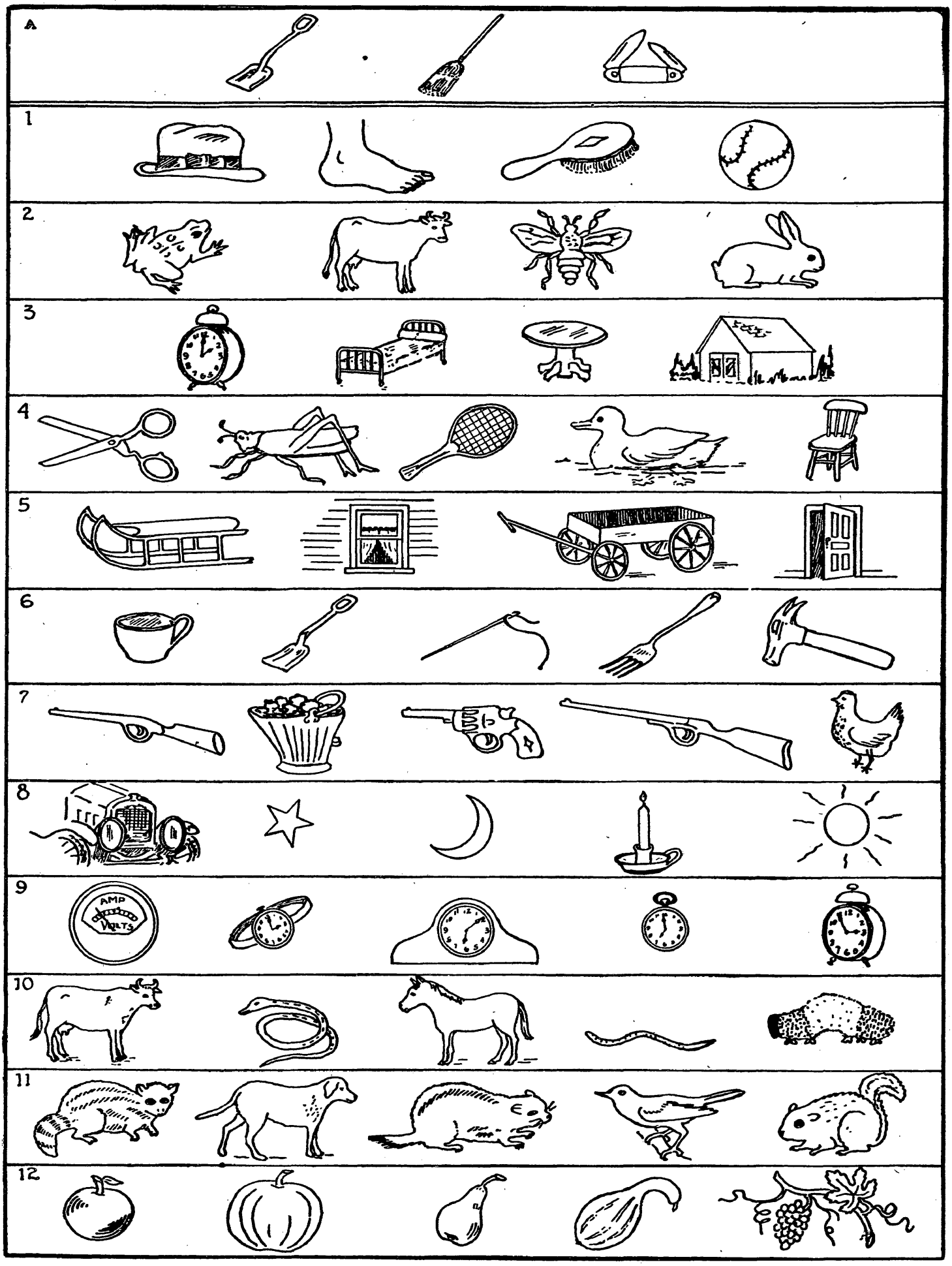

Score_____

A.	1	2	3	2	5
1.	1	2	4	5	3
2.	6	7	9	4	6
3.	89	94	68	76	52
4.	19	23	16	36	34
5.	18	12	21	11	14
6.	22	36	42	27	39
7.	128	163	121	160	147
8.	836	921	901	872	944
9.	141	211	189	216	230
10.	248	321	378	429	411
11.	687	543	691	720	699
12.	2160	6482	7924	9013	8762
13.	1493	1687	1421	1746	1920
14.	3281	1346	8565	4163	5739
15.	8891	6571	8377	6543	7294
16.	6043	4302	9862	9871	5164
17.	10421	86892	17943	19236	25876
18.	92101	86292	45383	81474	94565
19.	81761	24324	33792	37900	50000
20.	64112	71682	16989	27214	61424
21.	81312	73034	82949	61585	80676
22.	711565	823476	316387	791298	614109
23.	121479	121470	121480	131820	120642
24.	9897450	8963847	9246482	8613324	7942513
25.	1111368	1122836	1115863	1114800	1110863

Score_____

A.	Can dogs walk?	Yes	No
1.	Can cats walk?	Yes	No
2.	Is snow white?	Yes	No
3.	Do men eat apples?	Yes	No
4.	Do we sleep on tables?	Yes	No
5.	Does a train swim?	Yes	No
6.	Are doors sometimes open?	Yes	No
7.	Are boys smaller than men?	Yes	No
8.	Does ice make water colder?	Yes	No
9.	Does dinner come before breakfast?	Yes	No
10.	Is an inch longer than a foot?	Yes	No
11.	Should we study our lessons?	Yes	No
12.	Does a gun make a loud noise?	Yes	No
13.	Does May come before April?	Yes	No
14.	Is thirteen more than a dozen?	Yes	No
15.	Do the stars shine at night?	Yes	No
16.	Is eight more than six?	Yes	No
17.	Do apple trees blossom in the spring?	Yes	No
