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THE UNIVERSITY OF MISSOURI BULLETIN

VOLUME 17 NUMBER 24

EXTENSION SERIES 21
EDITED BY CHARLES H. WILLIAMS

A MANUAL FOR THE MENTAL AND PHYSICAL EXAMINATION OF SCHOOL CHILDREN

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COLUMBIA, MISSOURI
SEPTEMBER, 1916

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The preparation of this manual has required an enormous amount of tedious work, and the writer is under obligation to the many people who have helped to do this work. Especial thanks are due to Mr. J. B. Steed, Miss Hazel Summerfield, and Miss Nell Rutledge. The graphs were prepared by Miss Blanche Lindsay.

In grading so many papers and in dealing with such a large amount of data, it is difficult to keep the results free from error, but great pains have been taken to make the work as accurate as possible.

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A MANUAL FOR THE MENTAL AND PHYSICAL EXAMINATION OF SCHOOL CHILDREN

OBJECT OF MENTAL TESTS

The object of mental tests is to assist the teacher in obtaining a knowledge of the individual child. Just as a dairyman, to be successful, must know his cows—the best breeds, the best feed, and the best kind of treatment—so a teacher must know her pupils. It is true that she learns about them from their regular work in their classes, but there are various factors besides ability that determine whether a child does well or poorly in school studies. Progress in school studies is not, therefore, an accurate indication of ability. The teacher needs an independent measure of ability. The tests constitute such a measure. A child often does poorly in a particular study because he was started wrong or at the wrong time or is poorly taught. The child may have come to believe, in such a case, that he has no ability in such a study, or perhaps in any study. The tests, being something new, arouse great interest; the child has no preconceived notion about his ability to perform them and is therefore very likely to do his best. A series of mental tests given at the beginning of the school year will give as good an idea of the pupils' ability as can be obtained ordinarily in a year in the ordinary school work. Moreover, the tests show in what aspects of the child's mind he is good and in what aspects, poor. However, too much reliance should not be placed on such differences unless several tests of the same kind are given. If each type of test were repeated about six times and the results of all the tests pooled, they would give an accurate indication of the abilities which the various tests measure.* Inasmuch as these abilities are those demanded in school work, the tests give an indication of the child's ability to do the school work. One could not know from the tests whether the child would *do* the school work or not. Doing the school work depends on ability and *effort*. The tests measure only *ability*. They enable us to prophesy success only to the extent that success depends on ability. This is one thing the teacher very

*Additional tests will be found in the author's *Examination of School Children*.

much needs to know, the child's ability. The tests, carefully given, will aid very much in determining this ability. Each child is, to some extent, a special problem. We must, therefore, use every means at our command to learn all possible about each child. It requires but an hour and a half to give the mental tests, and only a few days to grade the papers. The information obtained abundantly justifies the time and energy expended.

USE TO BE MADE OF THE RESULTS

The results of the tests will help the teacher in the classification and gradation of the pupils. This help is not much needed except in the doubtful cases. One often needs to know whether a pupil has failed because of lack of effort or lack of ability. The tests will help to answer this question. If a child fails because of lack of ability, he should probably not be promoted. If he fails because of lack of effort, he should probably be promoted and an attempt made to get him to do the work of which he is capable. The progress of children through the grades should be in accordance with *their ability and with the rapidity of their development*. Some children develop much faster than others and can therefore acquire the skill and knowledge of the school subjects much faster than others. The tests will aid in determining the development of the children and should lead to greater economy of time and effort in dealing with them.

An accurate knowledge of the child's ability and development will not only be a help in gradation and classification but should also help in the actual teaching. Every bit of information that a teacher can get about a child should be a help in dealing with that child. Studies made by the author indicate that there is a wide difference of ability possessed by the children ordinarily found in the same grade. It will usually be found that there are children in the third grade with as great ability as that of some pupils in the high school. A more careful system of gradation will lead to more nearly equal ability in the same grade and should make better teaching possible.

If mental tests were given in a school every year, the development of the child could be traced and the rapidity of this development determined. This information would be a great help in dealing with the individual child. It must be remembered that the mental tests are measures of the abilities possessed by individual children and are not measures of the efficiency of the teacher, except to the extent that the teaching may have affected the development of the child.

PHYSICAL MEASURES AND TESTS

It has been found that there is a close relation between mental and physical development. Therefore, it is important to know of the physical development of every child. If all the children of the same age in the schools are studied, it is found that the heavier ones, the

taller ones, the stronger ones, etc., are in the upper grades. Therefore, the physical development of the child should be studied, and the records of this development from year to year kept. Norms of the more important physical measures and tests are given in this manual.

GENERAL DIRECTIONS

The results of the mental tests in the school will be worse than useless unless the tests are given with the greatest care and scientific precision. Every test should be most carefully explained to the children so that they will know *exactly* what they are to do. The matter must be so presented to them that they will put forth *all possible* effort. They must take the tests seriously. Great care must be taken to see that there is no cheating. The work of each child should be his own work. In those tests in which time is an important element, the time must be *carefully kept*, with a stop watch if one is available. The papers should be distributed for the tests and turned face downward on the pupil's desk. The pupil, when all is ready to begin, should take the paper in his hand and at the signal "begin" turn it over and begin work, and when the signal "stop" is given, should quit work instantly and turn the paper over. Before the work begins, the necessary information should be placed on each paper. This information should be the pupil's name, age, grade, sex, and school. This should be on every paper. When the test is over the papers should be immediately collected.

LOGICAL MEMORY

Object.—The purpose of this test is to determine the pupil's facility in remembering and reproducing ideas. A pupil's standing in the test may serve as an indication of his ability to remember the subject matter of the school studies.

Method.—The procedure in this test is for the teacher to read slowly and distinctly the story to be reproduced. Immediately after the reading the pupils are to write down all of the story that they can recall. They must not begin to write till *after* the reading. Ten minutes should be allowed for the reproduction. This is ample time, and each pupil should be told to use the whole time in working on his reproduction. At the end of ten minutes, collect the papers. Care should be taken to see that each pupil does his own work, that there is no copying. Before reading the story, the teacher should give the following instructions:

I shall read to you a story entitled *Willie Jones and His Dog* (or *A Farmer's Son*, or *A Costly Temper*, as the case may be). After I have read the story you are to write down all you can remember of it. You are not to use the exact words that I read unless you wish. You are to use your own words. Try to recall

as much as possible and write all you recall. Try to get all the details, not merely the main facts.

Material.—For grades three, four, and five, use *Willie Jones and His Dog*; for grades six, seven, and eight, use *A Farmer's Son*; for the high school, use *A Costly Temper*. The norms for the latter are based on eighth grade and high school pupils.

