

## THE MEASUREMENT OF EFFICIENCY IN SPELLING, AND THE OVERLAPPING OF GRADES IN COM- BINED MEASUREMENTS OF READING, WRITING AND SPELLING.

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*Methods of Testing.* On first thought it would seem to be an easy matter to test spelling capacity by simply finding out how many words of a given list a person can spell correctly. The difficult problem, however, is the selection of a list of test words which shall test fairly and adequately any person's spelling ability, and which shall be equivalent in value, or, at least, shall have a known value. A number of extensive investigations of spelling have been made, but all of them, with the exception of the studies made by Ayres<sup>1</sup> and Buckingham,<sup>2</sup> have been made with arbitrarily selected words. To be sure, they were selected on good judgment for the purposes for which they were to be used, but, nevertheless, they were arbitrary and of unknown value as means of determining spelling capacity or attainment.

Rice,<sup>3</sup> in his pioneer study, used a sentence test containing seventy-five test words, a column test composed of fifty words, and a composition test in which the pupils wrote compositions on topics connected with their school studies. Cornman<sup>4</sup> later used Rice's column and composition tests, and also a test in which the pupils wrote as many words as they could in fifteen

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<sup>1</sup>LEONARD P. AYRES. *The Public Schools of Springfield, Illinois.* Russell Sage Foundation, New York.

<sup>2</sup>B. R. BUCKINGHAM. *Spelling Ability.* Columbia University.

<sup>3</sup>J. M. RICE. *The Futility of the Spelling Grind.* The Forum, 1897.

<sup>4</sup>O. P. CORNMAN. *Spelling in the Elementary School.* 1902. Boston.

minutes. They were allowed to write any words that came to their minds. Wallin,<sup>5</sup> in his investigation of spelling in Cleveland, employed a dictated composition test containing specified test words and a column test composed of a different set of forty or more words for each grade.

The chief criticisms of these methods are (1) that it is impossible to make valid comparisons of grade with grade or school with school when a different list is used for each grade whose relative difficulty is entirely unknown. It is, therefore, futile to say that one school or grade spells as well as, or better than, or worse than another. Yet such comparisons are made frequently in the studies referred to. (2) The composition test is of little value because the pupil is free to select his own words. He is quite sure to avoid the use of words concerning whose spelling he is uncertain. The same criticism applies to Cornman's fifteen-minute test. (3) The dictated-sentence test has the same fault as the column test. The words are more or less arbitrary and, when a different set of test words is used for each grade, comparisons are impossible.

More recently the lists compiled by Ayres and by Buckingham represent real attempts to select test words on a scientific basis. Ayres' list is composed of a set of ten words for each grade from the second to the eighth. Each set of ten was so selected, on the basis of previous tests, that seven out of ten children of a grade on an average can spell correctly all the words designed for that grade. The lists are as follows:

2d grade.	3d grade.	4th grade.	5th grade.	6th grade.	7th grade.	8th grade.
foot	fill	forty	several	decide	district	petrified
get	point	rate	leaving	general	consideration	tariff
for	state	children	publish	manner	athletic	emergency
horse	ready	prison	o'clock	too	distinguish	corporation
cut	almost	title	running	automobile	evidence	convenience
well	high	getting	known	victim	conference	receipt
name	event	need	secure	hospital	amendment	cordially
room	done	throw	wait	neither	liquor	discussion
left	pass	feel	manner	toward	experience	appreciate
with	Tuesday	speak	flight	business	receive	decision

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<sup>5</sup>J. E. W. WALLIN. *Spelling Efficiency*. Warwick & York, Baltimore.

These words have the advantage of being made up of words of known difficulty. There are, however, three points that should be considered. (1) The lists are so small that the chance of familiarity or unfamiliarity on the part of individual pupils with these particular words is rather large. The result is that, while the words no doubt have validity for testing a grade or class as a whole, they are apt to be quite unreliable as a test of individual pupils. (2) As a result of the manner in which the words were selected, they are sure to be too easy for the better pupils of each grade, and hence they would not test the spelling ability of such pupils. By definition, seven out of ten pupils can spell correctly all the words assigned to their grade. (3) It is impossible to measure grade-to-grade progress with objective certainty, because the relative difficulty of the lists for the different grades is unknown.

