NATIONAL CENTER For HEALTH STATISTICS | Series 11 Number 103

VITAL and HEALTH STATISTICS
DATA FROM THE NATIONAL HEALTH SURVEY

School Achievement of Children 6-11 Years

As Measured by the Reading and Arithmetic Subtests of the Wide Range Achievement Test

United States

Distribution of raw scores, standard scores, and grade equivalents by age, sex, and grade for noninstitutionalized children 6-11 years of age as obtained on these two subtests.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Health Services and Mental Health Administration

Rockville, Md. June 1970

Series 11 reports present findings from the National Health Examination Survey which obtains data through direct examination, tests, and measurements of samples of the U.S. population. The reports published to date (Nos. 1 through 34) have related to the adult program. Additional reports concerning this group will be forthcoming and will be numbered consecutively, 35, etc. The present report represents one of a large number of reports of findings from the children and youth programs, Cycles II and III of the Health Examination Survey. These reports emanating from the same survey mechanism, will be published in Series 11 but are numbered consecutively beginning with 101. It is hoped this will facilitate the efforts to provide users with all of the data and only the data in which they are interested.

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COOPERATION OF THE BUREAU OF THE CENSUS

In accordance with specifications established by the National Health Survey, the Bureau of the Census, under a contractual agreement, participated in the design and selection of the sample, and carried out the first stage of the field interviewing and certain parts of the statistical processing.

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THIS NEW REPORT from the National Center for Health Statistics contains national estimates of school achievement for children 6-11 years of age as measured by the Reading and Arithmetic subtests of the Wide Range Achievement Test. These data were obtained in the second cycle of the Health Examination Survey, conducted in 1963-65. In this survey, a probability sample of 7,417 children were selected to represent the 24 million children in this age group in the noninstitutional population of the United States. Out of the 7,417 children selected in the sample, 7,119 or 96 percent were examined. These examinees were closely representative of the child population of the United States from which they were drawn with respect to age, sex, race, region, size of place of residence, and change in size of place of residence from 1950 to 1960.

The findings on school achievement have been presented by age, grade, and sex. Grade equivalents, percentile ranks, and standard score equivalents of these raw scores are also included.

Comparison is made with the data available for the group on which Jastak standardized the 1963 revised Wide Range Achievement Test, two parts of which were used in this survey. National estimates from this survey, on the average, were lower than those for the standardization group for both subtests, significantly so for most ages on the Arithmetic subtest. In general, slightly greater variability in scores was found in the Reading but not the Arithmetic subtest for the U.S. children from the present study than that in Jastak's standardization group.

SYMBOLS

Data not available	---
Category not applicable	...
Quantity zero	-
Quantity more than 0 but less than 0.05	0.0
Figure does not meet standards of reliability or precision	*

SCHOOL ACHIEVEMENT OF CHILDREN

AS MEASURED BY THE READING AND ARITHMETIC SUBTESTS OF THE WIDE RANGE ACHIEVEMENT TEST

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INTRODUCTION

This report presents the school achievement of children 6-11 years by age and sex in the United States as estimated from the Reading and Arithmetic subtests of the Wide Range Achievement Test data obtained in the Health Examination Survey of 1963-65.

The Health Examination Survey is one of the major programs of the National Center for Health Statistics, authorized under the National Health Survey Act of 1956 by the 84th Congress as a continuing U.S. Public Health Service activity to determine the health status of the population.

The National Health Survey is carried out through three different survey programs.[1] One of these is the Health Interview Survey, which is concerned primarily with the impact of illness and disability upon people's lives and actions and the differentials observable in various population groups. It collects information from samples of people by household interviews. A second, the Health Record Survey, includes followback studies based on vital records, institutional surveys to establish sampling frames as well as provide data, and surveys based on hospital records. The third major program is the Health Examination Survey.

Data are collected in the Health Examination Survey by direct physical examinations, tests, and measurements performed on the sample population studied. This provides the best way to obtain actual diagnostic data on the prevalence of certain medically defined illnesses. It is the only way to secure information on unrecognized and undiagnosed conditions and on a variety of physical, physiological, and psychological measures within the population. It also provides demographic and socioeconomic data on the sample population under study.

The Health Examination Survey consists of a series of separate programs referred to as "cycles." Each cycle is limited to some specific segment of the U.S. population and to certain specified aspects of the health of that population. In the first cycle data were obtained on the prevalence of certain chronic diseases and on the distribution of various measurements and other characteristics in a defined adult population as previously described.[2,3]

The second program or cycle, on which this report is based, required the selection and examination of a probability sample of the Nation's noninstitutionalized children 6-11 years of age. The examination focused primarily on health factors relating to growth and development. It included an examination by a pediatrician and by a dentist; tests administered by a psychologist; and a variety of tests and measurements by a technician. A description of the survey plan, sample design, examination content, and operation of the survey is contained in another report.[4]

Field collection operations for this cycle were started in July 1963 and completed in December 1965. Out of the 7,417 children selected in the sample, 7,119 or 96 percent were examined. This national sample—both the total and those examined—is highly representative of the roughly 24 million noninstitutionalized children 6-11 years of age in the United States.[4]

During his single visit, each child was given a standardized examination by the examining team in the mobile units specially designed for use in the survey. Prior to the examination, information was obtained from the parent of the child consisting of demographic and socioeconomic data on household members as well as medical history, behavioral, and related data on the child to be examined. Ancillary data for the child on grade placement, teacher ratings of his behavior and adjustment, and health problems known to the teacher were requested from the school. For verification of the child's age and information related to the child at birth, birth certificates were obtained.

THE PSYCHOLOGICAL TEST BATTERY

A 60-minute test battery to assess the mental aspects of growth and development was included as part of the standard examination, after consultation with child psychologists from five leading universities and the National Institute of Mental Health. The battery consisted of verbal and nonverbal tests of or related to intelligence as well as other tests designed to assess various personality factors. The Vocabulary and Block Design subtests of the Wechsler Intelligence Scale for Children (WISC) and the Draw-a-Person Tests were the specific measures of intelligence. Five cards of the Thematic Apperception Test (TAT) were included for the assessment of personality factors. Two subtests of the Wide Range Achievement Test (WRAT) were included to measure achievement in the basic skills of arithmetic computation and reading. These tests were used also because it is reasonable to expect that school achievement would be related to intellectual status and to social and emotional adjustment.

A methodological study was undertaken to obtain a critical evaluation of the above-mentioned psychological procedures used for the second cycle of the Health Examination Survey. This study included a literature review of previous research and evaluation known to be available on each of the battery components, recommendations concerning the type of inference which could appropriately be made from the results to be obtained from the battery, and recommendations with respect to additional research which was deemed necessary in order to permit proper use of the data collected. The methodological study was conducted on a contract basis by Dr. S. B. Sells of the Institute of Behavioral Research, Texas Christian University. The results of this study have been published in the Center's methodological series.[5]

The Wide Range Achievement Test

The Wide Range Achievement Test was selected for use in measuring and evaluating the school achievement aspect of growth and development among children because this test has been widely used and well accepted as an individual school achievement test. The WRAT, furthermore, has been standardized and could be individually administered within the time available and within the framework of the examination.

The WRAT was developed by Jastak and Bijou in 1936[6] as a convenient tool for the study of the three basic study skills of reading, spelling, and arithmetic. Its content is concerned primarily with mastery of the mechanics of the basic subjects rather than with their comprehension. The Reading subtest consists of recognizing and naming letters and of pronouncing words. The Spelling subtest involves copying marks resembling letters, writing the subject's name, and writing single words to dictation. The Arithmetic subtest includes counting, reading number symbols, solving oral problems, and performing written computations. The Reading subtest is consequently a test of reading as a motor skill, the Spelling subtest focuses on words without sentence context, and the Arithmetic subtest involves number or computational facility with minimal dependence on reading. The WRAT was designed as an adjunct to tests of intelligence and school adjustment. Hence, duplication and overlaping with tests of comprehension, judgment, reasoning, and generalization

by means other than reading, spelling, and arithmetic are largely avoided.

Because of time limitations in the Health Examination Survey, only the Reading and Arithmetic subtests of the WRAT were included in the second cycle. Consequently, all further discussion of the WRAT and the data here reported will be limited to these two subtests.

The norms for the 1946 edition of the WRAT were designed to conform to those given for the New Stanford Achievement Test (Reading, to the New Stanford Word and Paragraph Reading, and Arithmetic to the New Stanford Arithmetic Computation subtest).[6] Test-retest reliability coefficients were reported to be .95 for Reading (N = 110) and .90 for Arithmetic (N = 120). The Reading subtest, moreover, was reported to be correlated .81 with the Paragraph and Word Reading subtest of the New Stanford Achievement Test; and the Arithmetic subtest correlated .91 with the Arithmetic Computation subtest of the New Stanford Achievement Test.

The 1963 edition of the WRAT,[7] which was the version used in the survey, was changed from the 1946 edition in two important aspects. The test was divided into two levels—Level I for ages 5-11, inclusive of the age range covered in this survey, and Level II for ages 12 years and over. The number of items at each level was also increased and the reliabilities of the subtests were thereby presumably increased. No adequate validity data were available for the new revision of the WRAT at the time that the second cycle of this survey was initiated. For this reason a special validation study was undertaken by Dr. K. Warner Schaie of West Virginia University under contract with the National Center for Health Statistics. The findings from this study have been published and will therefore be summarized only briefly here.[8]

In the validation study, Level I of the WRAT was administered to a total of 342 boys and 341 girls in the Monongalia County, W. Va. schools approximately equally distributed over grades 1 through 6. To reduce any bias from regional peculiarities a second sample composed of 317 boys and 310 girls was drawn from three other areas. Grades 1 and 4 for the second sample were obtained in Milwaukee County, Wis.; grades 2 and 5 in Los Angeles County, Calif.; and grades 3 and 6 in Fort Collins, Colo. The basic questions raised in the validation study concerned the validity of the WRAT as a brief measure of school achievement and its adequacy for accurately predicting actual grade placement and estimating school performance as it could be measured by standard comprehensive school achievement tests.

The results of the validation study showed that Level I of the revised WRAT has reasonably good concurrent validity as judged by the correlation of WRAT scores with those from the appropriate subtests of the Stanford Achievement Test. Although considerable variation occurred in the validity coefficients throughout the various grade levels and geographic regions of samples—these coefficients ranged from .41 to .87 for the Reading subtest and .49 to .78 for the Arithmetic— there was sufficiently high correlation with the criterion measures at every age level to suggest that the WRAT is indeed a satisfactory brief estimate of school achievement. The adequacy of the WRAT was also investigated at extreme levels of ability. Here it was found that Level I maintains its status as an adequate test of school achievement for both high and low ability students.

As an estimator of actual grade placement, however, the WRAT was found to vary from being in quite satisfactory agreement to differing considerably, depending upon the criterion used for comparison. Level I of both the Reading and Arithmetic parts of the WRAT was found to overestimate actual grade level as well as achievement in comparison with those from the Stanford Achievement Test (SAT), which was used as a criterion measure in the validation study. The tendency for the WRAT to overestimate in comparison with the SAT was particularly marked for the Reading section, and since this was observed in each of the various regional samples, it cannot be lightly dismissed as being due to geographic peculiarities. As a consequence of these studies it was recommended that restandardization and provision of revised grade placement equivalents on the basis of the Health Examination Survey data be provided.

FIELD ADMINISTRATION AND QUALITY CONTROL

Testing Procedures

The Reading and Arithmetic subtests of the Wide Range Achievement Test were given in the Health Examination Survey in accordance with the Manual of Instructions for the 1963 revised edition of the test,[7] with certain modifications, to insure uniformity of testing, as indicated below.

All testing was done by psychologists who had been trained at least at the level of the master's degree and who had previous experience in administering tests to children. There were two psychologists on the examining team at all times, usually a man and a woman. A total of 25 different field psychologists participated in administering the tests during the cycle. Additional training in the standard procedures developed for this part of the examination was given each examiner prior to the start of the testing, to assure uniform administration of the test battery to all examinees throughout the cycle.

Only Level I tests were used since the examinees ranged from 6-11 years at the time of interview. In a few instances children who were nearly 12 years old at the time of interview had reached their 12th birthday by the time of the examination. Level II was administered to part of this group. These results were used only to estimate the scores they would have been expected to attain on Level I (see appendix I). The WRAT subtests were given as the fourth and fifth parts of the battery following the Vocabulary and Block Design subtests from the Wechsler Intelligence Scale for Children.

The Arithmetic subtest, composed of an oral and written part, was given first. Starting with the written problems for any child under 8 years of age the first problem was pointed to and he was asked to "Read this." If the problem including the signs was read correctly he was asked the answer and shown where to write it. Then he was asked:

> "Now read this (pointing to the second problem) and put the answer on that line (pointing). Now read this (pointing to the third problem) and put the answer under the line. Then read all the problems in this row (pointing) and write your answer on or under the lines."

If the child was unable to read the first problem, the written part was discontinued and only the oral part administered.

For children 8 years and older, the following instructions were used, pointing to the written part:

> "Look at the problems printed below the heavy black line, I'd like to know how many of these problems you can figure out. Look at each one carefully to see what you're supposed to do—add, subtract, multiply or divide, and write your answers on or under the lines. You may do your figuring right on the paper in the empty spaces. You may skip the problems that are too hard for you, but do as many as you can. You have 10 minutes. Begin now."

Any child obtaining a score of less than 7 points on the written part was given the oral parts of the subtests. If his score on the written part was 7 or more he was given the 20-point credit for the oral parts.

The Reading subtest, composed of a reading and prereading part, is primarily a reading test not a test of speech or diction. Hence, when recognized, unusual pronunciations due to colloquialism, foreign accent, or defective articulation were accepted as correct. Misreading due to improper sequence of letter sounds, use of erroneous phonetic values, or misplaced accent was considered to be an incorrect answer.

Two copies of the test were used—a laminated version from which the examinee read and the completed test form from the examination record on which the examiner recorded.

Starting with the reading part, the examiner pointed to the first word and said:

> "Look at each word carefully and say it aloud. Begin here and read the words across the page so I can hear you. When you finish the first line, go on to the next."

In the case of young children, under 8 years of age, each word was pointed to with a pencil while the child attempted to read.

Ten seconds were allowed per word and a stop watch used. Any clear-cut response was accepted and scored as either right or wrong. The first time an error was made, the child was asked to say the word again and the time limit for that word extended another 10 seconds. The response was scored right, if the child corrected himself on the second trial. It was scored wrong if incorrect the second time also. From then on, the first response was scored as either right or wrong, unless the examinee spontaneously corrected the error he had made.

If the response was not clear, the examiner asked the child to repeat the word but did not attempt to teach, coach, question, or give any evidence of dissatisfaction with the answers. The examiner controlled the speed of reading by saying "next" or "go on to the next word" at the end of the time limit. If at the end of the time limit the child was about to say the word, he was given a chance to say it even though the time went slightly beyond 10 seconds. He was, however, not given credit for words pronounced after the 10 seconds. If the child hesitated or said he did not know the word, he was encouraged to try the word or "take a guess at it."

The examiner recorded the child's performance by underlining the first letter of the word if pronounced correctly. The first letter of words mispronounced was crossed off with a diagonal line. If the child first mispronounced and then correctly pronounced the word, the first letter was crossed out and the second underlined.

It is general practice in such tests—in order to reduce fatigue, limit administration time, and get a better assessment of achievement—to give automatic credit for an elementary section to those children who could answer at least some of the more difficult items. Additional credit thus obtained on the more difficult items would tend to more than compensate for the few chance errors that might have been incurred in the easier items had they been given.

Testing was discontinued after 12 consecutive failures. When failures occurred in the first line the examinee continued to read until he had 12 consecutive failures, then the three prereading parts of the subtest were administered, allowing 10 seconds per part. Any child scoring less than 10 points was also given the first and third of the prereading parts. Credit for the 15 points possible for these two prereading parts was automatically given if the child scored 10 points or more on the reading part.

Quality Control

For the entire psychological test battery, uniformity of testing techniques and instructions as well as the recording and scoring was maintained at a high level throughout the cycle. Prior to their testing, examiners were thoroughly trained by the Psychological Advisor in the special standard procedures to be used. They were required to memorize the testing instructions. A thorough review of testing practices was also given by the Psychological Advisor during the "dry runs" immediately preceding the start of each stand of examinations and on other occasions during the cycle as needed.

The two field psychologists at a particular examination location daily exchanged all test forms and checked each other's test for any apparent errors in administration or mistakes in recording.

An entire testing session was taped by each of the field psychologists one day during each week of testing. The transcription of the taped session was reviewed by headquarters staff—the Supervising Field Psychologist or the Psychological Advisor—who noted errors, commented on testing procedures as required, and then returned the tapes with comments to the examiners for study.

All test forms were immediately checked when they arrived at headquarters following the completion of the total round of examinations at any given location.

FINDINGS

Reading Subtest—Raw Scores

On the Reading subtest of the Wide Range Achievement Test children 6-11 years of age in the noninstitutional population of the United States attained a mean raw score of 51.5 out

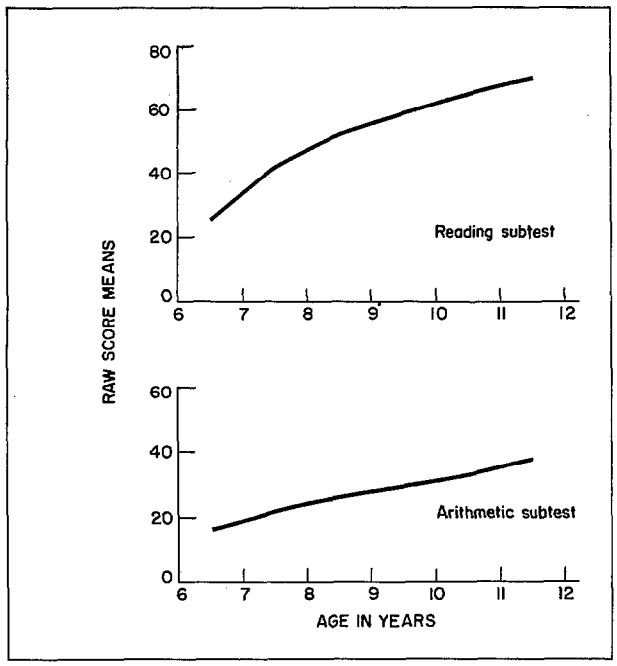

Figure 1. Average raw scores on the Reading and Arithmetic subtests of the Wide Range Achievement Test for children, 6-11 years, by age: United States.

of the possible 100 points in the test (table 1). Fifty percent of these children scored between 37 and 67 points, 90 percent between 16 and 83 points, and 98 percent between 9 and 90 points (tables 2 and 3).