WILLIE JONES AND HIS DOG

Willie | Jones | was a little | boy | only | five years old. | He had a dog | whose name was Buster. | Buster was a large | dog | with long, | black, | curly | hair. | His fore | feet | and the tip | of his tail | were white. | One day | Willie's mother | sent him | to the store | which was only | a short | distance away. | Buster went with him, following behind. | As Buster was turning | at the corner, | a car | struck him | and broke | one | hind | leg | and hurt | one | eye. | Willie was | very | sorry | and cried | a long | time. | Willie's father | came | and carried | the poor | dog | home. | The broken leg | got well | in five | weeks | but the eye | that was hurt | became blind. |

A FARMER'S SON

Will | was a farmer's | son | who attended school | in town. | His clothes | were poor and his boots | often smelled | of the farmyard | although he took great | care of them. | Since Will had not gone to school | as much | as his classmates, | he was often | at a disadvantage, | although his mind | was as good | as theirs,— | in fact, he was brighter | than most | of them. | James, | the wit | of the class, | never lost an opportunity | to ridicule | Will's mistakes, | his bright | red | hair, | and his patched | clothes. | Will | took the ridicule | in good part | and never | lost his temper. | One Saturday | as Will was driving | his cows | to pasture, | he met James | teasing | a young | child, | a cripple. | Will's | indignation | was aroused | by the sight. | He asked | the bully | to stop, | but when he would not, | Will pounced | upon him | and gave him | a good | beating, | and he would not | let James go | until he promised | not to tease | the crippled | child | again. |

A COSTLY TEMPER

✓ A man | named John | Murdock | had a servant | who worried him | much by his stupidity. | One day | when this servant was more | stupid | than usual, | the angry | master | of the house | threw a book | at his head. | The servant | ducked | and the book flew | out of the window. |

"Now go | and pick that book up!" | ordered the master. | The servant | started | to obey, | but a passerby | had saved him | the trouble, | and had walked off | with the book. | The scientist | thereupon | began to wonder | what book | he had thrown away, | and to his horror, | discovered | that it was a quaint | and rare | little | volume | of poems, | which he had purchased | in London | for fifty | dollars. |

But his troubles | were not over. | The weeks went by | and the man had almost | forgot his loss, | when strolling | into a second hand | bookshop, | he saw, | to his great delight, | a copy of the book | he had lost. | He asked the price. |

“Well,” | said the dealer, | reflectively, | “I guess we can let you have it | for forty | dollars. | It is a very | rare book, | and I am sure | that I could get seventy-five | dollars for it | by holding on a while.” |

The man of science | pulled out his purse | and produced the

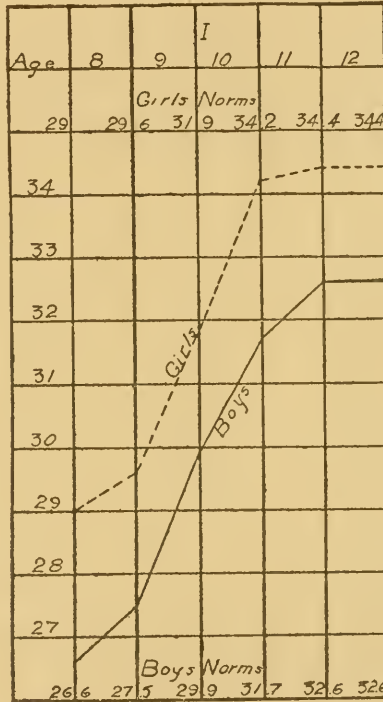


Plate I. Logical Memory—Willie Jones

money, | delighted at the opportunity of replacing | his lost | treasure. | When he reached home, | a card | dropped out | of the leaves. | The card was his own, | and further | examination | showed that he had bought back | his own property. |

“Forty dollars | worth of temper,” | exclaimed the man. | “I think I shall mend my ways.” | His disposition | afterward | became so | good | that | the servant became worried, | thinking the man | must be ill. |

The Results.—The material for the test is divided into units as indicated by the vertical lines. The pupil's written reproduction

should be compared unit by unit with the story as printed, and given one credit for each unit adequately reproduced. The norms for the three tests are shown in the graphs which follow, I, II and III. In these and all the graphs which follow, the actual ages are shown in the first horizontal column. The norms for girls are shown in the second horizontal column, the norms for boys are shown in the column at the bottom. By the norm for an age is meant the average performance of all the pupils of that age examined. By age ten is meant the pupils that have passed their tenth birthday and have not reached

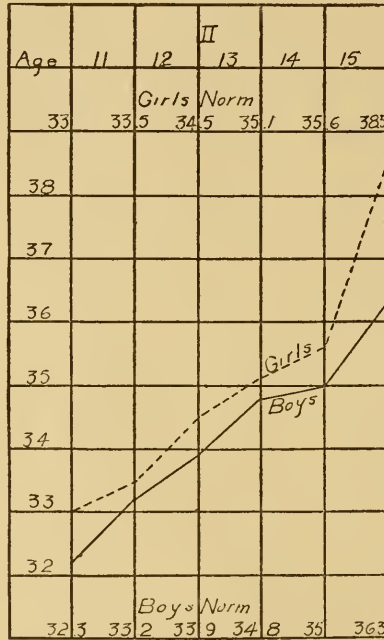


Plate II. Logical Memory—A Farmer's Son

their eleventh birthday, and the other ages are to be similarly interpreted. The vertical lines in the graphs indicate birthdays and the scores written on these lines indicate ability at these exact ages. The column marked ten, for example, includes all the children that are over ten and not yet eleven. The graphs show the development from age to age. In general, it will be noticed, there is an improvement of memory with age, but in the high school, in the *Costly Temper* test, there is a decline. This may not indicate a real decline in ability to remember ideas, but a change in attitude. The high school pupil probably acquires a habit of remembering only significant facts. His memory is selective, while in the earlier ages, the memory may be more

parrot-like, one idea being reproduced with about as much fidelity as another. This statement is made not as a *fact*, but as a *probable* explanation.

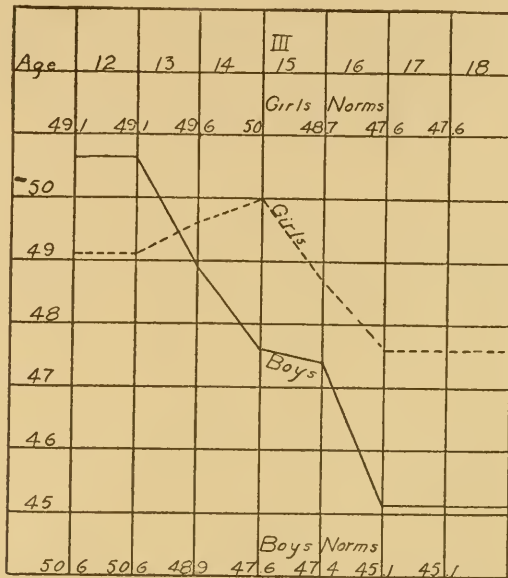


Plate III. Logical Memory—A Costly Temper

ROTE MEMORY

Object.—The object of the rote memory tests is to determine the pupil's memory span for unrelated impressions,—words that have no logical relations with one another. Much school work makes demands upon this ability. Therefore, the tests are of importance.

Method.—There are two lists of words, *concrete* and *abstract*, with six groups in each list. The list of concrete words should be given first, then the abstract. The procedure is to pronounce the first group, *cat, tree, coat*, and then pause for the pupils to write these three words. Then pronounce the next group, *mule, bird, cart, glass*, and pause for the reproduction, and so on through the list.

Give the following instructions:

We wish to see how well you can remember words. I shall pronounce first a group of three words. After I have pronounced them, you are to write them down. I shall then pronounce a group of four words, then one of five words, and so continue with a longer group each time. You must pay very close attention for I shall pronounce a group but once. You are not required to write the words in their order, but just as you recall them.