Buckingham selected, on the basis of a series of tests, two lists of twenty-five words each of known difficulty. These are arranged on a scale of increasing value, as follows:

1st List.		2d List.	
only	freeze	chicken	against
even	forty	butcher	circus
smoke	wear	Tuesday	guess
front	minute	answer	telephone
another	pear	raise	choose
lesson	button	beautiful	telegram
bought	janitor	instead	saucy
pretty	sword	tallor	already
nails	whistle	tying	pigeons
sure	stopping	towel	beginning
nor	carriage	tobacco	grease
cousin	saucer	whole	too
touch		quarrel	

The relative values of these words have been determined quite accurately. A child's spelling capacity would be measured by determining the number of words he can spell correctly and then assigning to him a score on the basis of the values of the words spelled. Criticisms (1) and (2) made in connection with the Ayres list apply here also. The force of the second criticism is shown by the distribution curves of spelling ability as published by Buckingham. The words are too easy for the better pupils even as far down as the fourth

grade. In the upper grades more and more of the pupils can spell correctly all the words in the list until in the eighth grade more than half of the pupils can spell all of the words correctly. A third point, perhaps a minor one, is that the scoring, if it is to be done accurately, is rather difficult.

The method for testing efficiency in spelling which is proposed here, and which has been used in this investigation, will be described first. The various critical points concerning its validity and accuracy will be considered later.\* The words were selected in the following manner: The first defined word on every even-numbered page in Webster's New International Dictionary (1910 edition) was chosen, making a total of 1186 words. From these all technical, scientific and obsolete words were discarded, which left 612 words. Finally, 12 other words which approached most closely to being technical or obsolete were discarded, so as to leave 600 words. These were then arranged alphabetically in the order of size, beginning with 3-letter words, 4-letter words, etc., down to the longest words. This list was then divided into six lists of 100 words each by choosing for the first list, the 1st, 7th, 13th, etc.; for the second list, the 2d, 8th, 14th, etc.; for the third list, the 3d, 9th, 15th, etc.; for the fourth list, the 4th, 10th, 16th, etc.; for the fifth list, the 5th, 11th, 17th, etc., and for the sixth list, the 6th, 12th, 18th, etc. The lists resulting from this process are as follows:

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\*This investigation was begun before the studies of Ayres and Buckingham were published. Consequently their methods were not taken into account.

## FIRST LIST

- |           |              |                     |
|-----------|--------------|---------------------|
| 1. add    | 35. prism    | 69. commence        |
| 2. but    | 36. rogue    | 70. estimate        |
| 3. get    | 37. shape    | 71. flourish        |
| 4. low    | 38. steal    | 72. luckless        |
| 5. rat    | 39. swain    | 73. national        |
| 6. sun    | 40. title    | 74. pinnacle        |
| 7. alum   | 41. wheat    | 75. reducent        |
| 8. blow   | 42. accrue   | 76. standing        |
| 9. cart   | 43. bottom   | 77. venturer        |
| 10. cone  | 44. chapel   | 78. ascension       |
| 11. easy  | 45. dragon   | 79. dishallow       |
| 12. fell  | 46. filter   | 80. imposture       |
| 13. foul  | 47. hearse   | 81. invective       |
| 14. gold  | 48. laden    | 82. rebellion       |
| 15. head  | 49. milden   | 83. scrimping       |
| 16. kiss  | 50. pilfer   | 84. unalloyed       |
| 17. long  | 51. rabbit   | 85. volunteer       |
| 18. mock  | 52. school   | 86. cardinally      |
| 19. neck  | 53. shroud   | 87. connective      |
| 20. rest  | 54. starch   | 88. effrontery      |
| 21. spur  | 55. vanity   | 89. indistinct      |
| 22. then  | 56. bizarre  | 90. nunciature      |
| 23. vile  | 57. compose  | 91. sphericity      |
| 24. afoot | 58. dismiss  | 92. attenuation     |
| 25. black | 59. faction  | 93. fulminating     |
| 26. brush | 60. hemlock  | 94. lamentation     |
| 27. close | 61. leopard  | 95. secretarial     |
| 28. dodge | 62. omnibus  | 96. apparitional    |
| 29. faint | 63. procure  | 97. intermissive    |
| 30. force | 64. rinsing  | 98. subjectively    |
| 31. grape | 65. splashy  | 99. inspirational   |
| 32. honor | 66. torpedo  | 100. ineffectuality |
| 33. mince | 67. worship  |                     |
| 34. paint | 68. bescreen |                     |

## SECOND LIST.

1. air	35. quill	69. covenant
2. cat	36. rough	70. eugenics
3. hop	37. shout	71. friskful
4. man	38. stick	72. luminous
5. row	39. swear	73. opulence
6. tap	40. trump	74. planchet
7. awry	41. whirl	75. reformer
8. blue	42. action	76. thorough
9. cast	43. bridle	77. watering
10. corn	44. charge	78. belonging
11. envy	45. driver	79. displayed
12. feud	46. finger	80. indention
13. game	47. heaven	81. mercenary
14. grow	48. legend	82. redevelop
15. home	49. motley	83. senescent
16. knee	50. portal	84. uncharged
17. look	51. recipe	85. whichever
18. mold	52. scrape	86. centennial
19. part	53. simple	87. constitute
20. ruin	54. strain	88. exaltation
21. take	55. weaken	89. invocative
22. tree	56. breaker	90. personable
23. well	57. congeal	91. strawberry
24. allay	58. disturb	92. concentrate
25. blaze	59. foreign	93. imaginative
26. buggy	60. hoggery	94. mathematics
27. clown	61. meaning	95. selfishness
28. doubt	62. onerate	96. collectivity
29. false	63. provoke	97. marriageable
30. forth	64. salient	98. agriculturist
31. grass	65. station	99. quarantinable
32. house	66. trample	100. relinquishment
33. money	67. abstract	
34. paper	68. bulletin	

