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THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report

of

Committee on Examination

This is to certify that we the undersigned, as a committee of the Graduate School, have given Willis Ernest Johnson final oral examination for the degree of Master of Arts . We recommend that the degree of Master of Arts be conferred upon the candidate.

Minneapolis, Minnesota

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L D Coffman
Chairman

Walter R. Swift

A. W. Rankin

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THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report

of

Committee on Thesis

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by Willis Ernest Johnson for the degree of Master of Arts.
They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota, and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts.

L D Coffman
Chairman

M J Vanlongenen

[illegible]

1918

THE FORMULATION OF STANDARDS OF EDUCATIONAL ACHIEVEMENTS FOR A STATE

by

WILLIS E. JOHNSON

Submitted in Partial Fulfillment
of the Requirements for the Degree
of Master of Arts in Education.
University of Minnesota
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Contents

I. Introduction

The present study was undertaken solely as an effort to co-operate with the more progressive superintendents and principals in South Dakota cities and towns for the better understanding of their school conditions with a view to bettering them. From its inception the writer had no thought of receiving scholastic recognition for the study and research. Indeed, this idea came only after the work was well under way and most of the tests had been given.

In standard scales and tests the educator of today has instruments for diagnosing educational situations. By using some of the best understood and most thoroughly standardized of these tests the writer wished to find answers to these four questions:

1. How well can the children in the elementary grades of the city and town schools of South Dakota read?

2. How rapidly and accurately do these children perform the four fundamental operations in arithmetic?

3. How proficient are they in spelling?

4. How well can they write and what is the speed at which they write?

These questions have been answered with a very high degree of accuracy. Innumerable other problems connect themselves with the solution of those enumerated as will appear in the following pages. Numerous comparisons are possible now that these fundamental outcomes are known.

While the writer takes some pride in the completion of the present task he is overwhelmed with a keen realization of the fact that

the real problem of betterment is still for the future. He recognizes that this study is only a small beginning on a small area of the illimitable school field. It is his hope that he may have an opportunity to pursue the study for years to come with the same purposes as those which prompted this one.

The writer wishes to acknowledge a deep debt of gratitude to Dean Lotus D. Coffman of the University of Minnesota for pointing out not only methods for solving this big and challenging problem but also for the suggestion that a close analysis of the processes involved would constitute a worthy contribution to the science of education. It has been the author's privilege to have had the personal counsel of the authors of the standard tests and scales used, Dr. M. E. Haggerty, Dr. Leonard P. Ayres and Mr. S. A. Courtis, and to them he feels personally grateful. To Professor Van Wagenen of the College of Education, University of Minnesota, and to Professor C. C. Stech and Professor Harry N. Fitch of the department of education of the Northern Normal and Industrial School the author is indebted for many valuable suggestions as to details in plan and method. The writer also wishes to acknowledge his indebtedness to Mrs. Leroy Crawford, Mr. Clayton Schmidt and to a score or more upper class students of the Northern Normal and Industrial School for many hours spent in assisting in the countless scorings and computations which this undertaking has involved. While the co-operating superintendents and principals and their hundreds of teachers may be thought of as the prime beneficiaries of this study, without their hearty co-operation the project would have been impossible.

II. The Problem

The problem, in brief, is to ascertain what standards of educational accomplishment actually obtain in the elementary grades of town and city schools of South Dakota. This problem involves a study of the methods of obtaining reliable data and a carefully worked out plan of obtaining the data. This, in turn, is based upon problems of statistical methods and of standardized educational tests and measurements. Finally come the problems of the organization of the data in tabulated, comparative and graphic forms and the testing and demonstration of these data for reliability. Reliable conclusions may then safely be derived and confidently submitted to the teachers of the state. These measures of present efficiency will constitute temporary goals of achievement for schools that fall short of the median standards and points for advance for the schools that are above the standard.

III. The Outcomes

What may we expect from a research of this kind? "What's the use?" These omnipresent questions need to be answered in definite terms. The following are set as objectives and outcomes to be realized through this study.

1. A means of raising standards. Definite knowledge of actual conditions must precede intelligently directed progress. There can be no such thing in education as the complete realization of aims; a new goal is always projected from the one already attained. To learn in definite, objective terms what attainments have been made is to obtain a vantage ground for projecting plans for further progress. This is particularly true when it is discovered that the pupils are short of the attainment of the majority in the same grades.