Material.—The words for the test are given in the following lists:

- | <i>Concrete</i> | <i>Abstract</i> |
|---|--|
| 1. cat, tree, coat | 1. good, black, fast |
| 2. mule, bird, cart, glass | 2. clean, tall, round, hot |
| 3. star, horse, dress, fence, man | 3. long, wet, fierce, white, cold |
| 4. fish, sun, head, door, shoe, block | 4. deep, soft, quick, dark, great, dead |
| 5. train, mill, box, desk, oil, pup, bill | 5. sad, strong, hard, bright, fine, glad, plain |
| 6. floor, car, pipe, bridge, hand, dirt, cow, crank | 6. sharp, late, scur, wide, rough, thick, red, tight |

Results.—The papers are graded by determining the number of concrete words and the number of abstract words that are reproduced. No account is taken of whether the words are in the right position or not. A perfect score in each test would therefore be thirty-three. The norms are shown in plates IV. and V.

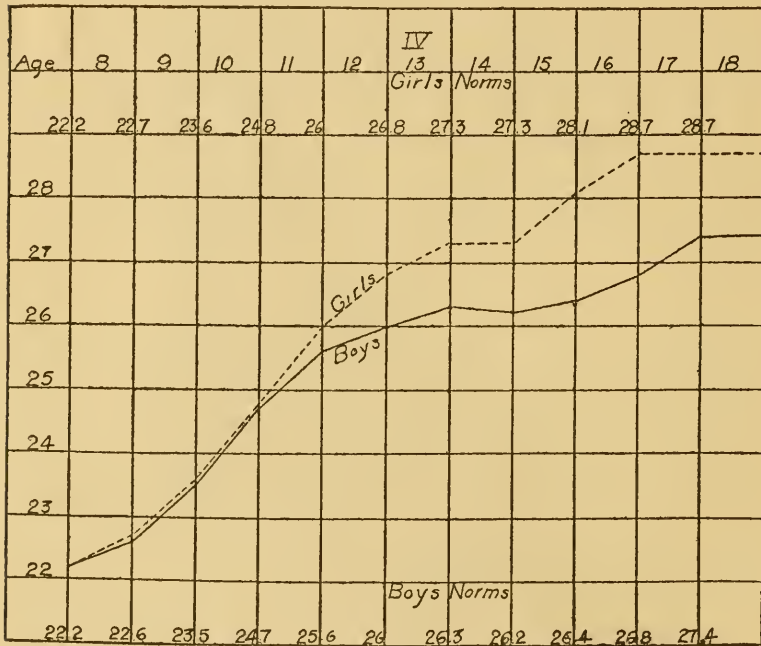


Plate IV. Concrete Rote Memory

THE SUBSTITUTION TEST

Object.—This test determines one's ability to build up new associations. It is a test of quickness of learning.

Method.—The substitution test-sheets are distributed to the pupils and turned face down on the desks. The teacher gives the following instructions:

We wish to see how fast you can learn. At the top of the sheet which has been distributed to you there is a key. In nine circles are written the nine digits and for each digit there is written a letter which is to be used instead of the digit. Below the key are two columns of numbers; each number contains five digits. In

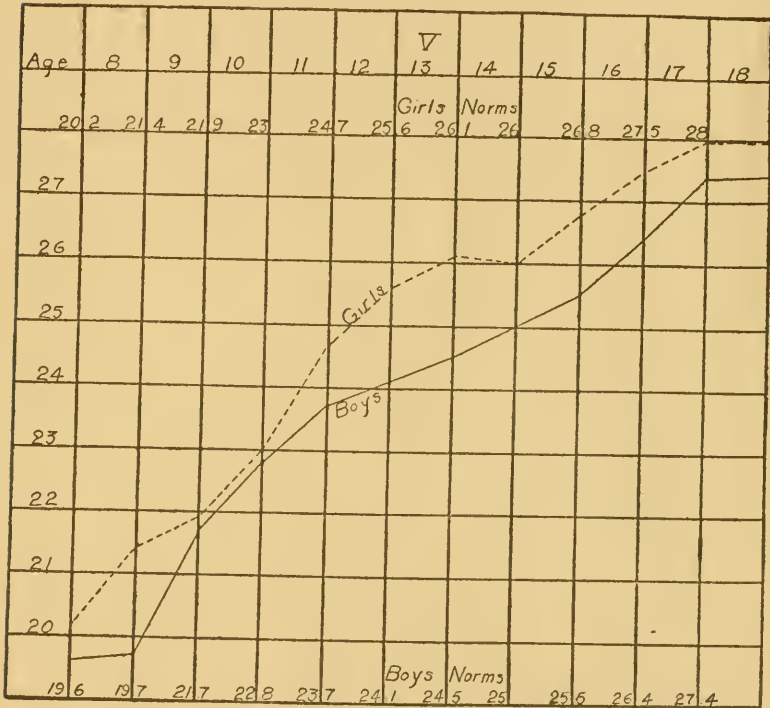


Plate V. Abstract Rote Memory

the five squares which follow the number you are to write the letters which correspond to the digits. Work as fast as you can and fill as many of the squares as you can without making mistakes. When I say "stop," quit work instantly and turn the paper over.

Before beginning the test the teacher should explain on the blackboard the exact nature of the test. This can be done by using other letters instead of those used in the key. Make sure that the pupils understand what they are to do. Allow *eight* minutes in grades three, four, and five, and *five* minutes above the fifth grade.

down and then all the other words that come into your mind. Do not write sentences, merely the words that come into your mind. Work as fast as you can.

Results.—Score the work by counting the number of words that have been written. The norms are shown in plate VII.

OPPOSITES

Object.—This is a test of controlled association. It tests one aspect of the association of ideas. All thinking is a matter of associa-

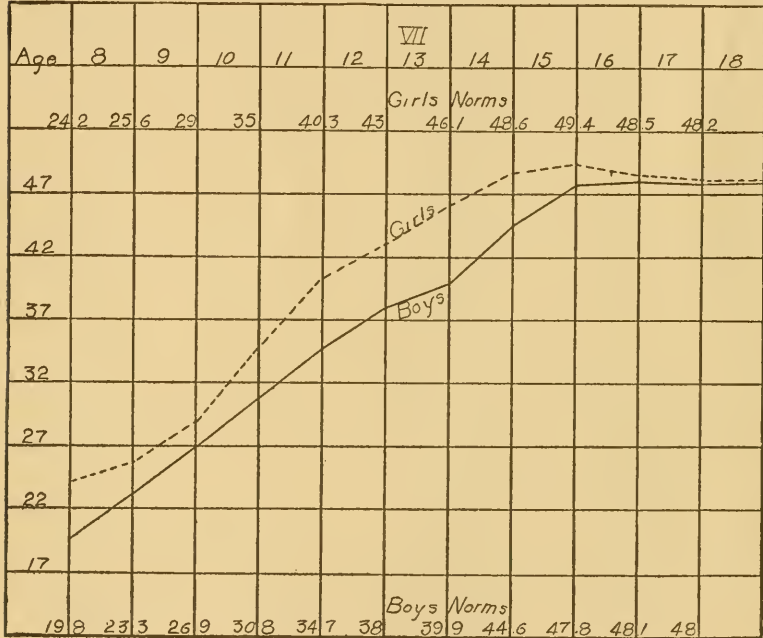


Plate VII. Free Association Test

tion of ideas. Reasoning is controlled association. The test may therefore be taken as a measure of speed in reasoning.

Method.—Distribute the opposites lists to the pupils and turn them face down on the desks. Use list *one* in grades three, four, and five, and list *two* in grades above. Allow two minutes in grades three, four, and five and one minute in grades above. Give the following instructions:

On the sheets that have been distributed to you are fifty words. After each word you are to write a word that has the opposite meaning. For example, if one word were *far*, you could write *near*.