## THIRD LIST.

- |           |              |                     |
|-----------|--------------|---------------------|
| 1. art    | 35. razor    | 69. dominate        |
| 2. dry    | 36. saint    | 70. exchange        |
| 3. ice    | 37. smell    | 71. governor        |
| 4. mix    | 38. stock    | 72. manifest        |
| 5. run    | 39. swoop    | 73. osculate        |
| 6. top    | 40. twine    | 74. pleasure        |
| 7. back   | 41. white    | 75. revising        |
| 8. bond   | 42. barrel   | 76. traverse        |
| 9. chip   | 43. buckle   | 77. westward        |
| 10. crib  | 44. cotton   | 78. capitally       |
| 11. ever  | 45. engine   | 79. extremism       |
| 12. fire  | 46. flimsy   | 80. indicated       |
| 13. guilt | 47. helmet   | 81. monoplane       |
| 14. hack  | 48. lesser   | 82. repertory       |
| 15. hunt  | 49. ocular   | 83. stimulate       |
| 16. lace  | 50. potato   | 84. unlocated       |
| 17. main  | 51. relate   | 85. accidental      |
| 18. more  | 52. season   | 86. citizenize      |
| 19. pelt  | 53. single   | 87. contribute      |
| 20. sand  | 54. supply   | 88. expertness      |
| 21. tang  | 55. weight   | 89. locomotive      |
| 22. turn  | 56. captain  | 90. prevailing      |
| 23. wine  | 57. contour  | 91. symmetrize      |
| 24. amuse | 58. earnest  | 92. consolatory     |
| 25. blind | 59. fowling  | 93. incremental     |
| 26. catch | 60. inflate  | 94. penetrative     |
| 27. count | 61. measure  | 95. superintend     |
| 28. dress | 62. palaver  | 96. conterminous    |
| 29. fancy | 63. raising  | 97. naturalistic    |
| 30. freak | 64. seizing  | 98. artificiality   |
| 31. gross | 65. sulphur  | 99. re-examination  |
| 32. inlet | 66. trestle  | 100. sentimentalism |
| 33. muddy | 67. adhesive |                     |
| 34. peace | 68. buttress |                     |

## FOURTH LIST.

- |           |              |                     |
|-----------|--------------|---------------------|
| 1. bee    | 35. remit    | 69. enabling        |
| 2. elk    | 36. scale    | 70. external        |
| 3. key    | 37. speak    | 71. greeting        |
| 4. new    | 38. stone    | 72. mosquito        |
| 5. saw    | 39. thick    | 73. outfling        |
| 6. war    | 40. under    | 74. positive        |
| 7. base   | 41. widen    | 75. romantic        |
| 8. book   | 42. bearer   | 76. undulate        |
| 9. clue   | 43. canine   | 77. adverbial       |
| 10. down  | 44. create   | 78. carpentry       |
| 11. fall  | 45. eraser   | 79. franchise       |
| 12. flat  | 46. garret   | 80. infatuate       |
| 13. girt  | 47. hollow   | 81. promenade       |
| 14. hand  | 48. little   | 82. rigmorole       |
| 15. iron  | 49. office   | 83. strippling      |
| 16. lime  | 50. prince   | 84. vegetable       |
| 17. make  | 51. retain   | 85. assignment      |
| 18. move  | 52. settle   | 86. comparison      |
| 19. plug  | 53. sluice   | 87. coordinate      |
| 20. shop  | 54. swerve   | 88. expressage      |
| 21. tear  | 55. withal   | 89. mayonnaise      |
| 22. tusk  | 56. chicken  | 90. recompense      |
| 23. wire  | 57. counter  | 91. untraveled      |
| 24. apple | 58. emperor  | 92. consumptive     |
| 25. blood | 59. freight  | 93. infuriation     |
| 26. chain | 60. journal  | 94. photosphere     |
| 27. craft | 61. neglect  | 95. terrestrial     |
| 28. drawn | 62. passion  | 96. horsemanship    |
| 29. field | 63. reserve  | 97. regenerative    |
| 30. frost | 64. serpent  | 98. circumscribed   |
| 31. guard | 65. surface  | 99. sculpturesque   |
| 32. jelly | 66. trouble  | 100. verisimilitude |
| 33. ocean | 67. affected |                     |
| 34. pitch | 68. calendar |                     |