2. The improvement of methods of instruction. The ultra conservative criticise modern educational measurements on the ground that they are simply diagnostic. They are not prescriptive. They reveal the disease but not the remedy. There is a measure of truth in this criticism. Prescription, however, is based upon diagnosis. Definite knowledge of the existing pathology is the sine qua non for intelligently directed remedy. To know where weakness exists is to know where to place emphasis. In most cases a remedy is immediately suggested.

3. A better time distribution. The appraisal of attainments and a knowledge of their distribution suggests immediately points for maximal and minimal stress. A most cursory glance at comparative standards reveals the fact that some elements of attainment are being sacrificed at the expense of more desirable ones.

4. A check on teacher efficiency. This is a mediate outcome. The present study is of a confidential nature and protects the inefficient school and inefficient teacher from public criticism. The data, however, are at hand for such an appraisement and the way is pointed out for an ultimate check on teacher efficiency.

5. The types and modes of distribution and variability. Under this head is grouped a number of outcomes of far reaching significance. Several kinds of arithmetical abilities are patently revealed in the simple Courtis tests. There are several kinds of spelling abilities and reading abilities. Even the objective outcomes of handwriting reveal several kinds of attainments, one pupil's handwriting showing legibility but not uniformity or beauty, another showing a marked degree of beauty with a low degree of legibility, a third sacrificing quality for speed, etc. The high percentage of variability in attainments in certain schools suggests a searching for the causes in faulty gradation, irregularity of attendance, variability of extra-school surroundings, poor teaching methods, etc. Indeed, the whole gamut of educational factors is opened to re-examination.

6. A stimulus to interest. Comparisons may some times be odious but they are usually stimulating. Not only are comparisons of schools made possible but comparisons of attainments are also possible. The former may be said to stimulate emulation and the latter to suggest elimination. It is the almost invariable experience that these studies when properly conducted cause the teachers and pupils to take a marked interest in their work and in the processes of learning. The latter is a most desirable outcome if not carried too far. When the teacher asks herself, "Why are my pupils inaccurate in adding," or the pupils ask of themselves a similar question, there is hope for immediate improvement. The most universal type of school motivation is superinduced, the desire for progress.

IV. Other Studies of a Similar Nature.

In 1893 a series of articles on "The American Public School" by J. M. Rice appeared in The Forum[1]. They purported to be word pictures of actual teaching in some of the schools of certain cities in the United States with the author's scathing criticisms. A few years later Dr. Rice conceived the idea of giving the same tests in arithmetic and spelling in various schools and succeeded in accumulating much interesting data. This seems to have been the beginning of the modern movement in education in deriving standard tests and scales and in using them to evaluate teaching conditions and achievements. In 1908 C. W. Stone[2] took up a similar problem in a more systematic manner. S. A. Courtis[3] then started his work upon his now famous tests in the four fundamentals in arithmetic. In 1910 E. L. Thorndike[4] developed his handwriting scale.

Since that time a great many standard scales and tests have been derived, covering practically all subjects of the elementary and high school. The value of these instruments of evaluation and appraisal of school work is inestimable.

In 1910 the first definitely planned school survey[5] was undertaken in the city of Boise, Idaho. During the next year a survey[6] of the schools of New York City was begun and in this survey the Courtis arithmetic tests were employed. Since this time a great many surveys have been made and standard tests and scales have been employed more and more in these surveys.

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1 The Forum, Vol. XIV Nos. p. 145 et seq.
2 Stone, C. W., "Arithmetical Abilities and Some Factors Determining Them." Columbia University Contributions to Education (1908).
3 Courtis, S. A., "The Courtis Standard Tests in the Three R's. (1914).
4 Thorndike, E. L., "Handwriting" (1916).
5 Van Sickle, J. H., "Progress in City School Systems," in Report of Commissioner of Education (1913). Vol. I, p. 109.
6 Supra, (1914) Vol. I, p. 39.

Two types of surveys are undertaken. One is an intensive study of some one school system, the other is an extensive study of the work being done in certain subjects in many systems. As this investigation is of the latter type we may note a few examples more in detail.

One of the first thoroughgoing studies of a character similar to the present one was undertaken under the direction of M. E. Haggerty[1] in Indiana in 1914. A comparative study of arithmetic abilities among the elementary school pupils in twenty cities was made, using the Courtis tests.