Work as fast as you can, and when I say "stop," quit work instantly and turn your paper over.

Results.—The score is the number of opposites correctly written. The norms are shown in plate VIII.

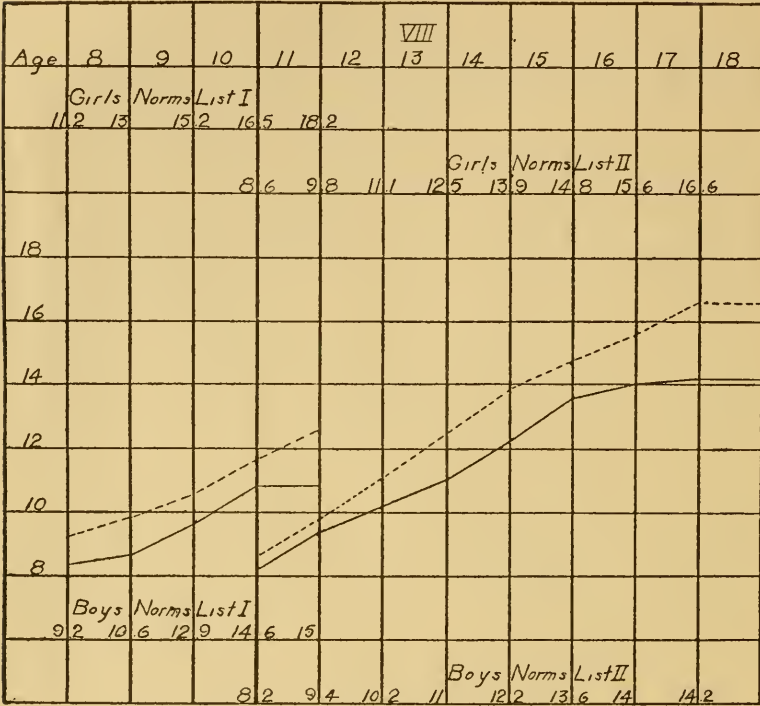


Plate VIII. Opposites Test—Lists I, and II.

OPPOSITES—List No. I.

- | | |
|-----------|------------|
| 1. good | 13. clean |
| 2. big | 14. sharp |
| 3. rich | 15. fast |
| 4. out | 16. black |
| 5. sick | 17. old |
| 6. hot | 18. up |
| 7. long | 19. thick |
| 8. wet | 20. quick |
| 9. yes | 21. pretty |
| 10. high | 22. heavy |
| 11. hard | 23. late |
| 12. sweet | 24. wrong |

- | | |
|------------|-----------|
| 25. smooth | 38. night |
| 26. strong | 39. open |
| 27. dark | 40. first |
| 28. dead | 41. over |
| 29. wide | 42. love |
| 30. empty | 43. come |
| 31. above | 44. east |
| 32. north | 45. top |
| 33. laugh | 46. wise |
| 34. man | 47. front |
| 35. before | 48. girl |
| 36. winter | 49. sad |
| 37. ripe | 50. fat |

OPPOSITES—List No. II.

- | | |
|-------------|------------|
| 1. strong | 26. hot |
| 2. deep | 27. long |
| 3. lazy | 28. wet |
| 4. seldom | 29. fierce |
| 5. thin | 30. great |
| 6. soft | 31. dead |
| 7. many | 32. cloudy |
| 8. valuable | 33. hard |
| 9. gloomy | 34. bright |
| 10. rude | 35. fine |
| 11. dark | 36. plain |
| 12. rough | 37. sharp |
| 13. pretty | 38. late |
| 14. high | 39. sour |
| 15. foolish | 40. wide |
| 16. present | 41. drunk |
| 17. glad | 42. tight |
| 18. strange | 43. empty |
| 19. wrong | 44. sick |
| 20. quickly | 45. friend |
| 21. black | 46. above |
| 22. good | 47. loud |
| 23. fast | 48. war |
| 24. clean | 49. in |
| 25. tall | 50. yes |

THE WORD BUILDING TEST

Object.—This is a test of a certain type of inventiveness, namely linguistic invention. Specifically it tests the pupil's ability to construct words using certain prescribed letters.

Method.—The pupils are given the letters, a, e, o, m, n, r, and told to make as many words as possible using only these letters. Give the following instructions:



Plate IX. Word Building Test

I wish to see how many words you can make in five minutes, using only the letters which I give you. The words must be real English words. You must use only the letters which I give you and must not use the same letter more than once in the same word. You do not, of course, have to use all the letters in the same word. A word may contain one or more letters up to six.

Material.—The pupils need only sheets of blank paper.

Results.—The score is the number of words that do not violate the rules of the test as given in the instructions. The norms are shown in plate IX.

THE COMPLETION TEST

Object.—This test, to some extent, is a test of reasoning capacity. Of course, it is only one particular aspect of reasoning. The pupil

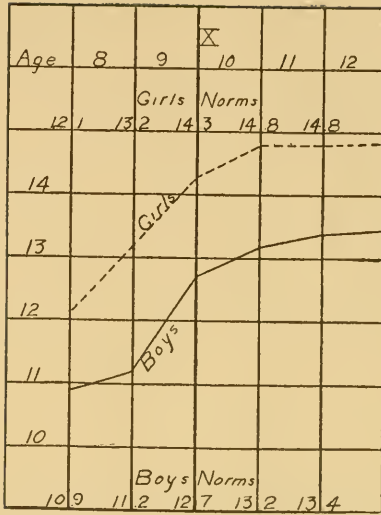


Plate X. Completion Test—Joe and the Fourth of July

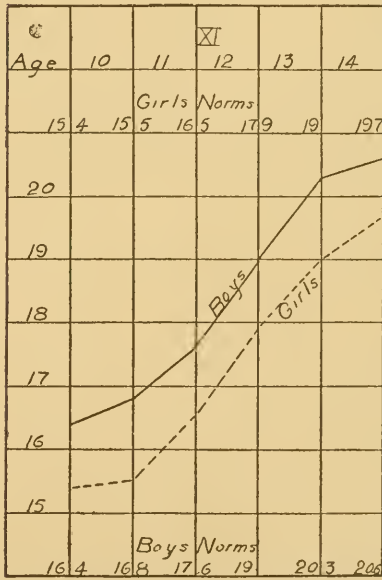


Plate XI. Completion Test—The Trout

is given a story that has certain words omitted. He must read the the story, see what it is trying to say and determine what words, put into the blanks, will make the correct sense. The meaning of the word written in a particular blank must not only make the sentence read sensibly but must fit into the story *as a whole*. Filling in the blanks in this way demands considerable thought.