The mean reading score increased with age, but at a decreasing rate throughout the age range, from 25.7 points at 6 years to 69.4 points at 11 years (fig. 1 and table 1). The variability, as indicated by the range within the selected percentages shown above, did not change consistently with age.

Boys averaged 2 to 4 points lower than girls as a group and did so consistently at each age level. Consistent sex differences also occurred at all but the extreme grade levels—kindergarten, fifth, and sixth grades (table 1, figs. 2 and 3). However, only at the second and third grade levels were the differences large enough to be statistically significant. Variability was consistently greater among boys than girls from 7 to 11 years of age but about the same for the 6-year-olds. At age 9 years the difference, however, was insignificant.

Considerable progress would be expected in reading skill (as used here pronunciation and word recognition) with the amount of formal education received. As indicated in table 1 and figure 4 a steady increase was found in mean score with grade level from kindergarten through seventh grade (from 19.4 to 76.7 points)—the range of grades for the examined children. From the first grade on, however, the average score generally tended to increase with grade level at a decreasing rate. Except for the first and second grade, the highest mean score was obtained by children at the modal age for a given grade. With the exceptions stated above, the children who were younger or older than the modal age did less well. The decrement for children above the modal age can be explained by the fact that older children in a given grade are likely to be those who repeat one or more grades due to low ability.

The situation is more complicated in the case of the first and second grade where chil-

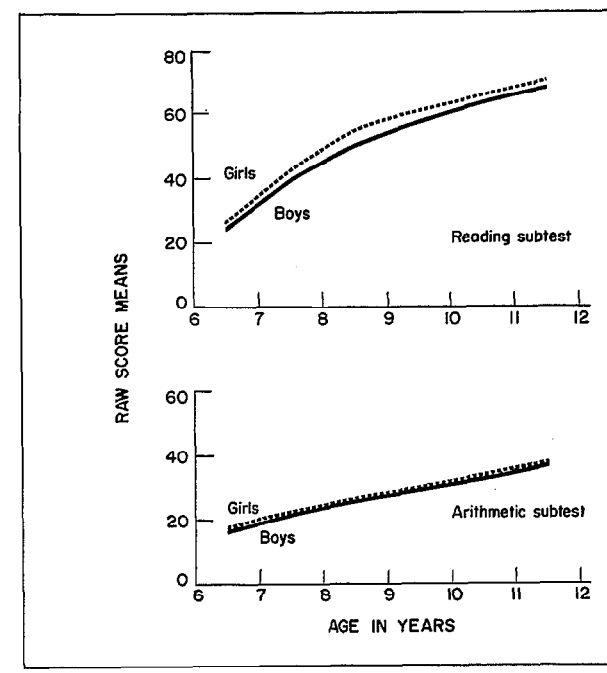

Figure 2. Average raw scores on the Reading and Arithmetic subtests of the Wide Range Achievement Test for boys and girls, 6-11 years, by age: United States.

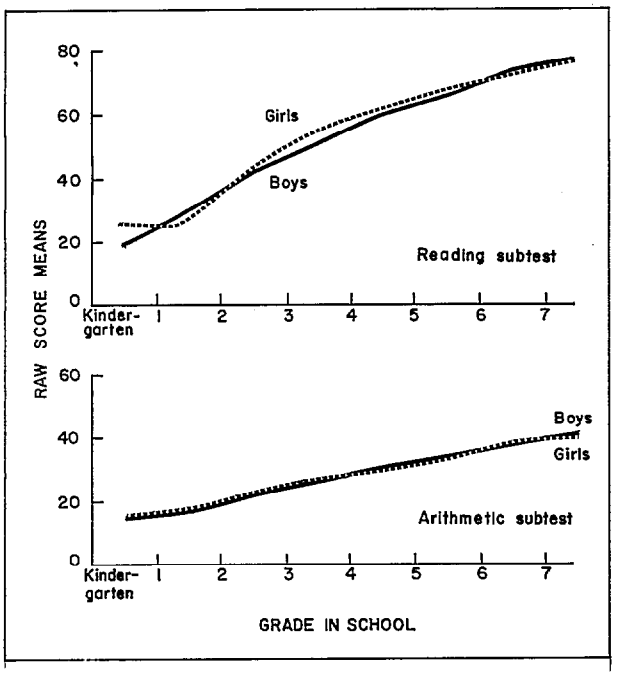

Figure 3. Average raw scores on the Reading and Arithmetic subtests of the Wide Range Achievement Test for boys and girls, 6-11 years, by grade in school: United States.

dren of the next age level above the modal age in that grade in each instance scored highest. Two complications may account for these findings. The first is related to an unavoidable artifact; i.e., the average age of children examined toward the end of the school year will be closer to the age next above the modal age for that school year. Thus first graders tested at age 7 include a disproportionate number of children tested at the end of the school year. These children (at least in the many areas without kindergarten) had completed their first educational exposure while most 6-year-old children tested in the same grade had on the average just begun their education. A second contribution to the above finding is the fact that many children who miss school entry by a month or two are likely to be placed in private school settings. Such children will enter the first grade with some educational advantage over their peers. The effects of these two factors would begin to be dissipated in subsequent grades, as seems consistent with the present data.

The children who were found to be in special classes that were ungraded had a raw score mean of 32 points which was slightly above that obtained by the first graders. These special classes included the physically as well as the mentally handicapped children who were living outside of institutions.

No consistent pattern of increasing or decreasing variability with grade level is evident, although the kindergarten group had a wider range of scores between the 99th and 1st percentiles than did those in the other grades (table 3). The ungraded group showed an even greater variability in this respect than did those in kindergarten.

Arithmetic Subtest—Raw Scores

Children 6-11 years of age in the noninstitutionalized population of the United States had a mean of 27.3 points out of a possible 63 points on the Arithmetic subtest of the Wide

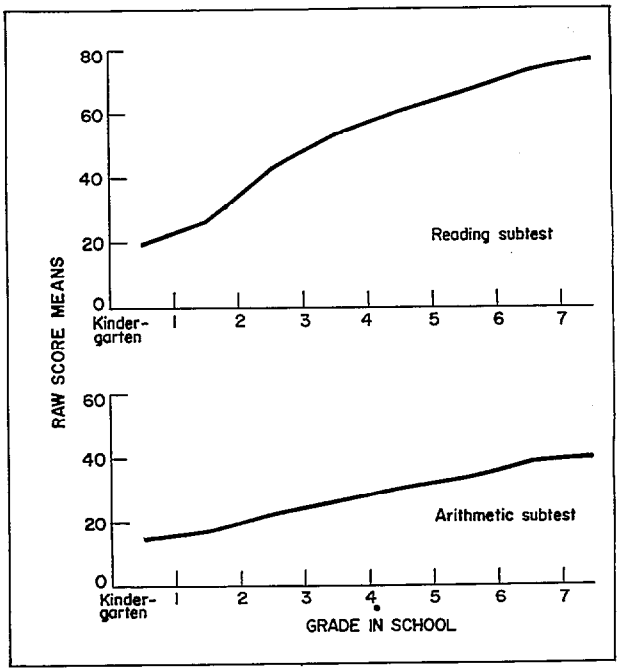

Figure 4. Average raw scores on the Reading and Arithmetic subtests of the Wide Range Achievement Test for children, 6-11 years, by grade in school: United States.

Range Achievement Test, as estimated from the Health Examination Survey in 1963-65 (table 4). Fifty percent of the children scored between 22 and 33 points, 90 percent scored between 14 and 43 points (a range of 29 points), while 98 percent scored between 7 and 49 points—a range of 42 points (tables 5 and 6).

As for the Reading subtest, the mean score on the Arithmetic subtest increased with age, but with a more constant increment from age 7 years on (fig. 1 and table 4). The variability in scores for the Arithmetic subtest as measured by the ranges indicated above was slightly greater for the two oldest age groups (table 5).

The mean scores obtained by the boys were only negligibly lower, by less than 1 point, than those for girls throughout the age range. From age 9 years on boys were slightly more variable in the scores attained on the Arithmetic subtest than were girls and for both the two oldest age groups—10 and 11 years—showed the most variability (tables 5 and 6 and fig. 2).

A steady increase in mean scores may be seen throughout the grade range as computational skill is acquired. The rate of increase is slower up to the third grade than that shown for the Reading subtest even when the difference in the length of the two subtests is considered (table 4 and fig. 4). Variability was slightly greater at both extremes of the grade distribution (table 6).

In the lower grades—kindergarten through third grade—girls obtained negligibly higher scores than did boys. From the fourth grade on no consistent pattern of sex differences could be ascertained (table 4 and fig. 3).

The survey design artifact leads to a disproportionate number of children in the age level just above the modal age tending to be tested at the end of the school year. This is apparent in the age within grade data reported for the Arithmetic subtest among first graders where the highest mean is obtained for the age group just above the modal age for both boys and girls. From second grade on differences between mean scores at the modal age and those a year older become insignificant except for boys in the second grade and girls in the third.

Grade Equivalents

The increase in reading and arithmetic skills with grade, as measured by the WRAT, is clearly evident. The degree of linear association or correlation between grade level and the reading test is .75 and for the Arithmetic test it is even higher, .87. A convenient way of expressing this growth in terms of the academic progress shown in these skills with grade employs the concept of grade equivalents. Grade equivalents are usually expressed in terms of the grade and fractional parts of the grade in which the typical student obtains the corresponding raw score, or, in other words, the average raw score obtained within the specified grade subdivision.

Testing in the Health Examination Survey was done throughout the year. It was assumed, therefore, that children tested during the summer would be at the same grade level which they would enter in the fall. During the school year, time in grade was divided into approximately one-half month intervals for computational purposes. In the tables, however, time in grade is shown rounded to the nearest month.

It was found that reading and arithmetic skills are roughly normally distributed, as shown in the following section, and it was assumed, in the absence of a clear-cut pattern to the contrary for both subtests, that their association with grade is essentially linear—i.e., a constant increase in skill with grade. The linear regression of grades on raw scores was therefore determined and the theoretical mean raw score from this line for each grade subdivision was obtained. Grade equivalents for raw scores based upon the total sample of boys and girls combined are shown for the Reading and Arithmetic subtests in tables 7 and 8 to the nearest one-tenth of a grade.

The actual mean scores attained at each month of the school year, of course, are scattered to some extent around these linear regression lines fitted by the method of least squares, as shown in figures 5 and 6. The scatter is greater for Reading than Arithmetic average scores, as would be expected since the degree of linear association with grade for

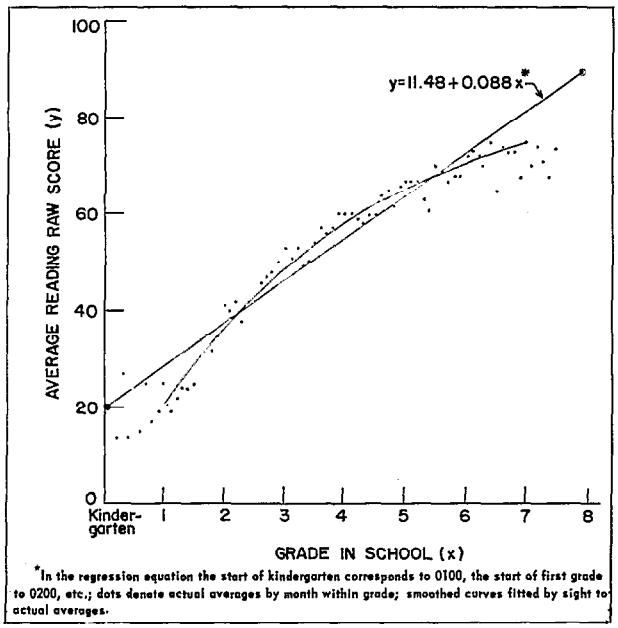

Figure 5. Average raw Reading scores attained by month-within-grade and the fitted linear regression line of raw score on grade for children, 6-11 years: United States.

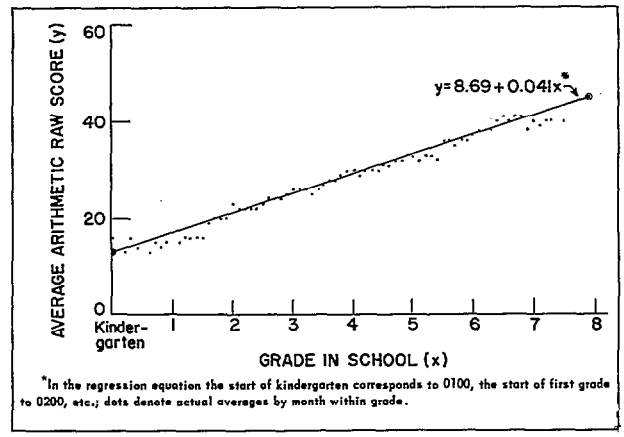

Figure 6. Average raw Arithmetic scores attained by month-within-grade and the fitted linear regression line of raw score on grade for children, 6-11 years: United States.

the latter is higher. This linear regression line appears to adequately express the increase in Arithmetic scores with grade. However, for the Reading subtest a better fit to the average raw scores is obtained by the smoothed curve which has been, for convenience, here roughly fitted by sight (fig. 5 and table 7). There appears to be an accelerating increase in this skill in the lower grades and a slowing of the rate of increase in the upper grade levels. Since only 6-year-olds in kindergarten and 11-year-olds in seventh grade were tested, children in these two grades are not representative of what would be expected from the whole of these two respective grades.

Standard Scores

Direct comparison of the two subtests with each other or with other measures of academic achievement may be misleading if based on either grade equivalents or percentile ranks of raw scores, because both will reflect the length of these tests, or more precisely the range of test scores obtained. Moreover, it is not necessarily reasonable to assume that standing on various measures of achievement should show equal growth patterns. While the national survey would be expected to yield score distributions for the entire range of the tests, it does not follow at all that completely similar distributions of scores would occur for each age subsample. Indeed, the range of items attempted would be expected to increase over successive ages in the range covered.

For these reasons, the raw scores were also converted separately into standard scores for each subtest for each half-year age interval represented in the national survey sample. Half-year rather than yearly intervals were used to better reflect any uneven growth pattern in school achievement during the year. To permit comparison between the two subtests and between them and other instruments used in educational settings, all scores were standardized with a mean of 100 and a standard deviation of 15 (see appendix II). It should be noted that all standard scores reported in table 9 for the Reading subtest and in table 10 for the Arithmetic subtest were computed on the basis of the actually obtained national estimates of means and standard deviations for the age groups in the survey as shown in table A.

It has been generally assumed that the academic skills measured by these subtests are normally distributed in the population. Since this is the first time that these test scores have been obtained on such a highly representative sample of the child population of the United States, it is of interest to test this hypothesis. An approximate chi-square test of the goodness of fit to the normal distribution of the actual distributions of standard scores obtained in this survey was done for all children and for boys and girls at single years of age (tables 11 and 12). Each of the distributions was found to be essentially normal. Deviations of the magnitude observed were small enough to be easily due to chance alone. None were significant at the 5-percent probability level. The most deviant distributions were for 7-year-olds on the Arithmetic subtest and 6-year-olds on the Reading subtest.

Table A. Means and standard deviations on the Reading and Arithmetic subtests of the Wide Range Achievement Test for Jastak's standardization group[1] and estimates for the United States among children 6-11 years of age, 1963-65

Age	Jastak's standardization group[1]			United States, 1963-65[2]	
	Number	Mean	Standard deviation	Mean	Standard deviation
Reading subtest					
72-77 months	340	24.08	10.43	21.32	10.43
78-83 months	327	32.25	10.72	29.94	12.14
84-89 months	358	39.85	12.30	38.03	12.90
90-95 months	389	46.83	12.40	44.77	13.12
96-101 months	367	51.48	12.68	50.53	13.99
102-107 months	357	54.17	13.04	53.99	12.64
108-113 months	341	57.40	13.07	57.46	13.58
114-119 months	328	61.16	13.37	59.72	14.34
120-125 months	330	63.18	13.44	63.55	14.27
126-131 months	325	66.60	13.39	65.03	14.67
132-137 months	299	68.48	13.35	67.89	14.30
138-143 months	286	70.35	13.28	70.67	14.01
Arithmetic subtest					
72-77 months	331	17.14	4.70	15.26	4.57
78-83 months	301	19.32	4.74	18.43	4.72
84-89 months	337	22.16	4.62	20.74	4.70
90-95 months	357	24.97	4.68	23.39	4.07
96-101 months	332	27.03	4.51	25.14	4.23
102-107 months	334	28.50	4.42	27.06	3.96
108-113 months	321	29.95	4.43	28.82	4.32
114-119 months	296	31.93	4.80	30.08	4.61
120-125 months	306	33.72	5.77	31.80	5.14
126-131 months	301	37.03	6.27	33.99	5.81
132-137 months	285	39.48	6.50	36.17	6.61
138-143 months	271	41.72	6.58	38.58	7.16

[1]Jastak, J.F., and Jastak, S.R.: WRAT Manual. The Wide Range Achievement Test. Wilmington, Del. Guidance Associates, 1965.

[2]Estimates of means and standard deviations for the United States are based on the inflated sample. See appendix II for a further explanation and for the number of examinees on which these findings are based.