## FIFTH LIST.

- |           |              |                      |
|-----------|--------------|----------------------|
| 1. bow    | 35. revel    | 69. entirely         |
| 2. fly    | 36. scorn    | 70. farewell         |
| 3. law    | 37. spire    | 71. incident         |
| 4. old    | 38. strut    | 72. mountain         |
| 5. see    | 39. three    | 73. parallel         |
| 6. ache   | 40. voice    | 74. prelimit         |
| 7. head   | 41. wince    | 75. spectral         |
| 8. call   | 42. beaver   | 76. urbanize         |
| 9. cold   | 43. cannon   | 77. aggrieved        |
| 10. draw  | 44. crispy   | 78. clarifier        |
| 11. fast  | 45. escape   | 79. hydraulic        |
| 12. foil  | 46. gladly   | 80. inheritor        |
| 13. glue  | 47. hustle   | 81. purgation        |
| 14. hard  | 48. mallet   | 82. sacrifice        |
| 15. jack  | 49. oriole   | 83. surviving        |
| 16. line  | 50. pulley   | 84. vestibule        |
| 17. mark  | 51. rubric   | 85. authorship       |
| 18. musk  | 52. shears   | 86. concoction       |
| 19. prig  | 53. solace   | 87. derigation       |
| 20. slat  | 54. trifle   | 88. federative       |
| 21. test  | 55. yellow   | 89. memorandum       |
| 22. vend  | 56. circuit  | 90. regularity       |
| 23. wood  | 57. crooked  | 91. abnormality      |
| 24. armor | 58. enstamp  | 92. disseminate      |
| 25. boast | 59. general  | 93. insensitive      |
| 26. chase | 60. lateral  | 94. predominate      |
| 27. cross | 61. nourish  | 95. unprevented      |
| 28. enjoy | 62. placard  | 96. inarticulate     |
| 29. fixed | 63. resolve  | 97. stupendously     |
| 30. glean | 64. signify  | 98. communicating    |
| 31. guild | 65. tabloid  | 99. anthropometric   |
| 32. joint | 66. unitive  | 100. emancipationist |
| 33. order | 67. approved |                      |
| 34. point | 68. cerebral |                      |

## SIXTH LIST.

- |           |              |                       |
|-----------|--------------|-----------------------|
| 1. box    | 35. river    | 69. erosible          |
| 2. gap    | 36. shaft    | 70. fetching          |
| 3. lay    | 37. stall    | 71. juncture          |
| 4. pod    | 38. sugar    | 72. narcotic          |
| 5. sex    | 39. throw    | 73. parasite          |
| 6. alms   | 40. watch    | 74. probator          |
| 7. bird   | 41. young    | 75. squeaker          |
| 8. camp   | 42. begird   | 76. vagabond          |
| 9. comb   | 43. causal   | 77. amphibian         |
| 10. dusk  | 44. discus   | 78. clearness         |
| 11. fear  | 45. ferret   | 79. impatient         |
| 12. foot  | 46. gutter   | 80. intestine         |
| 13. goat  | 47. killed   | 81. quadruple         |
| 14. hawk  | 48. middle   | 82. sauciness         |
| 15. keep  | 49. paddle   | 83. ticketing         |
| 16. life  | 50. puzzle   | 84. virulence         |
| 17. mass  | 51. sample   | 85. bafflement        |
| 18. navy  | 52. shield   | 86. condescend        |
| 19. raft  | 53. spring   | 87. disconcert        |
| 20. some  | 54. tubule   | 88. illiterate        |
| 21. that  | 55. bicycle  | 89. metropolis        |
| 22. vice  | 56. commode  | 90. repression        |
| 23. work  | 57. discard  | 91. animalcular       |
| 24. aside | 58. excuser  | 92. divestiture       |
| 25. brawn | 59. gravity  | 93. intrinsic         |
| 26. chime | 60. leaping  | 94. prerogative       |
| 27. crown | 61. obloquy  | 95. upholsterer       |
| 28. equip | 62. pontiff  | 96. interference      |
| 29. flock | 63. retreat  | 97. subantarctic      |
| 30. grand | 64. society  | 98. convocational     |
| 31. hedge | 65. tigress  | 99. imperturbation    |
| 32. knock | 66. vitiate  | 100. irresponsibility |
| 33. ought | 67. auditory |                       |
| 34. poppy | 68. churlish |                       |

The reasons for selecting the words on this particular basis were: (1) It would give a random sampling of the entire non-technical English vocabulary. Familiar or unfamiliar words, large or small words, hard or difficult words would all be included in the test lists in the same proportions in which they occur in the entire vocabulary. (2) This selection would give a list including a fair sampling of very easy and very difficult words, so that it could be used for testing the spelling capacity of the beginner as well as that of the expert speller. (3) It would yield a list sufficiently large for testing adequately any child's spelling ability. (4) It would give a list that could be duplicated in the same manner by anyone else, if, for some reason, it should be desired to have a different but comparable list. Similar lists of 100 words each could be constructed, for example, by selecting the 2d, 3d, or any other defined word on the even or odd-number pages of Webster's New International Dictionary and then discarding words in the manner described above so as to leave 600 words.