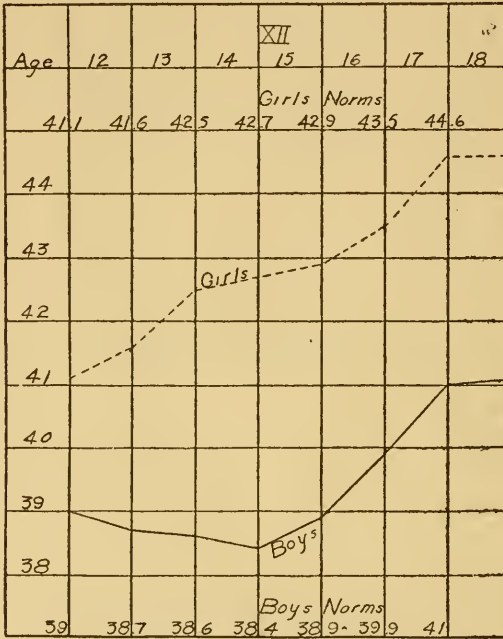


Plate XII. Completion Test—Dr. Goldsmith's Medicine

Method.—Distribute the test-sheets and turn them face down on the desks. Allow ten minutes in all the tests. Give the following instructions:

On the sheets which have been distributed is printed a story, which has certain words omitted. You are to put in the blanks the words that are omitted. The words, which you write in, must give the proper meaning so that the story reads correctly. The word, which you fill in, must not only give the proper meaning to the sentence but to the story as a whole.

Material.—Use the completion test-sheets, *Joe and the Fourth of July*, for grades three, four and five; *The Trout* for grades, six, seven and eight; and *Dr. Goldsmith's Medicine* for the high school.

Results.—In scoring the papers, allow one credit for each blank correctly filled. The norms are shown in plates X, XI, and XII. It

will be noticed that the boys excel in the Trout story. This is doubtless because the story is better suited to them on the ground of their experience and interest.

JOE AND THE FOURTH OF JULY

Joe *ran* errands for *his* mother and *took* care of the *baby* until by the Fourth of July his penny *grew* to be a dime. The day before the Fourth, he *went* down town all by *himself* to get his fire *works*. There were so *many* kinds he hardly knew which to *buy*. The clerk knew that it takes a *long* time to decide, for he had been a *boy* himself not very *long* ago. So he helped Joe to *select* the very best kinds. "When are you going to *fire* them off?", asked the clerk. "I will fire *them* very *early* tomorrow," said the boy. So that night Joe set the *alarm* clock, and the next *morning* got up *early* to fire his firecrackers.

THE TROUT

The trout is a fine fish. Once a big trout *lived* in a pool *close* by a spring. He used to *stay* under the bank with *only* his head showing. His wide-open *eyes* shone like jewels. I tried to *catch* him. I would *creep* up to the *edge* of the pool *where* I could see his *bright* eyes looking up.

I *caught* a grasshopper and *threw* it over to him. Then there was a *splash* in the water and the grasshopper *was gone*. I *did* this *two* or three times. Each time I *saw* the rush and *spl ash* and saw the bait had been *taken*.

So I put the *sa me* bait on my *hook* and *threw* it over into the *water*. But *all* was silent. The fish was an *old* one and had *grown* very wise. I did this *day* after day with the same luck. The trout *knew* there was a *hook* hidden in the bait.

DOCTOR GOLDSMITH'S MEDICINE

This *is* a story of good medicine. Most medicine is *bad* to take, but this was so good *that* the sick man *wished* for more.

One day a poor woman *went* to Doctor Goldsmith and *asked* him to *go* to see her *sick* husband. "He *is* very sick," she said, "and I *can* not *get* him to eat anything."

So Doctor Goldsmith *went* to see him. The doctor *saw* at once that the *reason* why the man *could* not eat was *because* he was so poor that he had *not* been *able* to buy good food.

Then he *said* to the woman, "Come to my house this evening and I will *give* you some *medicine* for your *husband*."

The woman *went* in the evening and the doctor gave her a small paper box tied up tight. "It is very heavy," she said. "May I see what it looks *like*?" "No," said the doctor, "wait until you get *home*." When she *got* home, and she and her husband *opened* the box so that he *could* take the first *dose* of medicine,—what do you think they *saw*? The box was *filled* with silver *money*. This was the *good* doctor's medicine.

THE PHYSICAL TESTS AND MEASURES

Object.—The object of the physical tests is to determine the physical development of the pupils.

Method and Material.—For accurately measuring height a stadiometer is needed. Great care should be exercised in making the measurements. If the pupils are measured standing with their shoes on, the height of the heel should be deducted. The heel of the shoe can be accurately measured by means of callipers.

For weight, accurate platform scales are needed. For testing strength use the Smedley dynamometer, and give three trials with each hand, recording the best result for each. For testing muscular speed, use tapping apparatus and electric counter, making a thirty seconds test with the right hand and then a thirty seconds test with the left hand. Before beginning the test, demonstrate to the pupil how it is to be done and allow him to try a second or two to see that he holds the stylus properly. The stylus should be held vertically and the pupil should strike the plate lightly.

The lung capacity test is made by means of a wet spirometer. The pupil is urged to fill the lungs as full as possible and then expel all the air into the spirometer. Give three trials and record the best result. The vital index is determined by dividing the lung capacity by the weight. Owing to the importance to the body of the aeration of the blood, the vital index is an important measure. Moreover, since the index is the ratio of the lung capacity to the weight, it has a value that the other physical measures do not have. When we have measured a child's weight or height, we can make no inferences unless we know whether the child belongs to a long stock or a short stock, a heavy stock or a light stock. But, when we have determined the amount of air-space in the lungs per pound of weight of the child, we have a measure that is of direct and special significance. The norms are shown in the tables. A more complete description of these tests and other tables of norms may be found in the author's *Examination of School Children*, or in Whipple's *Manual of Mental and Physical Tests*.

MATERIAL AND APPARATUS

Test sheets for the mental tests can be obtained from the University of Missouri, Department of Educational Psychology, at cost. All persons using the tests are requested to send a summary of the results to the department. Apparatus for the physical tests can be obtained from C. H. Stoelting Co., Chicago.

TABLES

Tables I to IX contain the physical norms. In all the tables which follow, the age indicated is the age at the last birthday. The average would, therefore, be a half year older. In the tables which show the mental tests records, the first vertical row gives the age, the second vertical row gives the number of cases examined, the

third row gives the average for each age, the fourth row gives the average deviation, found by dividing the sum of the individual deviations by the number of cases.

For practical work with the mental tests, the norm graphs on the earlier pages of this bulletin should be used. They were constructed from these tables which follow by finding the average of adjacent ages. The graphs were also somewhat smoothed.

TABLE I. STANDING HEIGHT IN CM.

| Age | Boys | | Girls | |
|--------|--------------|---------|--------------|---------|
| | Number Cases | Average | Number Cases | Average |
| 6 | 61 | 115.4 | 66 | 113.4 |
| 7 | 59 | 118.8 | 57 | 120.3 |
| 8 | 75 | 125.5 | 60 | 123.8 |
| 9 | 74 | 130.6 | 68 | 130.6 |
| 10 | 64 | 135.5 | 70 | 135.1 |
| 11 | 75 | 140.7 | 61 | 141.6 |
| 12 | 64 | 144.0 | 67 | 146.9 |
| 13 | 67 | 151.2 | 79 | 154.7 |
| 14 | 59 | 156.1 | 55 | 156.3 |
| 15 | 60 | 164.4 | 78 | 159.4 |
| 16 | 37 | 164.5 | 79 | 159.5 |
| 17 | 34 | 171.8 | 48 | 159.7 |
| 18 | 36 | 171.2 | 33 | 159.3 |
| Adults | 72 | 172.7 | 137 | 161.8 |