As might have been expected, distributions of observed scores by age are skewed slightly positively (upward) for the younger and skewed slightly negatively (downward) for the older children in the Reading subtest. This pattern (skewing) is, however, not found for the Arithmetic subtest.

Standard score tables would permit use of actually computed standard scores (tables 9 and 10) for within age comparisons. For across age comparisons with time, however, care needs to be taken in interpreting them since the distribution of such scores by age does differ slightly. At particularly the extremes of the distribution a change in standing for a given child with age might be inferred even though his relative position to his age peers had not actually shifted. Use of the normalized data in tables 11 and 12, in this instance, would avoid such erroneous inference.

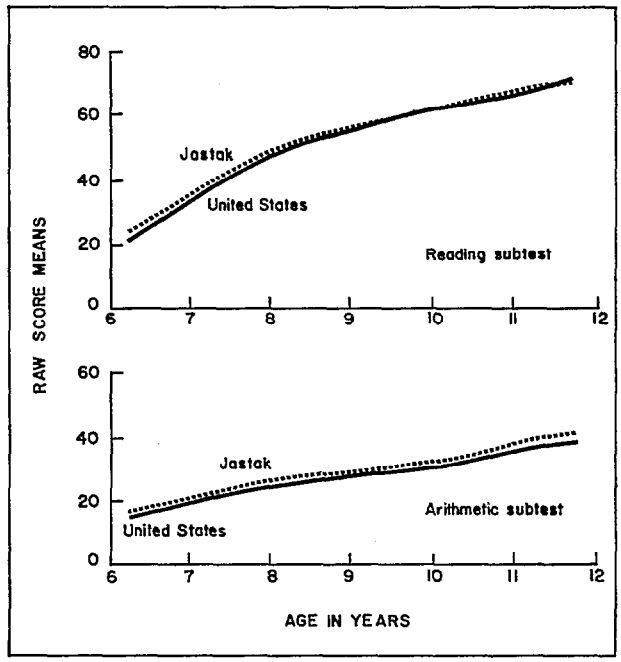

Figure 7. Averages on the Reading and Arithmetic subtests of the Wide Range Achievement Test for Jastak's standardization group (1965) and estimates for the United States among children, 6-11 years, 1963-65.

Comparison With Standardization Data

The sample used in the Health Examination Survey as indicated previously, is a highly representative probability sample of the noninstitutional population of the United States from 6-11 years of age. It is of interest then to compare the results obtained from this survey with the data available for the group on which Jastak standardized the Revised (1963) Wide Range Achievement Test. It should be noted, however, that the sample of the Health Examination Survey on which the United States estimates are based was nearly twice as large at each 6 months age interval as the corresponding sample used for the standardization study (table A and appendix II).

As indicated in table A and figure 7, the average raw scores attained from the Health Examination Survey on the Reading subtest tended to be slightly lower than those from the standardization group. These differences, however, were statistically significant at the 5-percent level only for the 6- and 6½-year-olds. From 7 years on, differences were negligible and not statistically significant.

On the Arithmetic subtest a different situation was found. Here, national estimates from the Health Examination Survey also averaged consistently lower than those obtained for the standardization group. Mean differences were significant at the 5-percent level of significance for all ages except the 6½-, 7-, and 9-year-old children.

Children in the Health Examination Survey tended, except at 6 and 8½ years of age, to be more variable in reading skills than was Jastak's standardization group (fig. 8). They tended to be somewhat less variable on the Arithmetic subtest, though not consistently so throughout the age range.

Comparison of the ratings of school achievement in terms of grade equivalents as determined from the average raw scores obtained by children throughout the United States at each grade subdivision (month-within-grade) in the present study with those norms published on Jastak's 1963 edition of the WRAT test form showed distinct differences for both subtests.

On the Reading subtest Jastak's 1963 norms are higher at the extremes of the grades (first

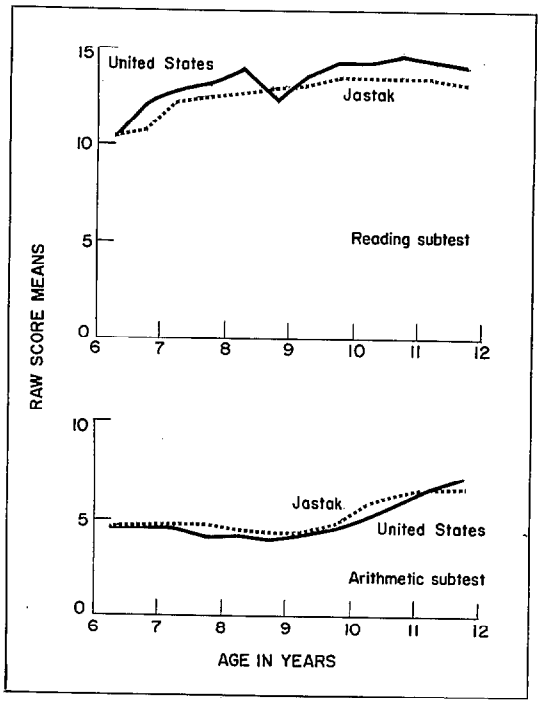

Figure 8. Standard deviations on the Reading and Arithmetic subtests of the Wide Range Achievement Test for Jastak's standardization group (1965) and estimates for the United States among children, 6-11 years, 1963-65.

grade and midfifth grade on) and lower from the second through the midfourth grade than the linear regression values obtained in the present study. Better agreement is seen between the published norms and the smoothed averages from the present study. On this basis Jastak's 1963 norms are at the most lower by 2 to 3 months in second grade and higher by a similar amount in sixth grade (fig. 5, appendix I, and table 7).

For the Arithmetic subtest Jastak's 1963 norms are 2 to 5 months higher during kindergarten than those obtained from the linear regression values (or the actual averages) obtained in the present study and are consistently lower from second grade on, with differences ranging from 1 to 5 months (fig. 6, appendix I, and table 8). The differences at the kindergarten level undoubtedly reflect the fact that the 6-year-olds from the present study who were in the kindergarten cannot be considered representative of children in that grade, the majority of whom would be a year younger. The children in the present study from first through sixth grade, however, should be a good representative sample of children in those respective grades.

Combined Scores

The WRAT was included in the Health Examination Survey as the measure designed to estimate school achievement. Therefore data are also shown here for the combined Reading and Arithmetic scores. Direct combination of raw scores is, of course, not possible because of the unequal length of the two subtests. Combination was therefore made on the basis of the sum of the standard scores for the two subtests restandardized within 6-month age intervals setting the mean at 100 and the standard deviation at 15 as was done for the individual subtests (see appendix II). The resulting scores, having been thus standardized within the age groups, do not permit evaluation of age trends for the combined scores. Nevertheless, data in tables 13-15 of this report permit assessment of relative standing and grade placement of children on the basis of the combined Reading and Arithmetic scores.

Table 13 provides the necessary information to obtain a combined standard score estimating school achievement for children within each 6-month age interval. To use this table the standard scores for Reading and Arithmetic are summed and the sum entered in the table.

Table 14 permits conversion of the combined standard score for Reading and Arithmetic into a grade level equivalent. The latter grade level estimate may be desired if the user does not wish to apply different relative weights for the importance of the Reading and/or Arithmetic grade levels and would rather use a combined grade level estimate. Note that the standard scores entered in table 13 are those obtained after entry into tables 11 and 12.

Percentile equivalents for the standard and normalized standard Reading and Arithmetic scores by age and sex are shown in table 15. As may be seen here the combined scores are even more nearly normally distributed than were those from either subtest.

Discussion and Summary

This report contains national estimates of school achievement for children 6-11 years of age in the noninstitutionalized population of the United States as determined from Reading and Arithmetic scores on the Wide Range Achievement Test obtained in the Health Examination Survey of 1963-65. In the survey a probability sample of 7,417 children was selected to represent the 24 million noninstitutionalized children in the United States 6-11 years of age. The total of 7,119 or 96 percent of the sample examined were found to be highly representative of children of this age in the United States.

These findings on school achievement have been presented by age, grade, and sex in their raw score form to permit comparison with other studies using the Wide Range Achievement Test. Grade equivalents, percentile ranks, and standard score equivalents of these raw scores are also included.

As has previously been indicated, the U.S. estimate of scores on the average as obtained in this study are lower than those found in the standardization data for both tests, significantly so for most ages on the Arithmetic subtest. In general slightly greater variability in scores was found on the Reading but not Arithmetic subtest for the U.S. children from the present study than was found in Jastak's standardization group. Both the Health Examination Survey data and Jastak's data were collected evenly over the entire year, so the differences in time of year at which the data were collected cannot account for the discrepancy.

School achievement on the Arithmetic subtest, as measured by grade equivalents of raw scores obtained for the U.S. child population represented in this study, is consistently higher than that shown in Jastak's 1963 norms from second grade on. For the Reading subtest Jastak's 1963 norms are in somewhat better agreement but are lower at the second grade and higher at the sixth than those obtained in the present study when compared with average raw scores (smoothed) obtained at the various months-within-grade from the present study.

REFERENCES

[1]National Center for Health Statistics: Origin, program, and operation of the U.S. National Health Survey. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 1-No. 1. Public Health Service. Washington. U.S. Government Printing Office, Aug. 1963.

[2]National Center for Health Statistics: Plan and initial program of the Health Examination Survey. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 1-No. 4. Public Health Service. Washington. U.S. Government Printing Office, July 1965.

[3]National Center for Health Statistics: Cycle I of the Health Examination Survey, sample and response, United States, 1960-1962. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 11-No. 1. Public Health Service. Washington. U.S. Government Printing Office, Apr. 1964.

[4]National Center for Health Statistics: Plan, operation, and response results of a program of children's examinations. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 1-No. 5. Public Health Service. Washington. U.S. Government Printing Office, Oct. 1967.

[5]National Center for Health Statistics: Evaluation of psychological measures used in the Health Examination Survey of children ages 6-11. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 2-No. 15. Public Health Service. Washington. U.S. Government Printing Office, Mar. 1966.

[6]Jastak, J. F., and Bijou, S. W.: *The Wide Range Achievement Test*. Wilmington, Del. C. L. Story Co., 1946.

[7]Jastak, J. F.: *Wide Range Achievement Test*, rev. ed. Wilmington, Del. Guidance Associates, 1963.

[8]National Center for Health Statistics: A study of the achievement test used in the Health Examination Surveys of persons aged 6-17 years. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 2-No. 24. Public Health Service. Washington. U.S. Government Printing Office, June 1967.

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Table 1. Average reading raw scores on the Wide Range Achievement Test, for children, 6-11 years, by grade in school, sex, and age: United States, 1963-65

Sex and age	Total, all grades	Grade in school								
		Kinder-garten	1	2	3	4	5	6	7	Special class[1]
	Average raw score									
Both sexes										
Total, 6-11 years	51.5	19.4	26.2	42.7	53.4	60.7	66.5	73.0	76.7	32.0
6 years	25.7	19.4	24.9	39.3	-	-	-	-	-	23.1
7 years	41.4	*	30.6	43.3	53.4	-	-	-	-	28.7
8 years	52.3	-	29.0	45.1	54.6	60.4	-	-	-	24.3
9 years	58.6	-	*	34.8	51.9	62.0	66.0	-	-	31.7
10 years	64.3	-	*	*	46.8	59.2	68.0	71.4	*	33.2
11 years	69.4	-	-	*	*	53.5	62.5	73.3	76.8	43.6
Boys										
Total, 6-11 years	50.2	19.8	25.6	41.7	51.3	59.9	65.5	73.4	76.7	31.6
6 years	24.9	19.6	24.4	37.2	-	-	-	-	-	21.7
7 years	39.8	*	29.7	42.5	51.3	-	-	-	-	25.0
8 years	50.2	-	24.7	44.0	52.8	58.0	-	-	-	27.4
9 years	57.1	-	*	35.4	49.2	61.6	64.7	-	-	27.3
10 years	63.4	-	*	*	46.0	58.7	67.8	74.2	-	30.4
11 years	67.8	-	-	*	*	52.2	61.1	73.3	76.7	45.7
Girls										
Total, 6-11 years	53.0	19.1	26.9	43.7	55.6	61.5	67.4	72.6	76.7	32.8
6 years	26.5	19.1	25.5	41.1	-	-	-	-	-	23.8
7 years	43.0	-	31.6	44.1	54.9	-	-	-	-	41.1
8 years	54.4	-	35.6	46.3	56.2	62.2	-	-	-	20.0
9 years	60.2	-	*	33.2	55.5	62.4	67.4	-	-	36.4
10 years	65.2	-	-	*	46.9	59.6	68.2	68.7	*	37.4
11 years	70.9	-	-	*	*	54.3	64.6	73.3	76.8	36.1

[1]Ungraded.

Table 2. Percentile equivalents of raw scores[1] on the Reading subtest of the Wide Range Achievement Test, for children, 6-11 years, by sex and age: United States, 1963-65

Sex and percentile	Total, 6-11 years	Age in years					
		6	7	8	9	10	11
Both sexes	Raw score						
99	90	65	72	83	86	91	93
98	87	58	69	78	83	88	92
97	85	54	66	77	82	86	91
96	84	51	65	74	81	85	90
95	83	49	64	73	80	85	90
90	78	42	59	69	76	82	87
85	74	38	56	66	74	79	85
80	70	35	54	64	71	77	82
75	67	32	51	62	68	75	81
70	64	30	49	60	66	74	79
65	62	28	47	59	65	72	77
60	59	27	45	57	63	70	75
55	57	26	43	56	62	68	73
50	54	25	41	54	60	67	72
45	52	24	40	52	59	65	70
40	48	22	39	50	57	63	67
35	44	21	37	48	55	60	65
30	41	19	36	46	53	58	63
25	37	17	34	44	51	56	60
20	33	16	32	41	48	54	58
15	28	14	29	39	45	50	55
10	23	12	25	35	40	46	52
5	16	10	18	30	34	40	45
4	15	9	16	28	32	37	43
3	13	8	14	25	30	34	38
2	12	7	13	22	27	30	36
1	9	5	10	16	16	20	28
Boys							
99	90	65	73	83	85	91	93
98	88	56	66	77	83	88	92
97	86	52	65	76	82	86	91
96	84	49	64	74	81	85	91
95	83	48	62	72	81	85	90
90	77	42	58	68	76	82	88
85	73	38	55	65	73	78	86
80	69	35	52	63	70	76	82
75	66	32	50	61	66	74	80
70	63	29	47	59	65	73	78
65	60	28	45	57	64	71	76
60	58	26	43	56	62	70	74
55	55	25	41	54	60	68	72

See footnote at end of table.

Table 2. Percentile equivalents of raw scores[1] on the Reading subtest of the Wide Range Achievement Test, for children, 6-11 years, by sex and age: United States, 1963-65—Con.

Sex and percentile	Total, 6-11 years	Age in years					
		6	7	8	9	10	11
Boys—Con.	Raw score						
50	52	24	40	51	58	66	70
45	49	23	39	49	57	64	68
40	46	21	37	47	55	63	66
35	42	20	35	44	53	60	63
30	39	18	34	43	51	58	61
25	36	16	32	41	49	55	58
20	32	15	30	39	47	52	56
15	27	13	27	37	42	48	52
10	22	12	22	32	38	44	48
5	15	10	16	27	33	37	38
4	14	9	14	26	31	35	37
3	13	8	13	23	28	34	35
2	11	7	12	20	24	30	33
1	9	6	4	15	16	17	22
Girls							
99	90	66	72	83	86	90	93
98	86	59	70	78	83	87	92
97	85	54	68	76	82	86	91
96	84	53	66	74	81	85	90
95	83	51	65	73	80	85	89
90	78	44	59	70	77	82	86
85	74	39	57	68	74	79	84
80	71	35	55	65	72	78	82
75	68	32	53	63	70	76	81
70	66	30	51	62	68	74	79
65	63	29	49	60	66	72	78
60	60	28	47	59	65	71	76
55	58	26	44	58	63	69	75
50	56	26	43	56	62	67	73
45	53	25	41	55	60	65	71
40	51	23	40	53	59	63	69
35	47	22	39	52	58	61	67
30	43	20	37	50	56	59	65
25	40	18	36	48	53	57	63
20	35	17	34	45	51	55	60
15	29	15	31	42	48	52	58
10	25	13	28	39	43	49	54
5	18	10	21	32	38	43	52
4	16	10	20	31	36	41	51
3	14	9	17	29	32	37	48
2	12	8	14	24	30	31	46
1	10	5	12	21	18	21	39

[1]Score below which the given percentage of the population falls.

Table 3. Percentile equivalents of raw scores[1] on the Reading subtest of the Wide Range Achievement Test, for children, 6-11 years, by grade in school and sex: United States, 1963-65

Sex and percentile	Grade in school									
	Kindergarten	1	2	3	4	5	6	7	Special class[2]	Unknown
	Raw score									
Both sexes										
99	65	62	72	82	85	91	93	98	84	42
98	52	54	69	78	83	88	92	95	66	20
97	52	52	66	76	82	86	91	94	62	19
96	51	49	64	75	82	86	90	93	60	19
95	47	48	63	74	81	85	90	92	55	19
90	26	41	59	69	76	82	87	90	51	18
85	26	38	56	66	73	79	85	88	48	16
80	25	34	54	64	71	77	84	86	46	15
75	25	32	52	62	68	75	82	85	44	15
70	23	31	49	60	66	74	81	84	42	14
65	22	29	47	59	65	72	79	82	39	12
60	20	28	45	57	64	71	78	80	37	11
55	20	27	43	56	62	69	76	79	35	10
50	19	26	42	54	61	68	75	78	33	10
45	17	25	41	53	60	66	73	77	31	9
40	16	24	40	51	58	64	72	75	29	8
35	15	22	38	49	57	63	70	74	28	8
30	14	20	37	47	56	60	68	72	23	7
25	13	19	36	45	54	59	66	71	21	7
20	12	17	34	43	52	57	64	69	18	6
15	11	15	32	41	50	55	62	66	16	5
10	10	13	29	39	47	52	59	63	11	4
5	7	11	24	35	42	47	53	59	2	2
4	6	11	22	33	41	45	52	58	1	1
3	5	10	21	32	39	43	51	56	1	1
2	5	9	18	30	37	40	47	52	0	1
1	1	7	14	27	35	35	44	50	0	0
Boys										
99	66	59	73	80	86	92	94	95	89	43
98	65	53	69	77	84	88	92	93	84	42
97	65	51	66	76	82	87	92	93	66	42
96	52	48	64	75	82	86	91	92	65	20
95	52	47	63	72	81	84	90	92	61	20
90	46	41	59	67	76	81	88	91	52	16
85	26	38	56	65	73	78	87	89	49	16
80	25	34	53	63	70	76	85	88	45	15
75	25	32	50	61	68	74	83	87	42	14
70	23	30	47	59	66	73	82	86	38	13
65	21	28	46	57	65	72	80	85	37	11
60	19	27	44	55	63	70	78	82	36	10
55	17	26	42	53	62	68	76	80	34	10

See footnotes at end of table.