Several points concerning the validity of these tests must be discussed. First, it is urged by teachers that the lists do not contain a sufficient number of words familiar to the younger pupils to test fairly their spelling ability. To this we may reply that we are not trying to find out how many words any child can spell, but we are trying to test his spelling ability. We might likewise say that there are not sufficient familiar words for the older pupils either, because any pupil can spell a great many other words not found in these lists. The test is just, if only a fair sampling of words of the different types are present, so that the spelling ability of every pupil shall be measured accurately in relation to the spelling ability of every other pupil. There is good experimental evidence for believing that the tests do this.

Second, in testing any child or grade, how many lists need to be used, and how accurate is the resulting score? The experiments show that the spelling ability of any individual pupil can be ascertained quite accurately by the use of any two lists, preferably at two different times. Specifically, the problem would be this: If a pupil is tested with one list at one time and, let us say, the next day with a second list, how closely will

the two scores agree? On the basis of tests made with 519 pupils, the mean variation between the scores from any two of the six lists is 2.2 points. That is, the average deviation of the scores from two lists used on an individual pupil is 2.2 points. To illustrate the close agreement of the scores made by the same pupils on lists 1 and 5, for example, the following records are given:

RECORDS OF THE PUPILS IN THE FOURTH GRADE MADE WITH TWO LISTS

List 1. Per cent.	List 5. Per cent.	Final score. Per cent.
65	61.....	63
57	53.....	55
73	74.....	73.5
52	52.....	52
46	47.....	46.5
59	58.....	58.5
64	63.....	63.5
62	61.....	62
47	50.....	48.5
54	49.....	51.5
57	56.....	56.5
51	44.....	47.5
63	56.....	59.5
51	46.....	48.5
Etc.		

Thus the first pupil spelled 65 per cent. of the words in list 1 correctly and 61 per cent. of the words in list 5 correctly, etc. The agreement is obviously close, and the average of the scores made by pupils in two lists will represent quite accurately his spelling ability.

To ascertain in a different way the reliability of the tests, a comparison was made between the efficiency in spelling as measured for each pupil by two lists and the marks assigned by the teachers to the pupils for the year's work in spelling. Coefficients of correlation were computed between the marks and the test scores for grades 3 to 8 in a school of 256 pupils. The following are the coefficients:<sup>7</sup>

Third grade.....	.80
Fourth grade.....	.69
Fifth grade.....	.73
Sixth Grade.....	.46
Seventh grade.....	.59
Eighth grade.....	.84
Average.....	.69

<sup>7</sup>These calculations were made by Mr. W. F. Roecker.

These coefficients are uniformly high, with the exception of the one for the sixth grade. The lower coefficient there is due to the inaccurate marking of the teacher, which is indicated by the fact that practically all her pupils were marked either "Good" or "Excellent." These high coefficients indicate a close agreement between the scores in the tests and the teachers' estimates of the pupils' attainments. There is every reason for believing that the tests give a far more accurate evaluation of a pupil's achievement in spelling than the teacher's mark, even at the end of a whole year of instruction and observation. Concrete evidence for this will be presented later.

Third, what is the relative difficulty of the six lists? Is a score made on one list comparable with that made on any other list? To answer this question all grades were tested on one day with list 1 and on the second day with one of the other five lists. In this manner a direct comparison could be made of lists 2 to 6 with list 1. These results showed that the lists are practically identical in difficulty, list 6 being slightly more difficult and list 5 slightly easier. The actual data are as follows:

List 2 is	.9 point	easier	than list 1
List 3 is	.9 point	easier	than list 1.
List 4 is	2.6 points	easier	than list 1.
List 5 is	.9 point	harder	than list 1.
List 6 is	3.4 points	harder	than list 1.

For practical purposes the differences among the six lists, with the possible exception of lists 5 and 6, are so small that they are negligible. But if it is desired in any particular instance, the score of a given pupil or grade may be raised or lowered according to the above table of differences.

The fourth point relates to the relative difficulty of the words in each list. As they stand, the words are simply arranged according to size, which, of course, does not necessarily place them in the order of difficulty, except in a general way. The question of the relative difficulty of the words in each list separately is not very important so long as the lists as a whole are equal; that is, so long as each list contains approximately the same number of words of every degree of difficulty. This

is apparently the case, as shown above by the data given under the third point. For test purposes, the constitution of the various lists is practically identical.

*Directions for Administering and Scoring the Tests.* The tests are given in the following manner:

First have the pupils write the name, grade, school, city and date at the top of the sheet.