TABLE II. SITTING HEIGHT IN CM

| Age | Boys | | Girls | |
|--------|--------------|---------|--------------|---------|
| | Number Cases | Average | Number Cases | Average |
| 6 | 61 | 62.7 | 66 | 61.5 |
| 7 | 60 | 63.6 | 57 | 64.3 |
| 8 | 75 | 66.9 | 60 | 65.7 |
| 9 | 74 | 69.0 | 68 | 68.9 |
| 10 | 64 | 71.3 | 70 | 70.9 |
| 11 | 74 | 73.4 | 61 | 74.0 |
| 12 | 64 | 74.9 | 67 | 77.1 |
| 13 | 67 | 77.8 | 80 | 79.9 |
| 14 | 54 | 80.5 | 48 | 81.8 |
| 15 | 44 | 84.0 | 61 | 83.7 |
| 16 | 29 | 84.1 | 67 | 84.2 |
| 17 | 33 | 89.8 | 40 | 84.0 |
| 18 | 27 | 88.1 | 30 | 83.5 |
| Adults | 71 | 88.6 | 123 | 86.0 |

TABLE III. WEIGHT IN LBS.

| Age | Boys | | Girls | |
|--------|--------------|---------|--------------|---------|
| | Number Cases | Average | Number Cases | Average |
| 6 | 64 | 46.9 | 66 | 44.6 |
| 7 | 61 | 49.1 | 60 | 50.2 |
| 8 | 78 | 56.1 | 63 | 52.0 |
| 9 | 76 | 62.4 | 70 | 61.7 |
| 10 | 78 | 67.5 | 83 | 66.7 |
| 11 | 91 | 75.9 | 83 | 76.4 |
| 12 | 82 | 82.1 | 91 | 85.0 |
| 13 | 83 | 92.2 | 91 | 96.0 |
| 14 | 81 | 103.7 | 74 | 104.7 |
| 15 | 88 | 121.5 | 91 | 113.8 |
| 16 | 47 | 127.5 | 92 | 117.4 |
| 17 | 43 | 139.9 | 43 | 122.7 |
| 18 | 38 | 140.6 | 43 | 123.1 |
| Adults | 72 | 152.3 | 137 | 131.0 |

TABLE IV. LUNG CAPACITY IN CC.

| Age | Boys | | Girls | |
|--------|--------------|---------|--------------|---------|
| | Number Cases | Average | Number Cases | Average |
| 6 | 64 | 1262 | 64 | 943 |
| 7 | 61 | 1171 | 60 | 1103 |
| 8 | 77 | 1411 | 63 | 1226 |
| 9 | 76 | 1526 | 71 | 1446 |
| 10 | 73 | 1735 | 80 | 1513 |
| 11 | 87 | 1932 | 78 | 1762 |
| 12 | 75 | 2141 | 92 | 1894 |
| 13 | 82 | 2353 | 90 | 2210 |
| 14 | 77 | 2706 | 72 | 2330 |
| 15 | 85 | 3193 | 92 | 2449 |
| 16 | 50 | 3348 | 96 | 2526 |
| 17 | 43 | 3704 | 58 | 2552 |
| 18 | 48 | 3765 | 43 | 2640 |
| Adults | 71 | 4256 | 117 | 2814 |

TABLE V. GRIP RIGHT HAND IN KG.

| Age | Boys | | Girls | |
|--------|--------------|---------|--------------|---------|
| | Number Cases | Average | Number Cases | Average |
| 6 | 63 | 9.3 | 66 | 8.0 |
| 7 | 61 | 11.4 | 60 | 10.0 |
| 8 | 78 | 14.0 | 64 | 10.4 |
| 9 | 78 | 15.7 | 72 | 13.2 |
| 10 | 77 | 16.7 | 85 | 14.3 |
| 11 | 93 | 19.2 | 80 | 16.3 |
| 12 | 79 | 22.0 | 92 | 18.9 |
| 13 | 80 | 25.1 | 92 | 22.7 |
| 14 | 79 | 29.6 | 73 | 24.7 |
| 15 | 87 | 33.8 | 96 | 27.3 |
| 16 | 48 | 37.8 | 97 | 27.4 |
| 17 | 46 | 44.0 | 58 | 27.2 |
| 18 | 51 | 44.2 | 44 | 28.0 |
| Adults | 71 | 48.3 | 137 | 28.9 |

TABLE VI. GRIP LEFT HAND IN KG.

| Age | Boys | | Girls | |
|--------|--------------|---------|--------------|---------|
| | Number Cases | Average | Number Cases | Average |
| 6 | 63 | 9.2 | 66 | 7.6 |
| 7 | 61 | 11.0 | 60 | 9.1 |
| 8 | 78 | 12.6 | 64 | 10.1 |
| 9 | 78 | 14.4 | 71 | 12.2 |
| 10 | 77 | 15.4 | 85 | 13.4 |
| 11 | 93 | 18.0 | 81 | 15.6 |
| 12 | 78 | 20.3 | 94 | 18.5 |
| 13 | 81 | 23.3 | 92 | 21.7 |
| 14 | 79 | 27.7 | 73 | 23.1 |
| 15 | 86 | 29.2 | 96 | 25.3 |
| 16 | 53 | 36.0 | 97 | 26.1 |
| 17 | 45 | 42.3 | 59 | 25.5 |
| 18 | 48 | 42.7 | 44 | 26.3 |
| Adults | 71 | 46.1 | 137 | 26.9 |

TABLE VII. SPEED RIGHT HAND

| Age | Boys | | Girls | |
|--------|--------------|---------|--------------|---------|
| | Number Cases | Average | Number Cases | Average |
| 6 | 62 | 121 | 66 | 121 |
| 7 | 61 | 129 | 59 | 132 |
| 8 | 76 | 136 | 63 | 135 |
| 9 | 76 | 144 | 70 | 148 |
| 10 | 70 | 152 | 76 | 154 |
| 11 | 84 | 163 | 75 | 163 |
| 12 | 74 | 168 | 86 | 169 |
| 13 | 82 | 175 | 93 | 172 |
| 14 | 75 | 177 | 63 | 183 |
| 15 | 85 | 188 | 94 | 185 |
| 16 | 51 | 190 | 94 | 187 |
| 17 | 43 | 198 | 67 | 193 |
| 18 | 47 | 208 | 45 | 193 |
| Adults | 152 | 206 | 243 | 200 |

TABLE VIII. SPEED LEFT HAND

| Age | Boys | | Girls | |
|--------|--------------|---------|--------------|---------|
| | Number Cases | Average | Number Cases | Average |
| 6 | 62 | 107 | 66 | 103 |
| 7 | 61 | 111 | 57 | 112 |
| 8 | 76 | 111 | 63 | 118 |
| 9 | 76 | 123 | 69 | 128 |
| 10 | 70 | 131 | 76 | 133 |
| 11 | 83 | 136 | 75 | 141 |
| 12 | 73 | 141 | 90 | 148 |
| 13 | 81 | 150 | 91 | 151 |
| 14 | 75 | 154 | 67 | 158 |
| 15 | 83 | 166 | 94 | 159 |
| 16 | 51 | 168 | 93 | 163 |
| 17 | 43 | 176 | 57 | 172 |
| 18 | 49 | 179 | 41 | 172 |
| Adults | 151 | 190 | 243 | 180 |