Table 3. Percentile equivalents of raw scores[1] on the Reading subtest of the Wide Range Achievement Test, for children, 6-11 years, by grade in school and sex: United States, 1963-65—Con.

Sex and percentile	Grade in school									
	Kinder-garten	1	2	3	4	5	6	7	Special class[2]	Un-known
Boys—Con.	Raw score									
50	16	25	41	51	60	67	75	78	33	9
45	15	24	40	50	58	65	73	76	30	8
40	15	23	38	48	57	64	72	75	28	8
35	14	21	37	46	56	62	70	73	27	7
30	13	20	36	44	54	60	68	71	23	7
25	12	18	34	42	53	58	66	70	21	6
20	11	16	33	41	51	56	64	67	17	6
15	10	15	31	39	48	54	62	65	15	5
10	8	13	28	36	46	50	58	61	10	2
5	6	11	23	33	40	45	52	57	1	1
4	6	11	21	31	38	44	51	56	1	1
3	6	10	19	30	37	40	49	51	1	0
2	5	10	16	28	36	36	47	50	0	0
1	5	8	14	23	34	33	44	40	0	0
Girls										
99	46	67	71	82	85	90	93	99	54	19
98	31	57	69	80	83	87	91	96	54	19
97	30	54	66	77	82	86	91	94	52	19
96	27	50	65	76	81	86	90	93	52	18
95	27	48	64	74	80	85	90	92	51	18
90	26	41	59	70	76	82	86	88	49	18
85	26	38	56	67	73	80	84	86	48	17
80	25	35	54	65	71	78	83	85	46	16
75	25	33	52	64	69	76	82	84	45	16
70	24	31	51	62	67	75	80	83	44	15
65	23	30	49	60	66	73	78	81	42	14
60	21	28	47	59	64	71	77	80	42	12
55	20	28	44	57	62	70	76	79	40	11
50	20	26	43	56	61	69	75	78	36	11
45	19	26	42	55	60	68	73	77	32	10
40	19	25	41	54	59	66	72	76	30	9
35	18	23	40	52	58	64	70	74	29	8
30	17	21	38	50	57	62	68	73	23	8
25	15	20	37	49	55	60	66	72	21	7
20	14	18	35	46	53	58	64	70	20	7
15	12	16	33	44	52	56	61	66	18	5
10	11	14	30	42	49	54	59	63	18	4
5	10	11	25	39	46	51	54	60	6	3
4	10	11	24	37	44	48	52	60	6	3
3	2	10	22	36	43	45	52	59	5	2
2	1	9	20	32	40	44	48	56	1	2
1	1	6	15	29	36	40	20	52	0	2

[1]Score below which the given percentage of the population falls.

[2]Ungraded.

Table 4. Average raw arithmetic scores on the Wide Range Achievement Test, for children, 6-11 years, by grade in school, sex, and age: United States, 1963-65

Sex and age	Total, all grades	Grade in school								
		Kinder-garten	1	2	3	4	5	6	7	Special class[1]
	Average raw score									
Both sexes										
Total, 6-11 years	27.3	14.9	17.2	22.8	26.6	30.4	33.7	38.4	39.9	19.0
6 years	16.9	14.9	16.8	21.5	-	-	-	-	-	14.1
7 years	22.1	*	18.5	22.9	25.3	-	-	-	-	17.6
8 years	26.1	-	19.0	23.7	26.7	29.7	-	-	-	14.3
9 years	29.5	-	*	21.5	27.1	30.7	32.7	-	-	19.3
10 years	32.9	-	*	*	26.8	30.9	33.9	38.0	*	19.0
11 years	37.4	-	-	*	*	29.4	33.8	38.5	39.9	25.7
Boys										
Total, 6-11 years	27.0	14.8	17.1	22.7	26.4	30.5	33.8	38.2	40.7	19.0
6 years	16.7	14.7	16.6	21.5	-	-	-	-	-	13.7
7 years	21.7	*	18.6	22.8	25.1	-	-	-	-	15.6
8 years	25.9	-	17.7	23.8	26.6	29.5	-	-	-	16.6
9 years	29.2	-	*	21.1	26.4	30.7	32.8	-	-	17.8
10 years	32.6	-	*	*	26.8	30.9	34.0	38.0	-	17.5
11 years	37.0	-	-	*	*	29.1	33.7	38.3	40.7	26.6
Girls										
Total, 6-11 years	27.6	15.0	17.3	22.8	26.8	30.3	33.7	38.4	39.4	19.0
6 years	17.0	15.0	16.9	21.5	-	-	-	-	-	13.5
7 years	22.4	-	18.4	23.0	25.4	-	-	-	-	24.5
8 years	26.3	-	20.7	23.5	26.8	29.8	-	-	-	11.3
9 years	29.6	-	*	21.7	27.9	30.4	32.5	-	-	20.6
10 years	33.2	-	-	*	26.3	30.6	33.9	37.8	*	21.3
11 years	37.9	-	-	*	*	29.3	33.8	38.6	39.4	22.1

[1]Ungraded.

Table 5. Percentile equivalents of raw scores[1] on the Arithmetic subtest of the Wide Range Achievement Test, for children, 6-11 years, by sex and age: United States, 1963-65

Sex and percentile	Total, 6-11 years	Age in years					
		6	7	8	9	10	11
Both sexes	Raw score						
99	49	27	30	35	40	46	52
98	46	25	29	34	38	45	51
97	45	25	29	33	37	44	50
96	44	25	28	32	37	44	50
95	43	24	28	32	36	43	49
90	39	24	27	31	34	40	47
85	36	23	26	30	33	39	45
80	34	22	26	30	33	37	44
75	33	21	25	29	32	36	43
70	32	20	25	29	32	36	42
65	31	19	24	28	32	35	41
60	30	19	24	28	31	34	40
55	29	18	24	27	31	34	39
50	28	17	23	27	30	33	38
45	27	17	23	27	30	32	37
40	26	16	22	26	30	32	36
35	25	16	22	26	29	31	35
30	24	15	21	25	29	31	34
25	22	14	21	24	28	30	33
20	21	14	20	24	28	30	32
15	19	13	18	23	27	29	31
10	17	11	17	22	24	28	30
5	14	8	14	19	22	24	28
4	13	8	13	18	21	24	27
3	12	7	11	18	20	23	26
2	10	5	10	16	18	21	23
1	7	3	6	14	16	18	19
Boys							
99	49	27	30	36	43	46	52
98	46	25	29	34	39	45	51
97	45	25	29	33	38	44	50
96	44	25	28	32	37	44	50
95	43	24	28	32	37	43	49
90	39	24	27	31	34	41	47
85	36	23	26	30	34	39	45
80	34	22	26	30	33	38	44
75	32	21	25	29	32	36	43
70	31	20	25	28	32	36	41
65	30	19	24	28	31	34	40
60	30	19	24	28	31	34	39
55	29	18	24	27	30	33	38

See footnote at end of table.

Table 5. Percentile equivalents of raw scores[1] on the Arithmetic subtest of the Wide Range Achievement Test, for children, 6-11 years, by sex and age: United States, 1963-65—Con.

Sex and percentile	Total, 6-11 years	Age in years					
		6	7	8	9	10	11
Boys—Con.	Raw score						
50	28	17	23	27	30	33	37
45	26	17	23	26	30	32	36
40	25	16	22	26	29	32	35
35	24	16	22	25	29	31	34
30	23	15	21	25	28	31	33
25	22	14	20	24	28	30	32
20	21	13	20	24	27	30	32
15	19	12	18	22	25	29	31
10	16	11	16	22	24	27	29
5	13	8	13	19	21	24	27
4	12	8	12	18	20	23	26
3	11	7	10	17	19	22	25
2	10	5	8	16	18	20	22
1	7	3	5	14	16	13	18
Girls							
99	49	27	30	35	39	48	53
98	47	25	29	33	37	45	51
97	45	25	29	32	37	44	50
96	44	25	29	32	36	43	50
95	43	24	28	32	35	42	49
90	39	24	27	31	34	40	47
85	36	23	27	30	33	38	46
80	34	22	26	30	33	37	44
75	33	21	26	29	32	36	43
70	32	20	25	29	32	36	42
65	31	19	25	28	32	35	41
60	30	19	24	28	31	34	40
55	29	18	24	28	31	34	39
50	28	18	24	27	31	33	38
45	27	17	23	27	30	33	37
40	26	16	23	26	30	32	36
35	25	16	22	26	30	32	35
30	24	16	22	25	29	31	34
25	23	15	21	25	28	30	34
20	21	14	20	24	28	30	33
15	19	13	19	23	27	29	32
10	17	12	17	22	26	28	30
5	14	8	15	20	23	27	29
4	14	8	14	19	22	25	28
3	13	6	13	18	20	24	28
2	11	5	10	17	19	22	27
1	7	3	8	14	16	20	22

[1] Score below which the given percentage of the population falls.

Table 6. Percentile equivalents of raw scores[1] on the Arithmetic subtest of the Wide Range Achievement Test, for children, 6-11 years, by grade in school and sex: United States, 1963-65

Sex and percentile	Grade in school									
	Kinder-garten	1	2	3	4	5	6	7	Special class[2]	Un-known
	Raw score									
Both sexes										
99	29	27	30	35	41	47	52	56	43	23
98	23	26	30	33	38	45	51	54	33	16
97	22	25	29	32	37	44	50	53	32	16
96	22	25	29	32	36	43	50	53	31	16
95	21	25	28	32	36	42	49	52	31	15
90	20	24	27	31	34	40	47	50	29	15
85	18	22	26	30	34	39	46	49	27	14
80	18	22	26	30	33	38	45	47	26	14
75	18	21	25	29	32	37	44	46	25	13
70	17	20	25	29	32	36	43	45	24	12
65	17	20	25	28	32	35	42	44	23	11
60	17	19	24	28	31	35	41	44	22	10
55	16	18	24	28	31	34	40	43	22	10
50	16	18	24	27	31	34	39	42	21	10
45	15	17	23	27	30	33	38	42	20	9
40	15	17	23	26	30	33	37	41	19	8
35	14	16	22	26	30	32	37	40	17	7
30	14	16	22	26	30	32	36	40	16	5
25	13	15	22	25	29	31	35	38	14	4
20	13	14	21	24	29	31	34	38	13	3
15	12	13	20	24	28	30	33	36	9	2
10	11	12	19	23	28	29	32	35	6	1
5	8	9	16	22	26	28	31	34	2	1
4	8	8	16	21	26	28	30	34	1	0
3	5	8	15	21	25	27	30	33	1	0
2	4	6	14	20	24	27	30	32	1	0
1	2	5	12	18	22	25	28	32	0	0
Boys										
99	23	27	32	35	43	46	51	56	49	24
98	23	26	30	34	40	45	50	56	43	23
97	22	25	29	33	39	44	50	55	33	23
96	22	25	29	32	38	43	50	54	32	16
95	22	25	28	32	37	43	49	54	31	16
90	20	24	27	31	35	40	47	50	29	15
85	19	22	26	30	34	39	46	50	28	14
80	19	22	26	30	33	38	45	48	26	14
75	18	21	25	29	32	37	44	46	25	13
70	18	20	25	28	32	36	43	45	24	13
65	17	20	25	28	32	36	42	45	23	11
60	17	19	24	28	31	35	41	44	22	10
55	16	18	24	27	31	34	40	43	21	10

See footnotes at end of table.

Table 6. Percentile equivalents of raw scores[1] on the Arithmetic subtest of the Wide Range Achievement Test, for children, 6-11 years, by grade in school and sex: United States, 1963-65—Con.

Sex and percentile	Grade in school									
	Kindergarten	1	2	3	4	5	6	7	Special class[2]	Unknown
Boys--Con.	Raw score									
50	16	18	24	27	31	34	39	42	20	10
45	15	17	23	27	30	33	39	42	20	9
40	15	16	23	26	30	33	38	41	18	9
35	14	16	22	26	30	32	37	40	17	8
30	14	15	22	25	30	32	36	40	16	4
25	13	15	22	25	29	31	35	39	14	3
20	12	14	21	24	29	31	34	37	13	2
15	11	13	20	24	28	30	33	36	11	1
10	10	11	18	23	28	29	32	34	6	1
5	8	9	16	22	26	28	30	32	1	0
4	5	9	16	21	26	27	30	32	1	0
3	4	8	14	20	25	27	30	32	1	0
2	2	7	13	19	24	26	29	31	1	0
1	1	5	11	18	22	24	28	31	0	0
Girls										
99	30	28	30	34	38	48	52	54	32	16
98	29	26	29	33	37	45	51	53	31	16
97	20	25	29	32	36	44	50	52	31	16
96	20	25	29	32	36	43	50	51	31	16
95	20	25	28	32	36	42	49	50	30	15
90	18	24	27	31	34	40	47	49	28	15
85	18	23	27	30	34	38	46	48	27	14
80	18	22	26	30	33	37	44	47	26	14
75	17	21	25	29	32	36	43	46	26	13
70	17	20	25	29	32	36	42	45	25	12
65	17	19	24	28	32	35	41	44	24	11
60	17	19	24	28	31	34	41	44	23	10
55	16	18	24	28	31	34	40	43	22	10
50	16	18	24	27	31	34	39	43	22	9
45	16	17	23	27	30	33	38	42	21	8
40	15	17	23	27	30	33	37	41	20	7
35	15	16	23	26	30	32	36	40	19	6
30	14	16	22	26	29	32	36	39	16	5
25	14	15	22	25	29	31	35	38	15	4
20	13	14	21	25	29	31	34	38	10	4
15	12	14	20	24	28	30	33	37	8	3
10	12	12	19	23	28	29	32	36	5	3
5	9	9	17	22	26	28	31	35	4	2
4	8	8	16	22	26	28	31	34	4	2
3	8	7	16	21	25	28	30	34	3	2
2	4	6	15	20	23	27	30	34	1	1
1	3	5	14	20	22	26	29	34	0	0

[1]Score below which the given percentage of the population falls.
[2]Ungraded.

Table 7. Grade equivalents for raw scores on the Reading subtest of the Wide Range Achievement Test, for children, 6-11 years: United States, 1963-65

Raw score	Grade equivalent		Raw score	Grade equivalent	
	From regression line	From smoothed averages		From regression line	From smoothed averages
0-19	Prekindergarten		56	4.1	3.7
20	K .0	1.0	57	4.2	3.8
21	K .1	1.0	58	4.3	3.9
22	K .2	1.1	59	4.4	4.0
23	K .3	1.1	60	4.5	4.1-4.2
24	K .4	1.2	61	4.6	4.3
25	K .5	1.2	62	4.7	4.4-4.5
26	K .6-.7	1.3	63	4.8-4.9	4.6-4.7
27	K .8	1.3	64	5.0	4.8-4.9
28	K .9	1.4	65	5.1	5.0-5.1
29	1.0	1.4	66	5.2	5.2
30	1.1	1.5	67	5.3	5.3-5.4
31	1.2	1.6	68	5.4	5.5-5.6
32	1.3	1.7	69	5.5	5.7-5.8
33	1.4-1.5	1.7	70	5.6-5.7	5.9
34	1.6	1.8	71	5.8	6.0-6.1
35	1.7	1.8	72	5.9	6.2-6.3
36	1.8	1.9	73	6.0	6.4-6.5
37	1.9	2.0	74	6.1	6.6-6.7
38	2.0	2.1	75	6.2	6.8-7.0
39	2.1	2.1	76	6.3	---
40	2.2	2.2	77	6.4-6.5	---
41	2.3-2.4	2.3	78	6.6	---
42	2.5	2.4	79	6.7	---
43	2.6	2.5	80	6.8	---
44	2.7	2.6	81	6.9	---
45	2.8	2.7	82	7.0	---
46	2.9	2.8	83	7.1	---
47	3.0	2.8	84	7.2	---
48	3.1-3.2	2.9	85	7.3-7.4	---
49	3.3	3.0	86	7.5	---
50	3.4	3.1	87	7.6	---
51	3.5	3.2	88	7.7	---
52	3.6	3.3	89	7.8	---
53	3.7	3.4	90	7.9	---
54	3.8	3.5	91-100	8.0 and over	---
55	3.9-4.0	3.6			

NOTE: K = Kindergarten.

Table 8. Grade equivalents for raw scores on the Arithmetic subtest of the Wide Range Achievement Test, for children, 6-11 years: United States, 1963-65

Raw score	Grade equivalent
0-12	Prekindergarten
13	K .0-.1
14	K .2-.4
15	K .5-.6
16	K .7-.9
17	1.0-1.1
18	1.2-1.3
19	1.4-1.6
20	1.7-1.8
21	1.9-2.1
22	2.2-2.3
23	2.4-2.6
24	2.7-2.8
25	2.9-3.0
26	3.1-3.3
27	3.4-3.5
28	3.6-3.8
29	3.9-4.0
30	4.1-4.3
31	4.4-4.5
32	4.6-4.8
33	4.9-5.0
34	5.1-5.2
35	5.3-5.5
36	5.6-5.7
37	5.8-6.0
38	6.1-6.2
39	6.3-6.5
40	6.6-6.7
41	6.8-7.0
42	7.1-7.2
43	7.3-7.4
44	7.5-7.7
45	7.8-7.9
46-63	8.0 and over

NOTE: K = Kindergarten.