Pronounce the words clearly, but do not sound them phonetically, or inflect them so as to aid the pupils. Give the meaning of words that sound like words with a different meaning and spelling. The pupils are to write the words and to number them in the order in which they are given. Allow sufficient time for the writing.

Each grade is to be tested twice on two successive days. Use any one of the six lists on the first day and a different list on the second day. (When an entire school is being tested it may be desirable, though not necessary, to use on the first day the same list, say list 1, in all grades and any other list on the second day.)

In the first grade use the first 40 words of the list, in the second grade use the first 65 words, in the third grade use the first 80 words, in the fourth grade use the first 90 words, and in all other grades use the entire list.

The tests are scored by checking off all words spelled incorrectly and then counting the number of words spelled correctly. This number is the score and also the percentage of words correct, since the lists contain 100 words each. An average is taken of the scores made in the two tests, which is the final score for each pupil. Omitted words are counted as incorrect. Words that may be spelled in different ways are counted correct if they are spelled according to any one of the permissible ways.

*Standards of Efficiency in Spelling.* The spelling tests have been made thus far, according to the specifications stated above, on 2500 pupils in twelve schools of five cities located in Wisconsin, Minnesota and New York. From these tests tentative standard scores have been derived, which are shown in the following tables and curves. The standard scores are smoothed values derived from the actual averages. The differences between the two are very slight. These standard scores are probably not quite as reliable as those for reading and writing (see January and February numbers of this JOURNAL), because they are based on a smaller number of tests. This condition, however, is partly offset by the fact that the differences among the schools tested are less than those for

reading and writing, and by the fact that the smoothed values differ even less from the actual averages than was the case with the reading and writing scores.

## STANDARD SCORES FOR SPELLING.

Grades .....	1	2	3	4	5	6	7	8
	10	30	40	51	61	71	78	85

The following table gives the results for the various schools tested:

Grades .....	1	2	3	4	5	6	7	8
City A, School 1.....	12.8	36.0	41.0	52.7	61.5	70.0	80.6	86.3
School 2.....	11.5	30.0	43.8	50.4	66.1	74.6	79.2	82.4
School 3.....	7.0	29.0	42.0	49.0	63.2	78.0	75.5	79.8
City B, School 1.....	....	....	....	....	65.5	79.2	85.0	90.0
City C, School 1.....	9.8	28.4	37.3	40.6	55.7	67.1	73.2	80.1
Averages.....	10.3	30.8	41.0	48.2	62.4	73.8	78.7	83.7

It is obvious that the attainment in spelling of a pupil, class, or school can be determined by means of these tests and standard curves.

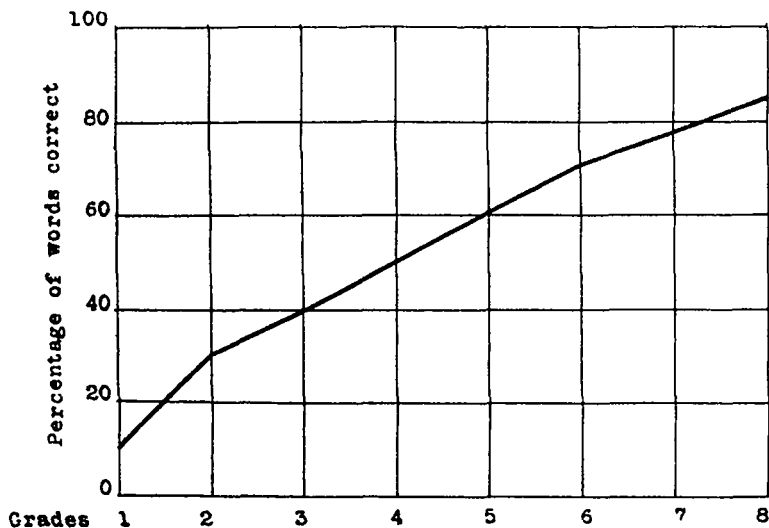


Figure 1. Standard curve for Spelling.