TABLE IX. VITAL INDEX

| Age | Boys | | Girls | |
|--------|--------------|---------|--------------|---------|
| | Number Cases | Average | Number Cases | Average |
| 6 | | | 64 | 21.1 |
| 7 | 61 | 23.8 | 60 | 21.9 |
| 8 | 77 | 25.2 | 63 | 23.5 |
| 9 | 76 | 24.4 | 71 | 23.4 |
| 10 | 73 | 25.7 | 80 | 22.6 |
| 11 | 87 | 25.4 | 78 | 23.1 |
| 12 | 75 | 26.1 | 92 | 22.3 |
| 13 | 82 | 25.5 | 90 | 23.0 |
| 14 | 77 | 26.1 | 72 | 22.2 |
| 15 | 85 | 26.2 | 92 | 21.4 |
| 16 | 50 | 26.2 | 96 | 21.5 |
| 17 | 43 | 26.4 | 58 | 20.8 |
| 18 | 48 | 26.4 | 43 | 21.4 |
| Adults | 71 | 27.9 | 117 | 21.5 |

TABLE X. SUBSTITUTION TEST

| Age | Boys | | | Girls | | |
|--------|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 8 | 98 | 10.07 | 3.4 | 77 | 12.7 | 3.6 |
| 9 | 122 | 11.8 | 3.5 | 121 | 13.76 | 4.8 |
| 10 | 148 | 13.6 | 3.9 | 126 | 15.7 | 4.8 |
| 11 | 155 | 15.4 | 4.3 | 127 | 18.9 | 4.8 |
| 12 | 150 | 17.7 | 4.6 | 167 | 20.5 | 4.9 |
| 13 | 149 | 17.71 | 4.7 | 141 | 22.5 | 4.3 |
| 14 | 108 | 20.8 | 4.8 | 109 | 23.5 | 4.5 |
| 15 | 113 | 23.4 | 4.9 | 111 | 26.8 | 4.9 |
| 16 | 70 | 24.16 | 4.9 | 92 | 27.7 | 4.3 |
| 17 | 51 | 26 | 5.2 | 65 | 29.2 | 4.1 |
| 18 | 36 | 24.75 | 4.2 | 48 | 27.9 | 5.5 |
| Adults | 64 | 29.1 | 5.3 | 167 | 32.2 | 5.8 |

TABLE XI. ROTE MEMORY CONCRETE

| Age | Boys | | | Girls | | |
|--------|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 7 | 11 | 23.2 | 2.0 | 16 | 21.5 | 3.4 |
| 8 | 61 | 21.3 | 3.5 | 56 | 22.9 | 2.7 |
| 9 | 79 | 24 | 3.2 | 83 | 22.6 | 3.5 |
| 10 | 96 | 23.9 | 3.4 | 83 | 23.9 | 2.1 |
| 11 | 99 | 25.5 | 2.7 | 80 | 25.7 | 3.2 |
| 12 | 97 | 25.8 | 2.9 | 98 | 26.3 | 2.7 |
| 13 | 95 | 26.3 | 3.2 | 81 | 27.4 | 2.6 |
| 14 | 73 | 26.3 | 3.4 | 73 | 27.3 | 3.0 |
| 15 | 90 | 26.2 | 3.8 | 87 | 27.3 | 2.8 |
| 16 | 59 | 26.7 | 3.6 | 65 | 28.9 | 2.9 |
| 17 | 39 | 27. | 2.8 | 47 | 28.5 | 2.2 |
| 18 | 30 | 27.9 | 4.3 | 28 | 28.9 | 1.4 |
| Adults | 38 | 28.5 | 1.8 | 61 | 28.6 | 1.9 |

TABLE XII. ROTE MEMORY ABSTRACT

| Age | Boys | | | Girls | | |
|--------|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 7 | 11 | 21 | 2.5 | 16 | 19.5 | 3.4 |
| 8 | 60 | 18.2 | 3.6 | 56 | 21 | 2.6 |
| 9 | 85 | 21.3 | 2.7 | 82 | 21.9 | 3.0 |
| 10 | 97 | 22.2 | 3.4 | 83 | 21.9 | 3.0 |
| 11 | 98 | 23.4 | 3.9 | 80 | 24.2 | 3.1 |
| 12 | 96 | 24 | 3.1 | 100 | 25.2 | 3.3 |
| 13 | 95 | 24.3 | 3.3 | 82 | 26.1 | 3.0 |
| 14 | 73 | 24.7 | 3.1 | 72 | 26.2 | 2.8 |
| 15 | 92 | 25.3 | 3.7 | 86 | 25.8 | 3.0 |
| 16 | 59 | 25.7 | 3.2 | 63 | 27.9 | 3.5 |
| 17 | 40 | 27.2 | 3.1 | 47 | 27.1 | 3.0 |
| 18 | 30 | 27.6 | 3.3 | 28 | 28.9 | 3.0 |
| Adults | 40 | 28.4 | 1.8 | 61 | 27.9 | 2.4 |

TABLE XIII. FREE ASSOCIATION

| Age | Boys | | | Girls | | |
|--------|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 7 | 12 | 17.4 | 4.4 | 16 | 24.2 | 8.6 |
| 8 | 66 | 22.3 | 5.7 | 58 | 24.3 | 7.9 |
| 9 | 75 | 24.4 | 8.6 | 84 | 27.0 | 9.1 |
| 10 | 93 | 29.4 | 11.7 | 76 | 31.0 | 12.5 |
| 11 | 97 | 32.3 | 12.5 | 86 | 39.0 | 14.4 |
| 12 | 97 | 37.1 | 14.3 | 107 | 41.7 | 14.4 |
| 13 | 94 | 39 | 15.3 | 90 | 44.4 | 14.7 |
| 14 | 62 | 40.9 | 13.9 | 74 | 47.8 | 12.7 |
| 15 | 78 | 48.3 | 11.4 | 74 | 49.4 | 12.6 |
| 16 | 47 | 47.3 | 12.6 | 58 | 49.4 | 13.8 |
| 17 | 43 | 49.0 | 13.4 | 38 | 47.6 | 14.2 |
| 18 | 24 | 47.1 | 13.4 | 30 | 48.9 | 13.6 |
| Adults | 459 | 51.46 | 14.5 | 816 | 49.3 | 15.5 |

TABLE XIV. COMPLETION TEST
JOE AND THE FOURTH OF JULY

| Age | Boys | | | Girls | | |
|-----|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 7 | 15 | 10.9 | 3.6 | 24 | 12 | 4.4 |
| 8 | 121 | 10.9 | 4.3 | 100 | 12.3 | 3.8 |
| 9 | 145 | 11.5 | 4.4 | 155 | 14.1 | 3.2 |
| 10 | 131 | 14.0 | 3.6 | 121 | 14.5 | 3.4 |
| 11 | 87 | 13.9 | 3.3 | 52 | 15.1 | 3.1 |
| 12 | 29 | 12.1 | 3.2 | 36 | 14.5 | 3.1 |
| 13 | 16 | 14.1 | 4.2 | 9 | 13.7 | 3.1 |
| 14 | 7 | 13.9 | 3.9 | 1 | 16 | |

TABLE XV. COMPLETION TEST
THE TROUT

| Age | Boys | | | Girls | | |
|-----|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 9 | 13 | 16.8 | 6.7 | 10 | 18.9 | 6.9 |
| 10 | 76 | 16.1 | 5.2 | 68 | 15 | 4.5 |
| 11 | 120 | 17.5 | 5.9 | 114 | 16.1 | 4.3 |
| 12 | 114 | 17.8 | 6.1 | 132 | 17.0 | 6.6 |
| 13 | 93 | 20.3 | 5.7 | 94 | 18.8 | 4.5 |
| 14 | 51 | 20.4 | 5.5 | 57 | 19.2 | 5.4 |
| 15 | 38 | 19.9 | 5.3 | 24 | 20.3 | 6.0 |
| 16 | 13 | 19.7 | 6.5 | 17 | 21.1 | 4.1 |