Table 9. Table for converting raw scores on the Reading subtest of the Wide Range Achievement Test to standard scores, for children, 6-11 years, by 6-month-age intervals: United States, 1963-65

Raw score	Age in months											
	72-77	78-83	84-89	90-95	96-101	102-107	108-113	114-119	120-125	126-131	132-137	138-143
	Standard score											
000	069	063	056	049	*	*	*	*	*	*	*	*
001	071	064	057	050	*	*	*	*	*	*	*	*
002	072	065	058	051	*	*	*	*	*	*	*	*
003	074	067	059	052	*	*	*	*	*	*	*	*
004	075	068	060	053	*	*	*	*	*	*	*	*
005	077	069	062	055	051	042	042	043	038	039	*	*
006	078	070	063	056	052	043	043	044	040	040	*	*
007	079	072	064	057	053	044	044	045	041	041	*	*
008	081	073	065	058	054	045	045	046	042	042	037	033
009	082	074	066	059	055	047	046	047	043	043	038	034
010	084	075	067	060	057	048	048	048	044	044	039	035
011	085	077	069	061	058	049	049	049	045	045	040	036
012	087	078	070	063	059	050	050	050	046	046	041	037
013	088	079	071	064	060	051	051	051	047	047	042	038
014	089	080	072	065	061	053	052	052	048	048	043	039
015	091	082	073	066	062	054	053	053	049	049	045	040
016	092	083	074	067	063	055	054	054	050	050	046	041
017	094	084	076	068	064	056	055	055	051	051	047	043
018	095	085	077	069	065	057	056	056	052	052	048	044
019	097	086	078	071	066	058	058	057	053	053	049	045
020	098	088	079	072	067	060	059	058	054	054	050	046
021	100	089	080	073	068	061	060	060	055	055	051	047
022	101	090	081	074	069	062	061	061	056	056	052	048
023	102	091	083	075	070	063	062	062	057	057	053	049
024	104	093	084	076	072	064	063	063	058	058	054	050
025	105	094	085	077	073	066	064	064	059	059	055	051
026	107	095	086	079	074	067	065	065	061	060	056	052
027	108	096	087	080	075	068	066	066	062	061	057	053
028	110	098	088	081	076	069	067	067	063	062	058	054
029	111	099	089	082	077	070	069	068	064	063	059	055
030	112	100	091	083	078	072	070	069	065	064	060	056
031	114	101	092	084	079	073	071	070	066	065	061	058
032	115	103	093	085	080	074	072	071	067	066	062	059
033	117	104	094	087	081	075	073	072	068	067	063	060
034	118	105	095	088	082	076	074	073	069	068	064	061
035	120	106	096	089	083	077	075	074	070	069	066	062
036	121	107	098	090	084	079	076	075	071	070	067	063
037	123	109	099	091	085	080	077	076	072	071	068	064
038	124	110	100	092	086	081	079	077	073	072	069	065
039	125	111	101	093	088	082	080	078	074	073	070	066
040	127	112	102	095	089	083	081	079	075	074	071	067
041	128	114	103	096	090	085	082	080	076	075	072	068
042	130	115	105	097	091	086	083	081	077	076	073	069
043	131	116	106	098	092	087	084	083	078	077	074	070
044	133	117	107	099	093	088	085	084	079	078	075	071
045	134	119	108	100	094	089	086	085	081	080	076	073
046	136	120	109	101	095	091	087	086	082	081	077	074
047	137	121	110	103	096	092	088	087	083	082	078	075
048	138	122	112	104	097	093	090	088	084	083	079	076
049	140	124	113	105	098	094	091	089	085	084	080	077
050	141	125	114	106	099	095	092	090	086	085	081	078

Table 9. Table for converting raw scores on the Reading subtest of the Wide Range Achievement Test to standard scores, for children, 6-11 years, by 6-month-age intervals: United States, 1963-65—Con.

Raw score	Age in months											
	72-77	78-83	84-89	90-95	96-101	102-107	108-113	114-119	120-125	126-131	132-137	138-143
	Standard score											
051	143	126	115	107	101	096	093	091	087	086	082	079
052	144	127	116	108	102	098	094	092	088	087	083	080
053	146	128	117	109	103	099	095	093	089	088	084	081
054	147	130	119	111	104	100	096	094	090	089	085	082
055	148	131	120	112	105	101	097	095	091	090	086	083
056	150	132	121	113	106	102	098	096	092	091	088	084
057	151	133	122	114	107	104	099	097	093	092	089	085
058	153	135	123	115	108	105	101	098	094	093	090	086
059	154	136	124	116	109	106	102	099	095	094	091	088
060	156	137	126	117	110	107	103	100	096	095	092	089
061	157	138	127	119	111	108	104	101	097	096	093	090
062	159	140	128	120	112	110	105	102	098	097	094	091
063	160	141	129	121	113	111	106	103	099	098	095	092
064	161	142	130	122	114	112	107	104	100	099	096	093
065	163	143	131	123	116	113	108	106	102	100	097	094
066	164	145	133	124	117	114	109	107	103	101	098	095
067	166	146	134	125	118	115	111	108	104	102	099	096
068	167	147	135	127	119	117	112	109	105	103	100	097
069	169	148	136	128	120	118	113	110	106	104	101	098
070	170	149	137	129	121	119	114	111	107	105	102	099
071	*	*	138	130	122	120	115	112	108	106	103	100
072	*	*	139	131	123	121	116	113	109	107	104	101
073	*	*	141	132	124	123	117	114	110	108	105	102
074	*	*	142	133	125	124	118	115	111	109	106	104
075	*	*	143	135	126	125	119	116	112	110	107	105
076	*	*	144	136	127	126	120	117	113	111	109	106
077	*	*	145	137	128	127	122	118	114	112	110	107
078	*	*	146	138	129	128	123	119	115	113	111	108
079	*	*	148	139	131	130	124	120	116	114	112	109
080	*	*	149	140	132	131	125	121	117	115	113	110
081	*	*	150	141	133	132	126	122	118	116	114	111
082	*	*	151	143	134	133	127	123	119	117	115	112
083	*	*	152	144	135	134	128	124	120	118	116	113
084	*	*	153	145	136	136	129	125	121	119	117	114
085	*	*	155	146	137	137	130	126	123	120	118	115
086	*	*	*	*	138	138	132	127	124	121	119	116
087	*	*	*	*	139	139	133	129	125	122	120	117
088	*	*	*	*	140	140	134	130	126	123	121	119
089	*	*	*	*	141	142	135	131	127	125	122	120
090	*	*	*	*	142	143	136	132	128	126	123	121
091	*	*	*	*	143	144	137	133	129	127	124	122
092	*	*	*	*	144	145	138	134	130	128	125	123
093	*	*	*	*	146	146	139	135	131	129	126	124
094	*	*	*	*	147	147	140	136	132	130	127	125
095	*	*	*	*	148	149	141	137	133	131	128	126
096	*	*	*	*	*	*	143	138	134	132	129	127
097	*	*	*	*	*	*	144	139	135	133	131	128
098	*	*	*	*	*	*	145	140	136	134	132	129
099	*	*	*	*	*	*	146	141	137	135	133	130
100	*	*	*	*	*	*	147	142	138	136	134	131

Table 10. Table for converting raw scores on the Arithmetic subtest of the Wide Range Achievement Test to standard scores, for children, 6-11 years, by 6-month-age intervals: United States, 1963-65

Raw score	Age in months											
	72-77	78-83	84-89	90-95	96-101	102-107	108-113	114-119	120-125	126-131	132-137	138-143
	Standard score											
00	050	041	*	*	*	*	*	*	*	*	*	*
01	053	045	*	*	*	*	*	*	*	*	*	*
02	056	048	*	*	*	*	*	*	*	*	*	*
03	060	051	*	*	*	*	*	*	*	*	*	*
04	063	054	*	*	*	*	*	*	*	*	*	*
05	066	057	050	032	*	*	*	*	*	*	*	*
06	070	060	053	036	*	*	*	*	*	*	*	*
07	073	064	056	040	*	*	*	*	*	*	*	*
08	076	067	059	043	039	028	*	*	*	*	*	*
09	079	070	063	047	043	032	*	*	*	*	*	*
10	083	073	066	051	046	035	035	035	036	038	041	040
11	086	076	069	054	050	039	038	038	039	041	043	042
12	089	080	072	058	053	043	042	041	042	043	045	044
13	093	083	075	062	057	047	045	044	045	046	047	046
14	096	086	078	065	061	051	049	048	048	048	050	048
15	099	089	082	069	064	054	052	051	051	051	052	051
16	102	092	085	073	068	058	055	054	054	054	054	053
17	106	095	088	076	071	062	059	057	057	056	057	055
18	109	099	091	080	075	066	062	061	060	059	059	057
19	112	102	094	084	078	069	066	064	063	061	061	059
20	116	105	098	088	082	073	069	067	066	064	063	061
21	119	108	101	091	085	077	073	070	068	066	066	063
22	122	111	104	095	089	081	076	074	071	069	068	065
23	125	115	107	099	092	085	080	077	074	072	070	067
24	129	118	110	102	096	088	083	080	077	074	072	069
25	132	121	114	106	100	092	087	083	080	077	075	072
26	135	124	117	110	103	096	090	087	083	079	077	074
27	139	127	120	113	107	100	094	090	086	082	079	076
28	142	130	123	117	110	104	097	093	089	085	081	078
29	145	134	126	121	114	107	101	097	092	087	084	080
30	148	137	130	124	117	111	104	100	095	090	086	082
31	152	140	133	128	121	115	108	103	098	092	088	084
32	155	143	136	132	124	119	111	106	101	095	091	086
33	158	146	139	135	128	123	115	110	104	097	093	088
34	162	149	142	139	131	126	118	113	106	100	095	090
35	165	153	146	143	135	130	122	116	109	103	097	092
36	168	156	149	146	138	134	125	119	112	105	100	095
37	171	159	152	150	142	138	128	123	115	108	102	097
38	175	162	155	154	146	141	132	126	118	110	104	099
39	178	165	158	157	149	145	135	129	121	113	106	101
40	181	169	162	161	153	149	139	132	124	116	109	103
41	*	*	165	165	156	153	142	136	127	118	111	105
42	*	*	168	169	160	157	146	139	130	121	113	107
43	*	*	*	*	163	160	149	142	133	123	115	109
44	*	*	*	*	167	164	153	145	136	126	118	111
45	*	*	*	*	170	168	156	149	139	128	120	113
46	*	*	*	*	*	*	160	152	141	131	122	116
47	*	*	*	*	*	*	163	155	144	134	125	118
48	*	*	*	*	*	*	167	158	147	136	127	120
49	*	*	*	*	*	*	170	162	150	139	129	122
50	*	*	*	*	*	*	174	165	153	141	131	124
51	*	*	*	*	*	*	*	*	156	144	134	126
52	*	*	*	*	*	*	*	*	159	147	136	128
53	*	*	*	*	*	*	*	*	162	149	138	130
54	*	*	*	*	*	*	*	*	165	152	140	132
55	*	*	*	*	*	*	*	*	168	154	143	134
56	*	*	*	*	*	*	*	*	171	157	145	136
57	*	*	*	*	*	*	*	*	174	159	147	139
58	*	*	*	*	*	*	*	*	176	162	150	141
59	*	*	*	*	*	*	*	*	179	165	152	143
60	*	*	*	*	*	*	*	*	182	167	154	145
61	*	*	*	*	*	*	*	*	*	*	156	147
62	*	*	*	*	*	*	*	*	*	*	159	149
63	*	*	*	*	*	*	*	*	*	*	161	151

Table 11. Normalized and actual standard scores on the Reading subtest of the Wide Range Achievement Test, for children, 6-11 years, by sex and age: United States, 1963-65

Sex and percentile	Standard score z^1	Normalized standard score (15z+100)	Age in years					
			6	7	8	9	10	11
Both sexes			Actual standard score					
99	2.33	135.0	153	135	134	130	128	125
98	2.05	130.8	144	132	128	126	124	124
97	1.88	128.2	138	128	128	125	122	123
96	1.75	126.2	134	127	124	124	122	122
95	1.64	124.6	132	126	124	123	122	122
90	1.28	119.2	122	120	119	118	118	118
85	1.04	115.6	117	117	116	116	115	116
80	0.84	112.6	113	115	113	114	113	114
75	0.67	110.0	109	111	111	110	111	112
70	0.52	107.8	106	109	108	108	110	110
65	0.39	105.8	104	106	108	107	108	108
60	0.25	103.8	102	104	106	104	106	106
55	0.13	102.0	101	102	104	104	104	104
50	0.00	100.0	100	100	102	102	103	102
45	-0.13	98.0	98	98	100	100	101	100
40	-0.25	96.2	96	97	97	98	98	98
35	-0.39	94.1	94	95	95	96	96	96
30	-0.52	92.2	92	94	93	94	94	94
25	-0.67	90.0	89	92	90	92	92	90
20	-0.84	87.4	88	89	88	89	90	88
15	-1.04	84.4	84	86	85	86	86	84
10	-1.28	80.8	82	81	80	80	82	82
5	-1.64	75.4	80	73	75	74	74	74
4	-1.75	73.8	78	70	72	72	72	72
3	-1.88	71.8	77	68	70	70	68	66
2	-2.05	69.2	76	68	66	66	64	65
1	-2.33	65.0	73	64	59	54	54	56
Boys								
99	2.33	135.0	156	136	134	128	128	125
98	2.05	130.8	141	128	128	126	124	124
97	1.88	128.2	136	127	126	125	122	123
96	1.75	126.2	132	126	124	124	122	123
95	1.64	124.6	130	124	122	124	122	122
90	1.28	119.2	122	119	118	118	118	120
85	1.04	115.6	117	116	114	116	114	118
80	0.84	112.6	113	112	112	112	112	114
75	0.67	110.0	109	110	110	108	110	112
70	0.52	107.8	105	106	108	107	109	110
65	0.39	105.8	104	104	106	106	107	108
60	0.25	103.8	101	102	104	104	106	105
55	0.13	102.0	100	100	102	102	104	102

[1] Abcissa x/σ for the areas under the normal curve corresponding to the percentiles.

Table 11. Normalized and actual standard scores on the Reading subtest of the Wide Range Achievement Test, for children, 6-11 years, by sex and age: United States, 1963-65—Con.

Sex and percentile	Standard score z^1	Normalized standard score (15z+100)	Age in years					
			6	7	8	9	10	11
Boys—Con.			Actual standard score					
50	0.00	100.0	98	98	98	100	102	100
45	-0.13	98.0	96	97	96	98	100	98
40	-0.25	96.2	94	95	94	96	98	96
35	-0.39	94.1	93	92	90	94	96	94
30	-0.52	92.2	90	92	90	92	94	92
25	-0.67	90.0	88	89	88	90	90	88
20	-0.84	87.4	86	87	85	88	88	86
15	-1.04	84.4	84	84	82	82	84	82
10	-1.28	80.8	82	78	77	78	78	78
5	-1.64	75.4	80	70	72	72	72	67
4	-1.75	73.8	78	68	70	70	70	66
3	-1.88	71.8	77	68	66	67	68	64
2	-2.05	69.2	76	66	64	63	64	62
1	-2.33	65.0	74	56	58	54	51	50
Girls								
99	2.33	135.0	154	135	134	130	127	125
98	2.05	130.8	145	133	128	126	124	124
97	1.88	128.2	138	131	126	125	122	123
96	1.75	126.2	137	128	124	124	122	122
95	1.64	124.6	134	127	124	123	122	121
90	1.28	119.2	125	120	120	120	118	118
85	1.04	115.6	118	118	118	116	115	116
80	0.84	112.6	113	116	114	114	114	114
75	0.67	110.0	109	113	112	112	112	112
70	0.52	107.8	106	111	111	110	110	110
65	0.39	105.8	105	109	108	108	108	110
60	0.25	103.8	104	106	108	107	107	108
55	0.13	102.0	101	103	106	104	105	106
50	0.00	100.0	101	102	104	104	103	104
45	-0.13	98.0	100	100	103	102	101	102
40	-0.25	96.2	96	98	101	100	98	100
35	-0.39	94.1	96	97	100	100	96	98
30	-0.52	92.2	93	95	97	97	94	96
25	-0.67	90.0	90	94	95	94	92	94
20	-0.84	87.4	89	92	92	92	90	90
15	-1.04	84.4	86	88	88	89	88	88
10	-1.28	80.8	84	84	85	84	84	84
5	-1.64	75.4	80	76	77	78	78	82
4	-1.75	73.8	80	76	76	76	76	80
3	-1.88	71.8	78	72	74	72	72	78
2	-2.05	69.2	77	68	68	70	66	76
1	-2.33	65.0	73	66	64	56	55	68
χ^2								
Both sexes	-	-	8.22	0.79	1.18	3.07	4.09	3.83
Boys	-	-	7.73	3.06	3.00	3.85	5.62	8.50
Girls	-	-	11.67	1.74	3.12	4.44	5.37	7.89

χ^2 is approximate test for normality of distribution. Chi-square value for the 5-percent probability level, 38.9, and for 1-percent level, 45.6.