18.	Are tigers usually tame?	Yes	No
19.	Is a village larger than a state?	Yes	No
20.	Does an auto sometimes need repair?	Yes	No
21.	Does wool come from cotton?	Yes	No
22.	Does a farm have a mayor?	Yes	No
23.	Is a stone a kind of machine?	Yes	No
24.	Does Easter come in July?	Yes	No
25.	Does the sun set in the morning?	Yes	No
26.	Are avenues found in cities?	Yes	No
27.	Should we honor famous men?	Yes	No
28.	Do we multiply in arithmetic?	Yes	No
29.	Is a mountain larger than a hill?	Yes	No
30.	Are awkward people usually graceful?	Yes	No

A.							
B.							
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							
16.							
17.							
18.							

Score_____

A E O N W R

A.	CU	SO	AR	IC
B.	DI	NE	SB	RM
1.	ES	OW	PW	MI
2.	ON	SV	NI	OM
3.	SW	NR	OI	EU
4.	AS	EI	WA	BS
5.	CS	RU	SI	AO
6.	EOR	WIS	AIO	MSI
7.	MRU	WIM	AOV	NRA
8.	SWC	UCM	IVR	OWR
9.	OSV	MSR	REO	MNS
10.	NUI	WRO	SVE	NSR
11.	NRV	NIC	EVU	ARO
12.	ORWN	MSUI	VCNI	SCRU
13.	RSIA	RWNE	WVSU	SURI
14.	RMVO	ROSI	WURS	EONW
15.	NWER	NWOI	AUCV	WUCM
16.	SOEN	AEVR	OAEW	RMIC
17.	SVMA	RUCI	EOUN	NOWE
18.	UAWSE	MAOJN	EWNAR	AVIRS
19.	WSEIA	WROAN	NOECN	WORUS
20.	WNERO	SROVU	RMACE	ROMIS
21.	CUNOR	NAROW	MUNEO	WROVN
22.	AUSEM	IANCR	WEAOR	WECOR
23.	ERCIN	WRAON	NARUS	NVRAC
24.	NICARW	NRAEOV	UOEAMI	EWNOAR
25.	NEOIUR	OINUSR	EAWNRO	AEURSN
26.	WOAREN	VIAENR	WAORNU	WNEVOC
27.	NORIUS	AWONER	OIUAMC	WVONRE
28.	WOIAEV	EWASOR	UOIMAC	WNAEOR
29.	AEORUM	RONWAV	ORAEWN	AROSNE
30.	ANROWE	UWONRE	WINERO	NOERAS

Score _____