TABLE XVI. COMPLETION TEST
DR. GOLDSMITH'S MEDICINE

| Age | Boys | | | Girls | | |
|--------|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 10 | 8 | 37.5 | 12.5 | 5 | 45 | 3.2 |
| 11 | 13 | 41.3 | 3.0 | 15 | 40.7 | 7.4 |
| 12 | 30 | 36.8 | 6.9 | 47 | 40.6 | 6.9 |
| 13 | 53 | 40.3 | 5.5 | 48 | 41.7 | 6.1 |
| 14 | 58 | 37.8 | 8.6 | 60 | 44.3 | 4.1 |
| 15 | 83 | 39 | 6.3 | 92 | 42.3 | 4.9 |
| 16 | 62 | 38.8 | 7.1 | 82 | 43 | 4.5 |
| 17 | 45 | 41.1 | 5.2 | 61 | 44.1 | 3.7 |
| 18 | 37 | 40.9 | 6.2 | 45 | 45.2 | 3.4 |
| Adults | 20 | 48.1 | 1.7 | 25 | 49.0 | 1.0 |

TABLE XVII. WORD BUILDING TEST

| Age | Boys | | | Girls | | |
|--------|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 7 | 11 | 6.2 | 1.6 | 16 | 7.4 | 1.9 |
| 8 | 52 | 8.2 | 2.8 | 53 | 7.8 | 2.2 |
| 9 | 63 | 7.6 | 2.7 | 67 | 9 | 3.9 |
| 10 | 70 | 9.5 | 3.8 | 60 | 9.6 | 3.6 |
| 11 | 77 | 11 | 4.7 | 56 | 11.4 | 3.6 |
| 12 | 76 | 12.2 | 3.5 | 66 | 12.9 | 4.0 |
| 13 | 66 | 12.2 | 3.4 | 66 | 14.1 | 4.4 |
| 14 | 42 | 13.9 | 3.6 | 51 | 14.5 | 3.5 |
| 15 | 48 | 12.7 | 3.5 | 46 | 15.3 | 3.7 |
| 16 | 36 | 14.5 | 4.7 | 40 | 14.2 | 4.5 |
| 17 | 27 | 13.4 | 4.1 | 25 | 16.8 | 4.2 |
| 18 | 14 | 15.6 | 2.2 | 19 | 15.1 | 4.5 |
| Adults | 40 | 20.5 | 2.8 | 59 | 20.1 | 3.5 |

TABLE XVIII. LOGICAL MEMORY—WILLIE JONES

| Age | Boys | | | Girls | | |
|-----|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 7 | 17 | 26.5 | 9.1 | 24 | 29.6 | 5.4 |
| 8 | 120 | 26.7 | 6.3 | 95 | 28.5 | 6.7 |
| 9 | 132 | 28.4 | 6.6 | 139 | 30.8 | 5.7 |
| 10 | 136 | 31.5 | 7.1 | 113 | 33.0 | 7.1 |
| 11 | 90 | 32.5 | 7.9 | 39 | 35.4 | 6.4 |
| 12 | 31 | 32.7 | 6.4 | 39 | 33.5 | 5.8 |
| 13 | 23 | 31.9 | 6.9 | 12 | 30.7 | 8.7 |
| 14 | 10 | 27.8 | 10.0 | 2 | 31 | 5 |

TABLE XIX. LOGICAL MEMORY—FARMER'S SON

| Age | Boys | | | Girls | | |
|-----|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 9 | 11 | 31.5 | 6.0 | 10 | 35.6 | 6.6 |
| 10 | 75 | 31.2 | 7.9 | 60 | 32.8 | 5.8 |
| 11 | 107 | 33.2 | 6.9 | 102 | 31.9 | 6.1 |
| 12 | 118 | 33.3 | 7.2 | 132 | 33.4 | 7.9 |
| 13 | 101 | 34.5 | 5.9 | 86 | 36.2 | 7.1 |
| 14 | 50 | 35.2 | 5.3 | 42 | 34.1 | 7.3 |
| 15 | 27 | 32.9 | 9.2 | 12 | 37.1 | 7.0 |
| 16 | 8 | 39.7 | 6.0 | 7 | 40.0 | 11.4 |

TABLE XX. LOGICAL MEMORY—COSTLY TEMPER

| Age | Boys | | | Girls | | |
|--------|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 11 | 8 | 47.4 | 8.5 | 5 | 49.6 | 8.6 |
| 12 | 30 | 52.5 | 10.8 | 50 | 49.0 | 8.3 |
| 13 | 68 | 50.3 | 8.1 | 88 | 53.6 | 11.1 |
| 14 | 74 | 46.5 | 9.8 | 80 | 50.9 | 9.1 |
| 15 | 105 | 48.4 | 9.2 | 110 | 49.6 | 9.5 |
| 16 | 66 | 46.8 | 11.5 | 86 | 47.8 | 10.8 |
| 17 | 49 | 43.4 | 10.8 | 64 | 46.9 | 12.3 |
| 18 | 40 | 46.8 | 10.3 | 35 | 49.2 | 10.2 |
| Adults | 64 | 64.0 | 10.5 | 164 | 69.6 | 10.3 |



TABLE XXI. OPPOSITES—LIST I.

| Age | Boys | | | Girls | | |
|-----|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 7 | 11 | 8.0 | 2.1 | 16 | 9.1 | 1.5 |
| 8 | 54 | 8.5 | 2.4 | 51 | 9.3 | 2.3 |
| 9 | 62 | 8.6 | 2.5 | 68 | 10.2 | 2.6 |
| 10 | 60 | 10.6 | 3.1 | 56 | 10.8 | 3.0 |
| 11 | 38 | 10.9 | 2.5 | 28 | 12.4 | 3.3 |
| 12 | 8 | 10.6 | 4.4 | 13 | 12.8 | 4.0 |

TABLE XXII. OPPOSITES—LIST II.

| Age | Boys | | | Girls | | |
|--------|--------------|---------|-------|--------------|---------|-------|
| | Number Cases | Average | A. D. | Number Cases | Average | A. D. |
| 8 | 34 | 4.1 | 1.2 | 10 | 5.0 | 1.7 |
| 9 | 34 | 4.6 | 3.9 | 44 | 5.7 | 2.2 |
| 10 | 60 | 8.4 | 3.3 | 55 | 7.4 | 3.1 |
| 11 | 96 | 9.4 | 2.9 | 95 | 9.0 | 3.4 |
| 12 | 117 | 10.2 | 2.9 | 125 | 10.4 | 3.3 |
| 13 | 112 | 10.8 | 4.6 | 125 | 11.9 | 3.6 |
| 14 | 70 | 11.2 | 3.4 | 91 | 13.2 | 3.5 |
| 15 | 84 | 13.3 | 2.8 | 76 | 14.6 | 3.7 |
| 16 | 43 | 14.0 | 3.4 | 57 | 15.0 | 3.7 |
| 17 | 24 | 14.0 | 3.7 | 22 | 16.2 | 3.0 |
| 18 | 23 | 14.4 | 2.3 | 21 | 17.1 | 2.9 |
| Adults | 37 | 15.0 | 3.8 | 85 | 15.4 | 1.9 |



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