Table 12. Normalized and actual standard scores on the Arithmetic subtest of the Wide Range Achievement Test, for children, 6-11 years, by sex and age: United States, 1963-65

Sex and percentile	Standard score z[1]	Normalized standard score (15z+100)	Age in years					
			6	7	8	9	10	11
Both sexes			Actual standard score					
99	2.33	135.0	133	127	132	136	136	132
98	2.05	130.8	126	124	128	129	133	130
97	1.88	128.2	126	124	126	126	131	128
96	1.75	126.2	126	120	122	126	131	128
95	1.64	124.6	124	120	122	122	128	126
90	1.28	119.2	124	116	118	116	120	122
85	1.04	115.6	120	114	114	112	117	116
80	0.84	112.6	116	114	114	112	112	114
75	0.67	110.0	114	110	110	108	108	112
70	0.52	107.8	110	110	110	108	108	110
65	0.39	105.8	107	106	107	108	106	108
60	0.25	103.8	107	106	107	106	103	106
55	0.13	102.0	104	106	104	106	103	104
50	0.00	100.0	100	103	104	102	100	102
45	-0.13	98.0	100	103	104	102	98	100
40	-0.25	96.2	97	100	100	102	98	98
35	-0.39	94.1	97	100	100	99	95	94
30	-0.52	92.2	94	96	96	99	95	92
25	-0.67	90.0	91	96	92	95	92	90
20	-0.84	87.4	91	93	92	95	92	88
15	-1.04	84.4	88	86	88	92	90	86
10	-1.28	80.8	81	82	85	82	87	84
5	-1.64	75.4	72	72	74	75	76	80
4	-1.75	73.8	72	68	70	72	76	78
3	-1.88	71.8	68	62	70	68	73	76
2	-2.05	69.2	62	58	63	62	67	68
1	-2.33	65.0	56	44	56	54	60	60
Boys								
99	2.33	135.0	133	127	136	146	136	132
98	2.05	130.8	126	124	128	132	134	130
97	1.88	128.2	126	124	126	129	131	128
96	1.75	126.2	126	120	122	126	131	128
95	1.64	124.6	124	120	122	126	128	126
90	1.28	119.2	124	116	118	116	122	122
85	1.04	115.6	120	114	114	116	117	116
80	0.84	112.6	116	114	114	112	114	114
75	0.67	110.0	114	110	110	108	108	112
70	0.52	107.8	110	110	107	108	108	108
65	0.39	105.8	107	106	107	106	103	106
60	0.25	103.8	107	106	107	106	103	104
55	0.13	102.0	104	106	104	102	100	102

[1]Abcissa x/σ for the areas under the normal curve corresponding to the percentiles.

Table 12. Normalized and actual standard scores on the Arithmetic subtest of the Wide Range Achievement Test, for children, 6-11 years, by sex and age: United States, 1963-65—Con.

Sex and percentile	Standard score z^1	Normalized standard score (15z+100)	Age in years					
			6	7	8	9	10	11
Boys—Con.			Actual standard score					
50	0.00	100.0	100	103	104	102	100	100
45	-0.13	98.0	100	103	100	102	98	98
40	-0.25	96.2	97	100	100	99	98	94
35	-0.39	94.1	97	100	96	99	95	92
30	-0.52	92.2	94	96	96	95	95	90
25	-0.67	90.0	91	93	92	95	92	88
20	-0.84	87.4	88	93	92	92	92	88
15	-1.04	84.4	84	86	85	85	90	86
10	-1.28	80.8	81	79	85	82	84	82
5	-1.64	75.4	72	68	74	72	76	78
4	-1.75	73.8	72	65	70	68	73	76
3	-1.88	71.8	68	58	66	65	70	74
2	-2.05	69.2	62	51	63	62	65	66
1	-2.33	65.0	56	41	56	54	46	58
Girls								
99	2.33	135.0	133	127	132	132	142	134
98	2.05	130.8	126	124	126	126	134	130
97	1.88	128.2	126	124	122	126	131	128
96	1.75	126.2	126	124	122	122	128	128
95	1.64	124.6	124	120	122	119	126	126
90	1.28	119.2	124	116	118	116	120	122
85	1.04	115.6	120	116	114	112	114	119
80	0.84	112.6	116	114	114	112	112	114
75	0.67	110.0	114	114	110	108	108	112
70	0.52	107.8	110	110	110	108	108	110
65	0.39	105.8	107	110	107	108	106	108
60	0.25	103.8	107	106	107	106	103	106
55	0.13	102.0	104	106	107	106	103	104
50	0.00	100.0	104	106	104	106	100	102
45	-0.13	98.0	100	103	104	102	100	100
40	-0.25	96.2	97	103	100	102	98	98
35	-0.39	94.1	97	100	100	102	98	94
30	-0.52	92.2	97	100	96	99	95	92
25	-0.67	90.0	94	96	96	95	92	92
20	-0.84	87.4	91	93	92	95	92	90
15	-1.04	84.4	88	89	88	92	90	88
10	-1.28	80.8	84	82	85	88	87	84
5	-1.64	75.4	72	76	78	78	84	82
4	-1.75	73.8	72	72	74	75	78	80
3	-1.88	71.8	65	68	70	68	76	80
2	-2.05	69.2	62	58	66	65	70	78
1	-2.33	65.0	56	51	56	54	65	66
	χ^2							
Both sexes	-	-	3.93	14.24	4.64	6.44	2.12	1.86
Boys	-	-	3.57	21.28	4.13	8.85	8.70	1.70
Girls	-	-	5.06	19.22	5.00	7.14	2.95	4.20

χ^2 is approximate test for normality of distribution. Chi-square value for the 5-percent probability level, 38.9, and for the 1-percent level, 45.6.

Table 13. Table for converting standard scores on the Reading and Arithmetic subtests of the Wide Range Achievement Test to a combined standard score, for children, 6-11 years, by 6-month-age intervals: United States, 1963-65

Sum of standard scores	Age in months											
	72-77	78-83	84-89	90-95	96-101	102-107	108-113	114-119	120-125	126-131	132-137	138-143
	Standard score (restandardized)											
050	15	20	19	18	18	17	18	20	19	15	20	33
051	16	20	19	18	18	17	19	20	20	16	20	34
052	16	21	20	19	19	18	19	21	20	16	21	34
053	17	21	20	20	19	19	20	21	21	17	21	34
054	18	22	21	20	20	19	20	22	21	17	22	35
055	18	22	21	21	20	20	21	22	22	18	22	35
056	19	23	22	21	21	20	21	23	22	19	23	36
057	19	23	23	22	21	21	22	23	23	19	24	36
058	20	24	23	22	22	21	22	24	23	20	24	37
059	20	24	24	23	22	22	23	24	24	20	25	37
060	21	25	24	23	23	22	23	25	24	21	25	38
061	22	25	25	24	24	23	24	25	25	21	26	38
062	22	26	25	24	24	24	25	26	25	22	26	39
063	23	27	26	25	25	24	25	27	26	23	27	39
064	23	27	26	26	25	25	26	27	26	23	27	40
065	23	28	27	26	26	25	26	28	27	24	28	40
066	24	28	27	27	26	26	27	28	28	24	28	40
067	25	29	28	27	27	26	27	29	28	25	29	41
068	25	29	28	28	27	27	28	29	29	25	29	41
069	26	30	29	28	28	27	28	30	29	26	30	42
070	27	30	30	29	29	28	29	30	30	26	30	42
071	27	31	30	29	29	29	29	31	30	27	31	43
072	28	31	31	30	30	29	30	31	31	28	32	43
073	28	32	31	30	30	30	31	32	31	28	32	44
074	29	32	32	31	31	30	31	32	32	29	33	44
075	29	33	32	32	31	31	32	33	32	29	33	45
076	30	34	33	32	32	31	32	34	33	30	34	45
077	31	34	33	33	32	32	33	34	34	30	34	46
078	31	35	34	33	33	32	33	35	34	31	35	46
079	32	35	34	34	33	33	34	35	35	32	35	47
080	32	36	35	34	34	33	34	36	35	32	36	47
081	33	36	36	35	35	34	35	36	36	33	36	47
082	33	37	36	35	35	35	35	37	36	33	37	48
083	34	37	37	36	36	35	36	37	37	34	37	48
084	35	38	37	36	36	36	37	38	37	34	38	49
085	35	38	38	37	37	36	37	38	38	35	38	49
086	36	39	38	38	37	37	38	39	38	36	39	50
087	36	39	39	38	38	37	38	39	39	36	40	50
088	37	40	39	39	38	38	39	40	39	37	40	51
089	37	40	40	39	39	38	39	40	40	37	41	51
090	38	41	40	40	39	39	40	41	41	38	41	52
091	38	42	41	40	40	40	40	42	41	38	42	52
092	39	42	41	41	41	40	41	42	42	39	42	53
093	40	43	42	41	41	41	41	43	42	39	43	53
094	40	43	43	42	42	41	42	43	43	40	43	53
095	41	44	43	42	42	42	43	44	43	41	44	54
096	41	44	44	43	43	42	43	44	44	41	44	54
097	42	45	44	44	43	43	44	45	44	42	45	55
098	42	45	45	44	44	43	44	45	45	42	45	55
099	43	46	45	45	44	44	45	46	45	43	46	56
100	44	46	46	45	45	45	45	46	46	43	46	56
101	44	47	46	46	46	45	46	47	46	44	47	57
102	45	47	47	46	46	46	46	48	47	45	48	57
103	45	48	47	47	47	46	47	48	48	45	48	58
104	46	49	48	47	47	47	47	49	48	46	49	58

Table 13. Table for converting standard scores on the Reading and Arithmetic subtests of the Wide Range Achievement Test to a combined standard score, for children, 6-11 years, by 6-month-age intervals: United States, 1963-65—Con.

Sum of standard scores	Age in months											
	72-77	78-83	84-89	90-95	96-101	102-107	108-113	114-119	120-125	126-131	132-137	138-143
	Standard score (restandardized)											
105	46	49	49	48	48	47	48	49	49	46	49	59
106	47	50	49	49	48	48	49	50	49	47	50	59
107	48	50	50	49	49	48	49	50	50	47	50	59
108	48	51	50	50	49	49	50	51	50	48	51	60
109	49	51	51	50	50	49	50	51	51	49	51	60
110	49	52	51	51	50	50	51	52	51	49	52	61
111	50	52	52	51	51	51	51	52	52	50	52	61
112	50	53	52	52	52	51	52	53	52	50	53	62
113	51	53	53	52	52	52	52	53	53	51	53	62
114	51	54	53	53	53	52	53	54	54	51	54	63
115	52	54	54	53	53	53	53	54	54	52	55	63
116	53	55	54	54	54	53	54	55	55	52	55	64
117	53	55	55	55	54	54	55	55	55	53	56	64
118	54	56	56	55	55	54	55	56	56	54	56	65
119	54	57	56	56	55	55	56	57	56	54	57	65
120	55	57	57	56	56	56	56	57	57	55	57	65
121	55	58	57	57	57	56	57	58	57	55	58	66
122	56	58	58	57	57	57	57	58	58	56	58	66
123	57	59	58	58	58	57	58	59	58	56	59	67
124	57	59	59	58	58	58	58	59	59	57	59	67
125	58	60	59	59	59	58	59	60	59	58	60	68
126	58	60	60	59	59	59	59	60	60	58	60	68
127	59	61	60	60	60	59	60	61	61	59	61	69
128	59	61	61	61	60	60	61	61	61	59	61	69
129	60	62	62	61	61	61	61	62	62	60	62	70
130	60	62	62	62	61	61	62	62	62	60	63	70
131	61	63	63	62	62	62	62	63	63	61	63	71
132	62	64	63	63	63	62	63	64	63	62	64	71
133	62	64	64	63	63	63	53	64	64	62	64	71
134	63	65	64	64	64	63	64	65	64	63	65	72
135	63	65	65	64	64	64	64	65	65	63	65	72
136	64	66	65	65	65	64	65	66	65	64	66	73
137	64	66	66	65	65	65	65	66	66	64	66	73
138	65	67	66	66	66	66	66	67	66	65	67	74
139	66	67	67	67	66	66	67	67	67	65	67	74
140	66	68	67	67	67	67	67	68	68	66	68	75
141	67	68	68	68	67	67	68	68	68	67	68	75
142	67	69	69	68	68	68	68	69	69	67	69	76
143	68	69	69	69	69	68	69	69	69	68	69	76
144	68	70	70	69	69	69	69	70	70	68	70	77
145	69	70	70	70	70	69	70	70	70	69	71	77
146	70	71	71	70	70	70	70	71	71	69	71	77
147	70	72	71	71	71	71	71	72	71	70	72	78
148	71	72	72	71	71	71	72	72	71	71	72	78
149	71	73	72	72	72	72	72	73	72	71	73	79
150	72	73	73	73	72	72	73	73	73	72	73	79
151	72	74	73	73	73	73	73	74	73	72	74	80
152	73	74	74	74	74	73	74	74	74	73	74	80
153	73	75	75	74	74	74	74	75	75	73	75	81
154	74	75	75	75	75	74	75	75	75	74	75	81
155	75	76	76	75	75	75	75	76	76	75	76	82
156	75	76	76	76	76	76	76	76	76	75	76	82
157	76	77	77	76	76	76	76	77	77	76	77	83
158	76	77	77	77	77	77	77	77	77	76	78	83
159	77	78	78	78	77	77	78	78	78	77	78	83

Table 13. Table for converting standard scores on the Reading and Arithmetic subtests of the Wide Range Achievement Test to a combined standard score, for children, 6-11 years, by 6-month-age intervals: United States, 1963-65—Con.

Sum of standard scores	Age in months											
	72-77	78-83	84-89	90-95	96-101	102-107	108-113	114-119	120-125	126-131	132-137	138-143
	Standard score (restandardized)											
160	77	78	78	78	78	78	78	79	78	77	79	84
161	78	79	79	79	78	78	79	79	79	78	79	84
162	79	80	79	79	79	79	79	80	79	78	80	85
163	79	80	80	80	80	79	80	80	80	79	80	85
164	80	81	80	80	80	80	80	81	80	80	81	86
165	80	81	81	81	81	81	81	81	81	80	81	86
166	81	82	82	81	81	81	81	82	82	81	82	87
167	81	82	82	82	82	82	82	82	82	81	82	87
168	82	83	83	82	82	82	82	83	83	82	83	88
169	82	83	83	83	83	83	83	83	83	82	83	88
170	83	84	84	84	83	83	84	84	84	83	84	89
171	84	84	84	84	84	84	84	84	84	84	84	89
172	84	85	85	85	84	84	85	85	85	84	85	89
173	85	85	85	85	85	85	85	85	85	85	86	90
174	85	86	86	86	86	86	86	86	86	85	86	90
175	86	87	86	86	86	86	86	87	86	86	87	91
176	86	87	87	87	87	87	87	87	87	86	87	91
177	87	88	88	87	87	87	87	88	88	87	88	92
178	88	88	88	88	88	88	88	88	88	88	88	92
179	88	89	89	88	88	88	88	89	89	88	89	93
180	89	89	89	89	89	89	89	89	89	89	89	93
181	89	90	90	90	89	89	90	90	90	89	90	94
182	90	90	90	90	90	90	90	90	90	90	90	94
183	90	91	91	91	91	91	91	91	91	90	91	95
184	91	91	91	91	91	91	91	91	91	91	91	95
185	92	92	92	92	92	92	92	92	92	91	92	95
186	92	92	92	92	92	92	92	92	92	92	92	96
187	93	93	93	93	93	93	93	93	93	93	93	96
188	93	93	93	93	93	93	93	94	93	93	94	97
189	94	94	94	94	94	94	94	94	94	94	94	97
190	94	95	95	94	94	94	94	95	95	94	95	98
191	95	95	95	95	95	95	95	95	95	95	95	98
192	95	96	96	96	95	96	96	96	96	95	96	99
193	96	96	96	96	96	96	96	96	96	96	96	99
194	97	97	97	97	97	97	97	97	97	97	97	100
195	97	97	97	97	97	97	97	97	97	97	97	100
196	98	98	98	98	98	98	98	98	98	98	98	101
197	98	98	98	98	98	98	98	98	98	98	98	101
198	99	99	99	99	99	99	99	99	99	99	99	102
199	99	99	99	99	99	99	99	99	99	99	99	102
200	100	100	100	100	100	100	100	100	100	100	100	102
201	101	100	101	100	100	100	100	100	100	101	100	103
202	101	101	101	101	101	101	101	101	101	101	101	103
203	102	102	102	102	101	102	102	102	102	102	102	104
204	102	102	102	102	102	102	102	102	102	102	102	104
205	103	103	103	103	103	103	103	103	103	103	103	105
206	103	103	103	103	103	103	103	103	103	103	103	105
207	104	104	104	104	104	104	104	104	104	104	104	106
208	104	104	104	104	104	104	104	104	104	104	104	106
209	105	105	105	105	105	105	105	105	105	105	105	107
210	106	105	105	105	105	105	105	105	105	106	105	107
211	106	106	106	106	106	106	106	106	106	106	106	108
212	107	106	106	107	106	107	106	106	106	107	106	108

Table 13. Table for converting standard scores on the Reading and Arithmetic subtests of the Wide Range Achievement Test to a combined standard score, for children, 6-11 years, by 6-month-age intervals: United States, 1963-65—Con.