Tests were given in the 5th, 6th, 7th and 8th grades. Information was also obtained as to when the children taking the tests had begun the study of arithmetic and the total school time devoted to the subject.

A detailed tabulation was made of the number of attempts (speed) and rights (accuracy) of each operation (addition, subtraction, multiplication and division) of each grade of each city, both in gross numbers and in per cents, with medians and variabilities. These data were also graphed. Tables showing the ranking of the grades of each city in attempts and rights and the total rankings were also given. An attempt to ascertain the optimum period for beginning arithmetic and the optimum period to be devoted to it were also made from a study of the tables showing the distribution of the times for beginning the study and the times devoted to it in comparison with the records of achievement of the children. Some rather startling results appeared in the tables. Some grades showing superior ability were devoting much less time to the subject than other grades which showed poorer ability. The fact that the test covered only the four fundamental operations, whereas the time reported covered all other arithmetical operations as well, prevented any very decisive conclusions.

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1 Haggerty, M. E. "Arithmetic: A Co-operative Study in Educational Measurements" (1915). Indiana University Bulletin Vol. XII, No. 18.

Among other somewhat similar surveys are those of Ashbaugh[1], Bobbitt[2] and Judd[3].

This study follows, in the main, the methods used in the foregoing surveys. It differs only in the kinds of tests and scales used and in the extent of the application of them, being more in kind and greater in extent (number of towns and cities) than most other similar undertakings.

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1 Ashbaugh, E. J., "The Arithmetical Skill of Iowa School Children". University of Iowa Extension Bulletin No. 24, (1916).
2 Bobbitt, J. F., "The Illinois Survey." (1917), p. 223.
3 Judd, C. H., "Measuring the Work of the Public Schools" (1916).

V. Method of Procedure.

1. Derivation of standard scales and tests. A detailed examination of the methods of deriving a standard test or scale does not concern this study excepting that the principles involved must be understood, rightly to interpret the data derived from the giving of the tests.

Uniformity of procedure with uniform material, and results from large numbers of children are essential to the standardization of a test or scale. This briefly summarizes the principles observed by Ayres in deriving the spelling and writing scales used, by Courtis in deriving the arithmetic tests and by Haggerty in revising the Thorndike reading test.

2. Securing of data. The custom which has obtained in this study and in studies of a similar nature to this has been as follows:

a. Tests are sent to co-operating teachers with full printed instructions as to the giving and tabulating of the tests.

b. Score sheets together with all test papers are received.

c. Scoring of individual papers is checked and tested for accuracy and rescoring made when necessary. Tabulated returns are corrected when necessary.

3. Tabulating and graphing of data.

4. Statistical methods involved. The classification and interpretation of the data are based upon certain accepted statistical methods. The definitions, explanations and formulae employed in this study are as follows:

a. Median. This is the point above and below which are found an equal number of cases. In determining this point the formula used by Whipple[1] was followed in computing the spelling medians.

Formula: $M = \frac{N+1}{2}$

1 Whipple, Guy Montrose, "Simple Processes," p.15.

After the appearance in the Seventeenth Year Book, Part II, pp. 121-2, the National Society for the Study of Education, of Buckingham's arguments for the formula $M = \frac{N}{2}$, the latter was adopted for the remaining computations. The method of computing the median is explained in following pages. (83-5)

Intervals of distribution are interpreted by the method used by Courtis[1]. If the measures are 1, 2, 3, etc. the interval is interpreted as extending from 1 to 1.9; from 2 to 2.9, etc.

b. Variability. In computing variability the measures "median deviation" and "percentage of variability" are employed.

Median deviation is the median of the deviates of the several measures in the distribution from their median or central tendency. Where distributions are normal this is the probable error.

Percentage of variability is the measure of variability (median deviation) divided by the central tendency (median).

The quartile range is explained on following pages. [83-5]

c. Correlation. The principle was adopted that calculations should not be refined beyond the accuracy which their original measures would warrant.[2] The method employed for calculating correlations was the rank difference method: $P = 1 - \frac{6 \Sigma D^2}{n(n^2 - 1)}$. r is found from table.[3] No r is considered as entitled to scientific consideration unless it is $\geq$ 3 P. E.[4]

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1 Courtis: "Standard Tests," Folder D, Series B, p. 8. See 1. below.
2 Strayer and Norsworthy: "How to Teach", p. 283.
3 Thorndike: "Mental and Social Measurements", p. 168.
4 Rugg: "Statistical Methods", p. 272.
1 This is the "Definite Step" of James. See School and Society, March 16, 1918 pp. 319-20.