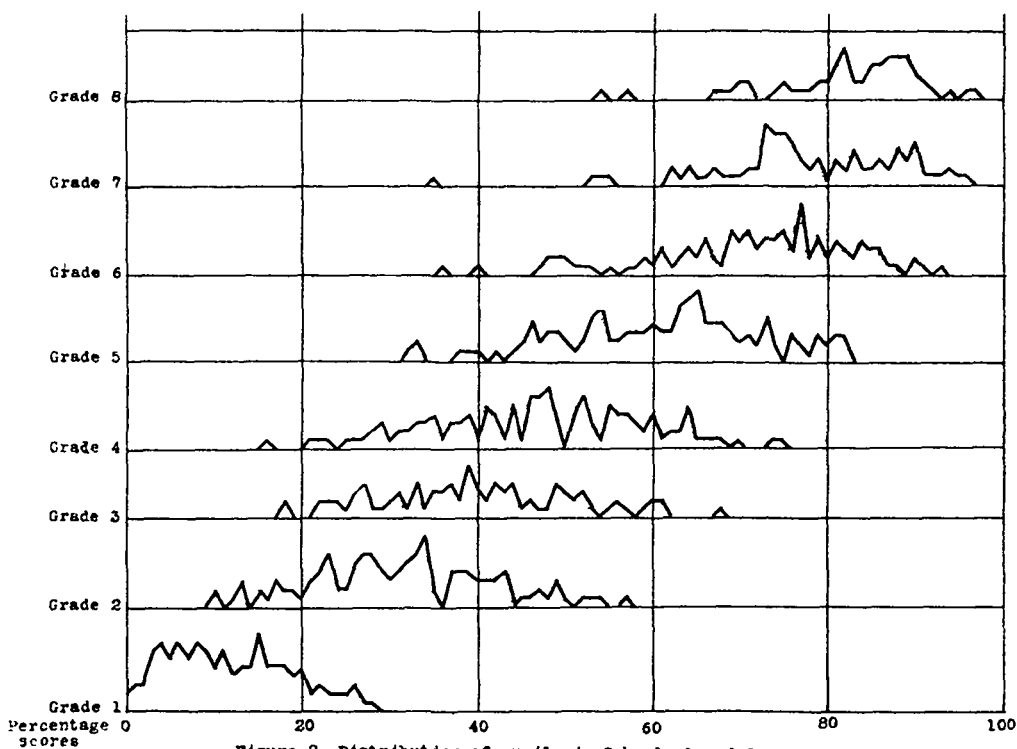


Figure 2. Distribution of pupils in Schools 1 and 2, City A and City B, in Spelling Ability.



*Individual Differences and the Overlapping of Grades.* The spelling tests reveal identically the same facts concerning the distribution of the pupils and the overlapping of the grades as were found in case of the reading and writing tests. The facts are presented in the curves of Figure 2. The numbers along the baseline are the percentage scores made in spelling, and the vertical distances indicate the number of pupils.

Little comment concerning the significance of these curves is necessary. The best impression of the real situation can be gotten by studying and comparing the curves themselves. To show the almost incredible amount of overlapping and the range of capacities found in the various grades, it will be seen that there are two pupils in the second grade who can spell as well as two pupils in the eighth grade. Other comparisons of a similar kind can be made on the basis of the curves. Expressing the amount of overlapping in terms of figures, we find that on the average 20.8 per cent. of the pupils in any given grade reach or exceed the median of the next grade above it, and 6.2 per cent. reach or exceed the median of the second grade above it.

#### THE OVERLAPPING OF GRADES IN READING, WRITING, AND SPELLING COMBINED.<sup>1</sup>

We have noticed, in connection with each one of the three subjects examined, the astoundingly wide ranges of abilities manifested by pupils in the same grades. The question naturally arises, Would these differences not be very much less if each pupil's performance in all studies were measured and combined? Thus, a fourth grade pupil might write as well as the average seventh grade pupil and read as well as the average fifth grade pupil, but spell no better than the average first grade pupil. His average performance in all three studies combined would not deviate very much from the average of his grade.

Now, what are the actual facts with regard to this problem? In order to obtain information on this question, the three

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<sup>1</sup>These tests are printed in available form as a bulletin, *The Measurement of Efficiency in Reading, Writing, Spelling, and English*. The College Book Store, Madison, Wis.