Sum of standard scores	Age in months											
	72	78-83	84-89	90-95	96-101	102-107	108-113	114-119	120-125	126-131	132-137	138-143
	Standard score (restandardized)											
213		107	107	107	107	107	107	107	107	107	107	108
214		107	108	108	108	108	108	107	107	108	107	109
215		108	108	108	108	108	108	108	108	108	108	109
216		108	109	109	109	109	109	109	109	109	109	110
217		109	109	109	109	109	109	109	109	110	109	110
218		110	110	110	110	110	110	110	110	110	110	111
219		110	110	110	110	110	110	110	110	111	110	111
220		111	111	111	111	111	111	111	111	111	111	112
221		111	111	111	111	112	111	111	111	112	111	112
222	112	112	112	112	112	112	112	112	112	112	111	113
223	113	112	112	113	112	113	112	112	112	113	112	113
224	114	113	113	113	113	113	113	113	113	114	113	114
225	114	113	114	114	114	114	114	113	113	114	113	114
226	115	114	114	114	114	114	114	114	114	115	114	114
227	115	114	115	115	115	115	115	114	114	115	114	115
228	116	115	115	115	115	115	115	115	115	116	115	115
229	116	115	116	116	116	116	116	115	116	116	115	116
230	117	116	116	116	116	117	116	116	116	117	116	116
231	117	117	117	117	117	117	117	117	117	117	117	117
232	118	117	117	117	117	118	117	117	117	118	117	117
233	119	118	118	118	118	118	118	118	118	119	118	118
234	119	118	118	119	119	119	118	118	118	119	118	118
235	120	119	119	119	119	119	119	119	119	120	119	119
236	120	119	119	120	120	120	120	119	119	120	119	119
237	121	120	120	120	120	120	120	120	120	121	120	120
238	121	120	121	121	121	121	121	120	120	121	120	120
239	122	121	121	121	121	122	121	121	121	122	121	120
240	123	121	122	122	122	122	122	121	122	123	121	121
241	123	122	122	122	122	123	122	122	122	123	122	121
242	124	122	123	123	123	123	123	122	123	124	122	122
243	124	123	123	123	123	124	123	123	123	124	123	122
244	125	123	124	124	124	124	124	124	124	125	123	123
245	125	124	124	125	125	125	125	124	124	125	124	123
246	126	125	125	125	125	125	125	125	125	126	125	124
247	127	125	125	126	126	126	126	125	125	127	125	124
248	127	126	126	126	126	127	126	126	126	127	126	125
249	128	126	127	127	127	127	127	126	126	128	126	125
250	128	127	127	127	127	128	127	127	127	128	127	126
251	129	127	128	128	128	128	128	127	127	129	127	126
252	129	128	128	128	128	129	128	128	128	129	128	126
253	130	128	129	129	129	129	129	128	129	130	128	127
254	130	129	129	129	129	130	129	129	129	130	129	127
255	131	129	130	130	130	130	130	129	130	131	129	128
256	132	130	130	131	131	131	131	130	130	132	130	128
257	132	130	131	131	131	131	131	130	131	132	130	129
258	133	131	131	132	132	132	132	131	131	133	131	129
259	133	132	132	132	132	133	132	132	132	133	132	130
260	134	132	132	133	133	133	133	132	132	134	132	130
261	134	133	133	133	133	134	133	133	133	134	133	131
262	135	133	134	134	134	134	134	133	133	135	133	131
263	136	134	134	134	134	135	134	134	134	136	134	132
264	136	134	135	135	135	135	135	134	134	136	134	132
265	137	135	135	135	136	136	135	135	135	137	135	132
266	137	135	136	136	136	136	136	135	136	137	135	133
267	138	136	136	137	137	137	137	136	136	138	136	133

Table 13. Table for converting standard scores on the Reading and Arithmetic subtests of the Wide Range Achievement Test to a combined standard score, for children, 6-11 years, by 6-month-age intervals: United States, 1963-65—Con.

Sum of standard scores	Age in months											
	72-77	78-83	84-89	90-95	96-101	102-107	108-113	114-119	120-125	126-131	132-137	138-143
	Standard score (restandardized)											
268	138	136	137	137	137	138	137	136	137	138	136	134
269	139	137	137	138	138	138	138	137	137	139	137	134
270	139	137	138	138	138	139	138	137	138	140	137	135
271	140	138	138	139	139	139	139	138	138	140	138	135
272	141	138	139	139	139	140	139	139	139	141	138	136
273	141	139	140	140	140	140	140	139	139	141	139	136
274	142	140	140	140	140	141	140	140	140	142	140	137
275	142	140	141	141	141	141	141	140	140	142	140	137
276	143	141	141	142	142	142	141	141	141	143	141	138
277	143	141	142	142	142	143	142	141	141	143	141	138
278	144	142	142	143	143	143	143	142	142	144	142	138
279	145	142	143	143	143	144	143	142	143	145	142	139
280	145	143	143	144	144	144	144	143	143	145	143	139
281	146	143	144	144	144	145	144	143	144	146	143	140
282	146	144	144	145	145	145	145	144	144	146	144	140
283	147	144	145	145	145	146	145	144	145	147	144	141
284	147	145	145	146	146	146	146	145	145	147	145	141
285	148	145	146	146	146	147	146	145	146	148	145	142
286	149	146	147	147	147	148	147	146	146	149	146	142
287	149	147	147	148	148	148	147	147	147	149	146	143
288	150	147	148	148	148	149	148	147	147	150	147	143
289	150	148	148	149	149	149	149	148	148	150	148	144
290	151	148	149	149	149	150	149	148	148	151	148	144
291	151	149	149	150	150	150	150	149	149	151	149	144
292	152	149	150	150	150	151	150	149	150	152	149	145
293	152	150	150	151	151	151	151	150	150	153	150	145
294	153	150	151	151	151	152	151	150	151	153	150	146
295	154	151	151	152	152	153	152	151	151	154	151	146
296	154	151	152	152	153	153	152	151	152	154	151	147
297	155	152	153	153	153	154	153	152	152	155	152	147
298	155	152	153	154	154	154	153	152	153	155	152	148
299	156	153	154	154	154	155	154	153	153	156	153	148
300	156	153	154	155	155	155	155	154	154	156	153	149
301	157	154	155	155	155	156	155	154	154	157	154	149
302	158	155	155	156	156	156	156	155	155	158	154	150
303	158	155	156	156	156	157	156	155	156	158	155	150
304	159	156	156	157	157	158	157	156	156	159	156	150
305	159	156	157	157	157	158	157	156	157	159	156	151
306	160	157	157	158	158	159	158	157	157	160	157	151
307	160	157	158	158	159	159	158	157	158	160	157	152
308	161	158	158	159	159	160	159	158	158	161	158	152
309	161	158	159	160	160	160	159	158	159	162	158	153
310	162	159	160	160	160	161	160	159	159	162	159	153

Table 14. Grade equivalents of standard scores on the combined Reading and Arithmetic subtests of the Wide Range Achievement Test, for children, 6-11 years, by 6-month-age intervals: United States, 1963-65

Standard score[1]	Age in months											
	72-77	78-83	84-89	90-95	96-101	102-107	108-113	114-119	120-125	126-131	132-137	138-143
	Grade equivalents											
47	...	...	...	...	...	...	...	...	...	1.0	...	...
48	...	...	...	...	...	...	...	...	...	1.1	...	...
49	...	...	...	...	...	...	...	...	...	1.2	...	...
50	...	...	...	...	...	...	...	...	...	...	...	...
51	...	...	...	...	...	...	...	...	...	1.3	...	...
52	...	...	...	...	...	...	...	...	...	1.4	...	...
53	...	...	...	...	...	...	...	...	...	1.5	...	...
54	...	...	...	...	...	...	...	...	...	1.6	2.0	...
55	...	...	...	...	...	...	...	...	1.0	...	2.1	...
56	...	...	...	...	...	...	...	...	...	1.7	2.2	...
57	...	...	...	...	...	...	1.0	...	1.1	1.8	2.3	...
58	...	...	...	...	...	...	...	1.0	1.2	1.9	...	...
59	...	...	...	...	...	...	1.1	...	1.3	2.0	2.4	...
60	...	...	...	...	...	...	1.2	1.1	1.4	...	2.5	...
61	...	...	...	...	...	...	...	1.2	1.5	2.1	2.6	...
62	...	...	...	...	...	...	1.3	1.3	...	2.2	2.7	...
63	...	...	...	...	...	...	1.4	...	1.6	2.3	...	...
64	...	...	...	...	...	...	...	1.4	1.7	2.4	2.8	...
65	...	...	...	...	...	...	1.5	1.5	1.8	2.5	2.9	...
66	...	...	...	K.0	...	...	1.6	1.6	1.9	...	3.0	...
67	...	...	...	...	...	...	...	1.7	2.0	2.6	3.1	...
68	...	...	...	K.1	...	1.0	1.7	...	2.1	2.7	...	2.0
69	...	...	...	K.2	...	...	1.8	1.8	...	2.8	3.2	2.1
70	...	K.0	...	...	1.0	1.1	...	1.9	2.2	2.9	3.3	2.2-2.3
71	...	...	...	K.3	...	1.2	1.9	2.0	2.3	...	3.4	2.4
72	...	K.1	...	K.4	1.1	1.3	2.0	2.1	2.4	3.0	3.5	2.5-2.6
73	...	...	...	K.5	1.2	...	...	...	2.5	3.1	3.6	2.7
74	...	K.2	...	...	...	1.4	2.1	2.2	2.6	3.2	...	2.8
75	...	...	...	K.6	1.3	1.5	2.2	2.3	...	3.3	3.7	2.9-3.0
76	...	K.3	K.0	K.7	1.4	1.6	...	2.4	2.7	...	3.8	3.1
77	...	...	K.1	...	...	...	2.3	2.5	2.8	3.4	3.9	3.2
78	...	K.4	K.2	K.8	1.5	1.7	2.4	...	2.9	3.5	4.0	3.3-3.4
79	...	...	K.3	K.9	1.6	1.8	...	2.6	3.0	3.6	...	3.5
80	...	K.5	...	1.0	...	1.9	2.5	2.7	3.1	3.7	4.1	3.6-3.7
81	...	...	K.4	...	1.7	2.0	2.6	2.8	3.2	...	4.2	3.8
82	...	K.6	K.5	1.1	1.8	...	...	2.9	...	3.8	4.3	3.9
83	...	...	K.6	1.2	...	2.1	2.7	...	3.3	3.9	4.4	4.0-4.1
84	...	K.7	K.7	...	1.9	2.2	2.8	3.0	3.4	4.0	4.5	4.2
85	...	...	...	1.3	...	2.3	...	3.1	3.5	4.1	...	4.3
86	...	K.8	K.8	1.4	2.0	...	2.9	3.2	3.6	...	4.6	4.4-4.5
87	...	...	K.9	1.5	2.1	2.4	3.0	3.3	3.7	4.2	4.7	4.6
88	...	K.9	1.0	...	...	2.5	...	...	3.8	4.3	4.8	4.7
89	...	...	...	1.6	2.2	2.6	3.1	3.4	...	4.4	4.9	4.8-4.9
90	...	1.0	1.1	1.7	2.3	...	3.2	3.5	3.9	4.5	...	5.0
91	K.0	...	1.2	1.8	...	2.7	...	3.6	4.0	...	5.0	5.1-5.2
92	K.1	1.1	1.3	...	2.4	2.8	3.3	3.7	4.1	4.6	5.1	5.3
93	K.2	...	1.4	1.9	2.5	2.9	3.4	...	4.2	4.7	5.2	5.4
94	K.3	1.2	...	2.0	...	...	...	3.8	4.3	4.8	5.3	5.5-5.6
95	K.4	...	1.5	...	2.6	3.0	3.5	3.9	...	4.9	...	5.7
96	K.5	1.3	1.6	2.1	2.7	3.1	3.6	4.0	4.4	5.0	5.4	5.8

See footnote at end of table.

Table 14. Grade equivalents of standard scores on the combined Reading and Arithmetic subtests of the Wide Range Achievement Test, for children, 6-11 years, by 6-month-age intervals: United States, 1963-65—Con.

Standard score[1]	Age in months											
	72-77	78-83	84-89	90-95	96-101	102-107	108-113	114-119	120-125	126-131	132-137	138-143
	Grade equivalents											
97	K.6-.7	1.4	1.7	2.2	...	3.2	...	...	4.5	...	5.5	5.9-6.0
98	K.8	...	1.8	2.3	2.8	3.3	3.7	4.1	4.6	5.1	5.6	6.1
99	K.9	1.5	...	...	2.9	...	3.8	4.2	4.7	5.2	5.7	6.2-6.3
100	1.0	...	1.9	2.4	...	3.4	...	4.3	4.8	5.3	5.8	6.4
101	1.1	1.6	2.0	2.5	3.0	3.5	3.9	4.4	4.9	5.4	...	6.5
102	1.2	...	2.1	...	3.1	3.6	4.0	...	...	...	5.9	6.6-6.7
103	1.3	1.7	2.2	2.6	...	...	...	4.5	5.0	5.5	6.0	6.8
104	1.4-1.5	...	...	2.7	3.2	3.7	4.1	4.6	5.1	5.6	6.1	6.9
105	1.6	1.8	2.3	2.8	3.3	3.8	4.2	4.7	5.2	5.7	6.2	7.0-7.1
106	1.7	...	2.4	...	...	3.9	...	4.8	5.3	5.8	...	7.2
107	1.8	1.9	2.5	2.9	3.4	...	4.3	...	5.4	...	6.3	7.3-7.4
108	1.9	...	2.6	3.0	3.5	4.0	4.4	4.9	...	5.9	6.4	7.5
109	2.0	2.0	...	...	...	4.1	...	5.0	5.5	6.0	6.5	7.6
110	2.1	...	2.7	3.1	3.6	4.2	4.5	5.1	5.6	6.1	6.6	7.7-7.8
111	2.2-2.3	2.1	2.8	3.2	...	...	4.6	5.2	5.7	6.2	...	7.9
112	2.4	...	2.9	3.3	3.7	4.3	...	...	5.8	...	6.7	8.0
113	2.5	2.2	3.0	...	3.8	4.4	4.7	5.3	5.9	6.3	6.8	...
114	2.6	...	...	3.4	...	4.5	4.8	5.4	6.0	6.4	6.9	...
115	2.7	2.3	3.1	3.5	3.9	...	...	5.5	...	6.5	7.0	...
116	2.8	...	3.2	...	4.0	4.6	4.9	5.6	6.1	6.6	7.1	...
117	2.9	2.4	3.3	3.6	...	4.7	5.0	...	6.2	...	...	...
118	3.0	...	3.4	3.7	4.1	4.8	...	5.7	6.3	6.7	7.2	...
119	...	2.5	...	3.8	4.2	4.9	5.1	5.8	6.4	6.8	7.3	...
120	...	...	3.5	...	...	...	5.2	5.9	6.5	6.9	7.4	...
121	...	2.6	3.6	3.9	4.3	5.0	...	...	...	7.0	7.5	...
122	...	...	3.7	4.0	4.4	...	5.3	6.0	6.6	...	...	...
123	...	2.7	3.8	...	...	...	5.4	...	6.7	7.1	7.6	...
124	...	...	...	...	4.5	...	...	...	6.8	7.2	7.7	...
125	...	2.8	3.9	...	4.6	...	5.5	...	6.9	7.3	7.8	...
126	...	...	4.0	...	...	...	5.6	...	7.0	7.4	7.9	...
127	...	2.9	...	...	4.7	...	...	...	7.1	7.5	...	...
128	...	...	...	...	4.8	...	5.7	...	...	...	8.0	...
129	...	3.0	...	...	...	...	5.8	...	7.2	7.6	...	...
130	...	...	...	...	4.9	...	...	...	7.3	7.7	...	...
131	...	...	...	...	5.0	...	5.9	...	7.4	7.8	...	...
132	...	...	...	...	...	...	6.0	...	7.5	7.9	...	...
133	...	...	...	...	...	...	...	...	7.6	...	...	...
134	...	...	...	...	...	...	...	...	...	8.0	...	...
135	...	...	...	...	...	...	...	...	7.7	...	...	...
136	...	...	...	...	...	...	...	...	7.8	...	...	...
137	...	...	...	...	...	...	...	...	7.9	...	...	...
138	...	...	...	...	...	...	...	...	8.0	...	...	...

[1]Mean of 100 and standard deviation of 15.

Table 15. Percentile equivalents for normalized and actual standard scores[1] on the combined Reading and Arithmetic subtests of the Wide Range Achievement Test, for children, 6-11 years, by sex and age: United States, 1963-65

Sex and percentile	Normalized standard scores[2]	Total, 6-11 years	Age in years					
			6	7	8	9	10	11
	Standard score							
Both sexes								
99	135	130	138	126	132	131	130	127
98	131	126	132	124	128	126	127	125
97	128	124	129	122	124	124	125	124
96	126	123	126	121	122	121	123	122
95	125	121	125	120	121	120	122	122
90	119	117	118	117	116	116	117	118
85	116	114	115	114	114	114	114	116
80	113	112	112	112	112	111	112	113
75	110	110	109	110	110	110	110	111
70	108	108	107	108	108	108	109	109
65	106	106	105	106	106	106	107	107
60	104	105	104	105	105	105	105	105
55	102	103	102	103	104	103	103	103
50	100	101	100	102	102	102	101	101
45	98	100	99	100	100	101	100	100
40	96	99	98	99	100	100	98	98
35	94	97	96	98	98	98	96	97
30	92	95	94	96	95	96	94	94
25	90	93	92	94	93	94	93	92
20	87	90	90	91	90	92	90	90
15	84	87	86	88	87	88	87	86
10	81	82	82	81	83	82	83	83
5	75	74	76	74	74	74	75	74
4	74	73	75	72	72	72	73	72
3	72	69	72	67	69	67	71	69
2	69	65	69	62	64	63	67	64
1	65	58	64	52	58	52	60	57
Boys								
99	135	131	138	125	134	134	128	127
98	131	127	133	123	129	127	127	124
97	128	124	130	121	123	125	125	123
96	126	123	126	120	122	122	124	122
95	125	122	125	120	120	121	123	122
90	119	117	118	116	116	116	118	118
85	116	114	114	114	113	113	114	116
80	113	111	111	112	110	110	111	112
75	110	109	109	109	108	108	110	110
70	108	107	107	107	107	106	108	108
65	106	105	105	105	105	105	106	106
60	104	104	103	104	104	103	104	104
55	102	102	101	102	102	102	102	102
50	100	100	100	100	100	100	101	101
45	98	99	98	100	99	100	99	99

[1]Mean of 100 and standard deviation of 15.

[2]Abcissa x/σ for the areas under the normal curve corresponding to the percentiles.

Table 15. Percentile equivalents for normalized and actual standard scores[1] on the combined Reading and Arithmetic subtests of the Wide Range Achievement Test, for children, 6-11 years, by sex and age: United States, 1963-65—Con.