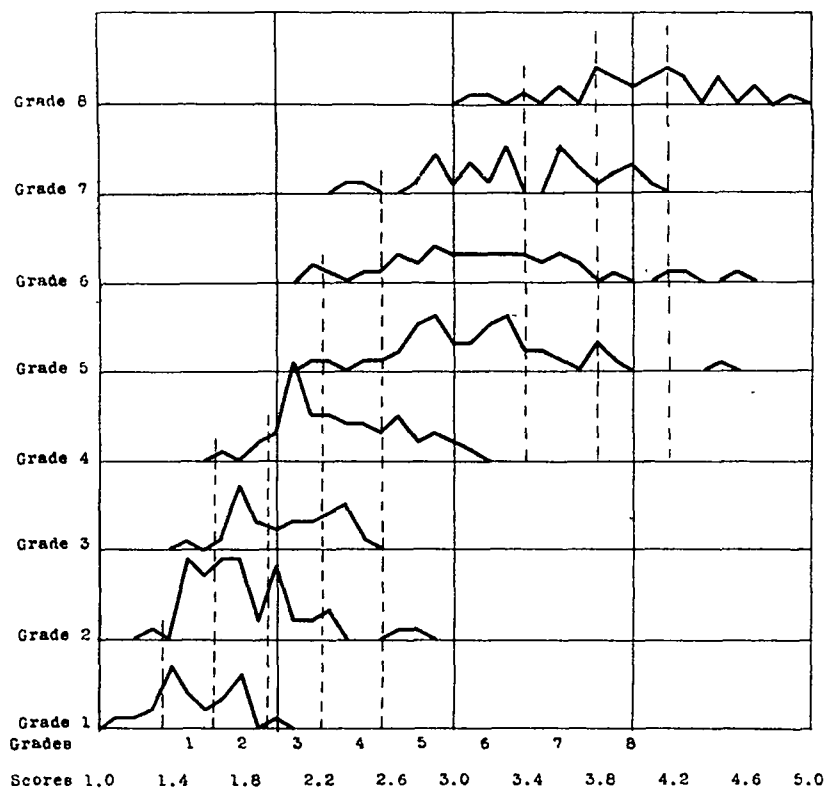


FIG. 3. Distribution of 401 pupils in Reading, Writing, and Spelling combined.

studies were taken to be of equal value, and an average score was computed for each pupil. This average score was obtained by reducing all scores for a given pupil to a common basis. For example, a fourth grade pupil made the following scores: Reading, speed, 2.6 words per second; comprehension, 13 words. Writing, speed, 81 letters per minute; quality, 9. Spelling, 44 words correct. The growth in speed of reading from the first to the eighth grade is from 1.5 words per second to 4.0 words per second, or a gain of 2.5. (See standard scores.) Similarly, the growth in comprehension is from 15 to 50 words, or a gain of 35 words; the growth in speed of writing is from 20 to 83 letters per minute, or a gain of 63 letters; the growth in quality is from 6.5 to 10.9, or a gain of 4.4 points; the growth in spelling is from 10 to 85, or a gain of 75.

If we may assume, as we have done here, that these increases are equal in value, then a growth of 2.5 in speed of reading = a growth of 35 in comprehension = a growth of 63 in speed of writing = a growth of 4.4 in quality of writing = a growth of 75 in spelling. Hence a gain of .1 in speed of reading = 1.4 in comprehension of reading = 2.5 in speed of writing = .22 in quality of writing = 3.0 in spelling. On this basis the final score of the pupil cited above is 2.4 in terms of the first member of the equation (speed of reading). In this manner a final score was computed for each pupil in a school of 401 pupils. These scores are plotted in the form of distribution curves for each grade, as shown in Figure 3.

A comparison of these curves reveals still an immense amount of overlapping. It is somewhat less than the overlapping of the performances in each subject separately, but it is not as much less as most teachers would anticipate. The vertical broken lines are so drawn as to indicate the range of ability that should be included in each grade. They are drawn at the points which lie half way between the standard scores of the various grades. For example, the standard score for the first grade is 1.5, and for the second 1.8. The vertical line is drawn at 1.65, and so on for the rest. Thus the space included between the first and the second vertical lines comprises the range that should be included in the first grade.

If we follow this column upward, we notice that it includes a considerable portion of the pupils in the second grade and a small portion of the pupils in the third grade. This means that these pupils in the second and third grade are only equivalent in performance to the first grade. If we make similar comparisons for the other grades, we find that the column for any one grade includes pupils in several higher and lower grades. Thus the column for the third grade includes pupils from the first up to the sixth grade, and the column for the fifth grade includes pupils from the second to the seventh grade.

If we express these overlappings in percentages, we find the following facts:

In the 1st grade	37.0%	reach or exceed the lower limit of the 2d grade.
In the 2d grade	31.4%	reach or exceed the lower limit of the 3d grade.
In the 3d grade	33.3%	reach or exceed the lower limit of the 4th grade.
In the 4th grade	27.4%	reach or exceed the lower limit of the 5th grade.
In the 5th grade	54.5%	reach or exceed the lower limit of the 6th grade.
In the 6th grade	30.0%	reach or exceed the lower limit of the 7th grade.
In the 7th grade	18.8%	reach or exceed the lower limit of the 8th grade.

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Average.... 33.2%

In the 2d grade	31.4%	fall below the upper limit of the 1st grade.
In the 3d grade	40.0%	fall below the upper limit of the 2d grade.
In the 4th grade	43.1%	fall below the upper limit of the 3d grade.
In the 5th grade	9.1%	fall below the upper limit of the 4th grade.
In the 6th grade	47.5%	fall below the upper limit of the 5th grade.
In the 7th grade	53.1%	fall below the upper limit of the 6th grade.
In the 8th grade	23.3%	fall below the upper limit of the 7th grade.

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Average.... 35.3%

This situation is utterly surprising. The highest one-third of the pupils in any given grade on the average are equal in efficiency to the pupils of the next grade above it, and the lowest one-third are equal in efficiency to the pupils of the next grade below it. This leaves only the middle one-third of pupils who are properly placed. In other words, if we were to place pupils according to their actual performance in school studies, one out of every three pupils should be in the next higher grade, one in the next lower grade, and one should remain where he is.