Sex and percentile	Normalized standard scores[2]	Total, 6-11 years	Age in years					
			6	7	8	9	10	11
	Standard score							
Boys—Con.								
40	96	98	96	98	97	99	98	97
35	94	96	94	97	95	97	95	95
30	92	93	92	95	93	94	94	93
25	90	91	91	92	91	92	91	90
20	87	89	89	90	88	89	88	87
15	84	85	85	86	85	85	85	84
10	81	80	81	80	80	78	81	80
5	75	73	77	73	72	72	74	72
4	74	71	76	67	70	69	72	70
3	72	67	74	63	64	66	67	66
2	69	63	68	56	59	62	64	59
1	65	54	65	46	56	52	46	55
Girls								
99	135	131	138	129	132	128	131	127
98	131	127	132	125	126	124	126	126
97	128	124	129	124	124	122	123	124
96	126	123	126	123	122	121	121	122
95	125	121	124	122	121	120	120	122
90	119	117	119	118	117	117	116	118
85	116	115	115	115	115	114	114	116
80	113	113	112	113	112	112	112	114
75	110	111	110	111	110	110	111	112
70	108	109	107	110	109	109	109	110
65	106	107	105	108	108	107	107	108
60	104	106	104	106	106	106	105	106
55	102	104	102	104	105	105	104	105
50	100	103	101	103	104	104	102	102
45	98	101	100	102	102	102	100	101
40	96	100	99	101	101	101	99	100
35	94	99	97	99	100	100	97	98
30	92	97	95	97	98	98	95	96
25	90	94	93	95	96	96	94	94
20	87	92	91	93	93	94	92	91
15	84	89	88	89	90	90	88	88
10	81	85	83	84	85	86	85	84
5	75	77	76	76	77	76	79	80
4	74	75	74	74	74	75	76	77
3	72	72	70	71	72	71	73	74
2	69	68	69	67	68	64	71	67
1	65	62	63	59	64	54	68	64
	χ^2							
Both sexes	-	-	0.51	6.54	2.87	5.85	1.64	3.12

[2] χ^2 is approximate test for normality of distribution. Chi-square value for the 5-percent probability level, 38.9, and for 1-percent level, 45.6.

APPENDIX I

WIDE RANGE ACHIEVEMENT TEST

Reading, Spelling, Arithmetic from Pre-School to College

By J. F. Jastak and S. W. Bijou

Copyright, 1963
Printed in U.S.A.

1937, 1946
Revised Edition
1963

Name . . . . . .Birthdate. . . . . .M.F. Chron. Age . . . . . .

Page 2. Arithmetic[1]
LEVEL I, Oral Part

5 Fingers, 6 fingers, 7 or 5? 24 or 82?

4 pennies, spent 1?_____; 3 and 2 apples?_____; 7 marbles, lose 4?_____

Written part.

2 + 2 = _____	4	5	23	3 x 1 = _____	23	49	57
3 - 1 = _____	+2	-2	42		x 2	-27	÷ 6
			+10				

Arithmetic—Level I—Grade Norms. Percentiles and quotients corresponding to grade rating and age may be found in the Manual.

Score	Grade	Score	Grade	Score	Grade	Score	Grade	Score	Grade	Score	Grade	Score	Grade	Score	Grade
0-2	Nursery	13	0.6	20	1.7	27	3.0	34	5.0	41	6.3	48	8.7	55	12.9
3-7	Prekg	14	0.8	21	1.9	28	3.3	35	5.2	42	6.6	49	9.2	56	13.3
8	0.1 Kg	15	0.9	22	2.1	29	3.6	36	5.3	43	6.8	50	9.7	57	14.2
9	0.2	16	1.0 Gr.	23	2.3	30	3.9	37	5.5	44	7.0	51	10.2	58	15.2
10	0.3	17	1.2	24	2.4	31	4.2	38	5.7	45	7.3	52	10.8		
11	0.4	18	1.3	25	2.6	32	4.5	39	5.9	46	7.7	53	11.5		
12	0.5	19	1.5	26	2.8	33	4.8	40	6.1	47	8.2	54	12.2		

Page 4. Reading[1]
LEVEL I

A C B I O T R F D S

Hot at saw cook gig ate were blue her cart close

when hen down play vase sleep area count tip clock

Percentiles and quotients corresponding to grade rating and age may be found in the Manual.

Level I—Reading—Grade Norms

Score	Grade	Score	Grade	Score	Grade	Score	Grade	Score	Grade	Score	Grade
0-2	Nursery	26	1.2	46	2.5	60	4.2	73	6.8	86	10.4
3-8	Prekg	27-28	1.3	47-48	2.6	61	4.3	74	6.9	87	10.8
9-10	0.1 Kg	29	1.4	49	2.7	62	4.5	75	7.1	88	11.1
11	0.2	30-31	1.5	50	2.8	63	4.7	76	7.2	89	11.4
12-13	0.3	32	1.6	51	2.9	64	4.9	77	7.4	90	11.7
14	0.4	33-34	1.7	52	3.0	65	5.1	78	7.7	91	12.1
15-16	0.5	35-36	1.8	53	3.2	66	5.3	79	8.0	92	12.5
17	0.6	37	1.9	54	3.4	67	5.5	80	8.3	93	12.9
18-19	0.7	38-39	2.0	55	3.6	68	5.7	81	8.7	94	13.3
20	0.8	40-41	2.1	56	3.7	69	6.0	82	9.0	95	13.7
21-22	0.9	42	2.2	57	3.8	70	6.2	83	9.3	96	14.1
23	1.0 Gr	43	2.3	58	3.9	71	6.4	84	9.7	97	14.5
24-25	1.1	44-45	2.4	59	4.1	72	6.6	85	10.0	98	15.0

[1]Items similar but not identical to some of those in test.

APPENDIX II

STATISTICAL NOTES

The Survey Design

The sample design for the second cycle of the Health Examination Survey, similar to the one used for the first cycle, was that of a multistage, stratified probability sample of loose clusters of persons in land-based segments. Successive elements dealt with in the process of sampling are the primary sampling unit (PSU), census enumeration district (ED), segment, household, eligible child (EC), and the sample child (SC).

At the first stage, the nearly 2,000 PSU's into which the United States (including Hawaii and Alaska) had been divided and then grouped into 357 strata for use in the Current Population Survey and Health Interview Survey were further grouped into 40 superstrata for use in Cycle II of the Health Examination Survey. The average size of each Cycle II stratum was 4.5 million persons, and all fell between the limits of 3.5 and 5.5 million. Grouping into 40 strata was done in a way that maximized homogeneity of the PSU's included in each stratum, particularly with regard to the degree of urbanization, geographic proximity, and degree of industrialization. The 40 strata were classified into four broad geographic regions (each with 10 strata) of approximately equal population and cross-classified into four broad population density groups (each having 10 strata). Each of the 16 cells contained either two or three strata. A single stratum might include only one PSU (or only part of a PSU as, for example, New York City, which represented two strata) or several score PSU's.

To take account of the possible effect that the rate of population change between the 1950 and 1960 census might have had on health, the 10 strata within each region were further classified into four classes ranging from those with no increase to those with the greatest relative increase. Each such class contained two or three strata.

One PSU was then selected from each of the 40 strata. A controlled selection technique was used in which the probability of selection of a particular PSU was proportional to its 1960 population. In the controlled selection an attempt was also made to maximize the spread of the PSU's among the States. While not every one of the 64 cells in the 4x4x4 grid contributes a PSU to the sample of 40 PSU's, the controlled selection technique ensured the sample's matching the marginal distributions in all three dimensions and being closely representative of all cross-classifications.

Generally, within a particular PSU, 20 ED were selected with the probability of selection of a particular ED proportional to its population in the age groups 5-9 years in the 1960 census, which by 1963 roughly approximated the population in the target age group for Cycle II. A similar method was used for selecting one segment (clusters or households) in each ED. Each of the resultant 20 segments was either a bounded area or a cluster of households (or addresses). All of the children in the age range properly resident at the address visited were EC. Operational considerations made it necessary to reduce the number of prospective examinees at any one location to a maximum of 200. The EC to be excluded for this reason from the SC group was determined by systematic subsampling.

The total sample included 7,417 children in the 6-11 age group with approximately 1,000 in each of the single years of age from 25 different States.

Reliability

Measurement processes employed in the survey were highly standardized and closely controlled. Of course, this does not mean that the correspondence between the real world and the survey results is exact. Data from the survey are imperfect for three major reasons: (1) results are subject to sampling error, (2) the actual conduct of a survey never agrees perfectly with the design, and (3) the measurement processes themselves are inexact even though standardized and controlled.

The first report on Cycle II [4] describes in detail the faithfulness with which the sample design was carried out. It notes that out of the 7,417 sample children, the 7,119 who were examined—a response rate of 96 percent—gave evidence that they were a highly representative sample of children of this age in the noninstitutional population of the United States.

The age distribution of the examinees by 6-month age intervals is as follows:

Age in months	*Number of examinees*
72-77	545
78-83	566
84-89	632
90-95	609
96-101	610
102-107	621
108-113	586
114-119	598
120-125	585
126-131	575
132-137	567
138-143	625

The response levels for the various demographic subgroups—including those for age, sex, race, region, population density, parents' educational level, and family income—show no marked differentials. Hence, it appears unlikely that nonresponse could bias the findings much in these respects.

Measures used to control the quality of the data from this survey in general have been cited previously;[4] those relating specifically to the Wide Range Achievement Test are outlined in an earlier section of this report.

Data recorded for each sample child are inflated in the estimation process to characterize the larger universe of which the sample child is representative. The weights used in this inflation process are a product of the reciprocal of the probability of selecting the child, an adjustment for nonresponse cases, and a poststratified ratio adjustment which increases precision by bringing survey results into closer alignment with known U.S. population figures by color and sex within single years of age 6-11.

In the second cycle of the Health Examination Survey the sample was the result of three stages of selection—the single PSU from each stratum, the 20 segments from each sample PSU, and the sample children from the eligible children. The probability of selecting an individual child is the product of the probabilities of selection at each stage.

Since the strata are roughly equal in population size and a nearly equal number of sample children were examined in each of the sample PSU's, the sample design is essentially self-weighting with respect to the target population; that is, each child 6-11 years had about the same probability of being drawn into the sample.

The adjustment upward for nonresponse is intended to minimize the impact of this factor on final estimates by imputing to nonrespondents the characteristics of "similar" respondents. Here "similar" respondents were judged to be examined children in a sample PSU having the same age (in years) and sex as children not examined in that sample PSU.

The poststratified ratio adjustment used in the second cycle achieved most of the gains in precision which would have been attained if the sample had been drawn from a population stratified by age, color, and sex and makes the final sample estimates of population agree exactly with independent controls prepared by the Bureau of the Census for the noninstitutional population of the United States as of August 1, 1964 (approximate midsurvey point) by color and sex for each single year of age 6-11. The weights of every responding sample child in each of the 24 age, color, and sex classes is adjusted upwards or downwards so that the weighted total within the class equals the independent population control.

In addition to children not examined at all, there were some whose examination was incomplete in one procedure or another. The extent of missing data for the Wide Range Achievement Test is shown in table I. The 89 children with missing Wide Range Achievement Tests included 41 who were not tested because of the time limitations of the examination, four who refused testing, and 44 for whom one or both test parts were considered invalid. For each of these 89 children a respondent of the same age-sex-race group with similar findings on related parts of the examination, insofar as these were available, was selected at random and his results for the test or tests assigned to the unexamined person. Theoretically this controlled selection technique would minimize the error introduced by the estimate and result in a negligible reduction in variance.

Sampling and Measurement Error

In the present report, reference has been made to efforts to minimize bias and variability of measurement technique.

The probability design of the survey makes possible the calculation of sampling errors. The sampling error is used here to determine how imprecise the survey test results may be because they come from a sample rather than from the measurement of all elements in the universe.

The estimation of sampling errors for a study of the type of the Health Examination Survey is difficult for at least three reasons: (1) measurement error and "pure" sampling error are confounded in the data—it is not easy to find a procedure which will either completely include both or treat one or the other separately, (2) the survey design and estimation procedure are complex and accord-

Table I. Missing or unusable Wide Range Achievement Tests, by age: Health Examination Survey, 1963-65

Age	One or more test parts missing	Reading subtest only missing		Arithmetic subtest only missing		Both subtests missing	
	Both sexes	Boys	Girls	Boys	Girls	Boys	Girls
Total, 6-11 years	89	10	10	3	3	26	37
6 years	23	2	2	-	-	8	11
7 years	14	4	-	-	-	2	8
8 years	15	1	2	1	-	3	8
9 years	12	-	3	1	-	4	4
10 years	16	2	2	-	2	7	3
11 years	9	1	1	1	1	2	3

ingly require computationally involved techniques for the calculation of variances, and (3) from the survey are coming thousands of statistics, many for subclasses of the population for which there are a small number of cases. Estimates of sampling error are obtained from the sample data and are themselves subject to sampling error which may be large when the number of cases in a cell is small or even occasionally when the number of cases is substantial.

Estimates of approximate sampling variability for selected statistics used in this report are presented in tables II and III. These estimates have been prepared by a replication technique which yields overall variability through observation of variability among random

Table II. Relative Sampling errors for average Reading scores on the Wide Range Achievement Test, for children, 6-11 years of age, by grade in school, sex, and age: United States, 1963-65

Sex and age	Total, all grades	Grade in school								
		Kindergarten	1	2	3	4	5	6	7	Special class[1]
Both sexes										
Total, 6-11 years	.47	1.93	1.17	.62	.57	.61	.35	.58	1.00	1.91
Boys										
Total, 6-11 years	.53	3.46	1.12	.81	.62	.63	.43	.62	1.50	2.31
6 years	.66	3.51	.94	1.35	-	-	-	-	-	5.36
7 years	.93	18.38	1.77	.94	2.08	-	-	-	-	7.59
8 years	.77	-	2.56	1.56	.76	.98	-	-	-	6.95
9 years	.57	-	12.56	4.23	1.33	.70	1.30	-	-	4.26
10 years	.91	-	7.77	15.33	1.49	1.66	.65	1.42	-	5.84
11 years	.53	-	-	14.95	6.76	2.99	1.24	.71	1.50	4.78
Girls										
Total, 6-11 years	.46	.88	1.31	.63	.63	.75	.54	.87	1.22	3.04
6 years	.73	.88	1.06	1.24	-	-	-	-	-	9.49
7 years	.51	-	2.01	.52	1.11	-	-	-	-	29.46
8 years	.65	-	6.28	1.79	.59	.66	-	-	-	9.62
9 years	.61	-	11.76	9.24	1.86	.62	1.73	-	-	7.26
10 years	.94	-	-	19.83	2.23	2.28	.51	4.00	45.96	5.46
11 years	.69	-	-	7.07	16.15	1.49	1.89	.53	1.22	6.40

[1]Ungraded.

Table III. Relative Sampling errors for average Arithmetic raw scores on the Wide Range Acheivement Test for children, 6-11 years of age, by grade in school, sex, and age: United States, 1963-65

Sex and age	Total, all grades	Grade in school								
		Kindergarten	1	2	3	4	5	6	7	Special class[1]
Both sexes										
Total, 6-11 years--	.23	.50	.39	.28	.29	.25	.33	.37	.87	1.01
Boys										
Total, 6-11 years--	.27	.68	.43	.29	.32	.28	.37	.51	1.10	1.36
6 years----------	.29	.70	.33	.42	-	-	-	-	-	3.73
7 years----------	.39	13.43	.91	.32	.27	-	-	-	-	3.63
8 years----------	.22	-	1.61	.37	.35	.30	-	-	-	3.24
9 years----------	.34	-	8.38	1.92	.37	.33	.46	-	-	2.02
10 years----------	.45	-	6.36	10.08	.80	.49	.40	.85	-	3.95
11 years----------	.32	-	-	9.76	2.01	.89	.69	.53	1.10	2.43
Girls										
Total, 6-11 years--	.20	.60	.39	.30	.34	.26	.35	.39	.92	1.40
6 years----------	.33	.60	.34	.49	-	-	-	-	-	5.43
7 years----------	.28	-	.86	.25	.37	-	-	-	-	17.43
8 years----------	.26	-	2.34	.50	.27	.42	-	-	-	5.59
9 years----------	.19	-	5.94	5.88	.70	.20	.51	-	-	2.27
10 years----------	.28	-	-	9.53	.77	.61	.37	.86	26.87	2.55
11 years----------	.38	-	-	4.94	8.12	.50	.73	.42	.93	5.40

[1]Ungraded.

subsamples of the total sample. This method reflects both "pure" sampling variance and a part of the measurement variance.

In accordance with usual practice, the interval estimate for any statistic may be considered the range within one standard error of the tabulated statistic, with 68 percent confidence; or the range within two standard errors of the tabulated statistic, with 95 percent confidence. The latter is used as the level of significance in this report.

An overestimate of the standard error of a difference $d=\underline{x}-\underline{y}$ of two statistics $\underline{x}$ and $\underline{y}$ is given by the formula $S_d=(S_x^2 + S_y^2)^{1/2}$ where S_x and S_y are the sampling errors, respectively, of $\underline{x}$ and $\underline{y}$, as shown in tables II and III.

Small Categories

In some tables, magnitudes are shown for cells for which the sample size is so small that the sampling error may be several times as great as the statistic itself. Obviously in such instances the statistic has no meaning in itself except to indicate that the true quantity is small. Such numbers, if shown, have been included in the belief that they may help to convey an impression of the overall story of the table.

Standard Scores

The following formula was used for computing the standard scores (SS) shown in this report:

$$SS_i = 1/s_{x_i}(15)(x-\bar{x}_i) + 100$$

where in tables 9 and 10 s_{x_i} is the standard deviation of the raw scores in the ith age interval, $\bar{x}_i$ is the arithmetic average or mean raw score in that age interval (both derived from the inflated sample) and x is the raw score for which the standard score is being derived. In table 13, the standard deviations and means used are from the distribution of the combined Reading and Arithmetic standard scores for the weighted sample.

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