The Formulation of South Dakota Standards.

1. Subjects chosen. The subjects chosen were the four fundamental elementary school subjects: (1) writing, (2) spelling, (3) arithmetic, and (4) reading. It was believed that standard attainments in these subjects would constitute a fair index for appraising the character of the work in the elementary schools of the state.

2. The tests used.

Arithmetic: Courtis Standard Research Tests, Series B, Form 4. Handwriting: A stanza of simple poetry written and re-written for three minutes and scored with the Ayres Handwriting Scale, Gettysburg edition.

Spelling: Three tests from three lists taken from the Ayres Measuring Scale for Ability in Spelling.

Reading: Haggerty's Understanding of Sentences, Scale Beta I.

3. The invitation to co-operate. An invitation to all of the principals and superintendents of town and city schools was prepared and extended[1]. Forty-two of them responded and have actively co-operated in getting these data. In preparing this invitation the fact that this kind of work is comparatively new was borne in mind. An attempt was made to put the invitation in such form as would secure the attention of the principals and superintendents and interest them in the project. The invitation therefore reported the results of related research work in non-technical terms and gave only enough tables and graphs to illustrate the possibilities of studies of this kind. As this invitation to co-operate was an essential step in this investigation and study it is given in full.

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[1] Bulletin of the Bureau of Research, Northern Normal and Industrial School, Aberdeen, South Dakota, July, 1918.

BUREAU OF EDUCATIONAL RESEARCH

Foreword

Within recent years a great movement has been started in the field of education in measuring educational progress and in testing methods and procedures. While present methods of educational and mental diagnosis leave much to be desired they have proved to be instruments with which every teacher should be thoroughly familiar.

For a number of years the Northern Normal and Industrial School has been doing considerable work in familiarizing its prospective graduates with these recent scientific studies in education, in helping them to acquire the use of scales, measures, and tests and teaching them how to interpret data derived from their use. The splendid practice facilities afforded in the city schools of Aberdeen make this work unusually successful.

It is the purpose of the Bureau of Educational Research to widen the scope of this scientific study of problems of education. It is the desire of the school to stimulate this type of study and investigation on the part of progressive superintendents and teachers of the state and to be of service to them. The school can be of assistance in giving tests and in organizing and tabulating the data and in drawing conclusions from the educational situations revealed.

Scale Use Illustrated.

This bulletin will fall into the hands of some teachers and superintendents who are not familiar with these studies. The following illustration of the use of a scale may make clearer these studies and experiments whereby education is being made more definite.

Two samples of handwriting were passed out to a class of fifty-nine normal students, most of whom had had teaching experience. These

samples were of exactly equal quality and two were used simply to facilitate the work of grading. The students were asked to grade the papers, each one marking independently of the others the grade in per cent on a card. They were asked to grade on the basis of legibility. One person estimated the handwriting to be worth 35, and four thought it should be graded 90, the range of grades covering 55 points. The distribution of grades is shown in the following diagram. Each dot represents a student's grade. The median or middle grade was 75 and the average grade was 72. The mode or number scored most often was 80.

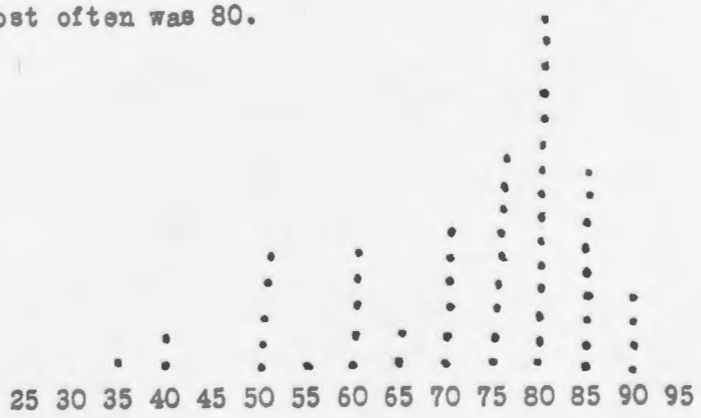

Fig. 1. Grading a Paper Without Using Scale
Distribution of 59 normal school students' grades given a paper in handwriting without the use of a scale. Each dot represents the grade assigned by one student.

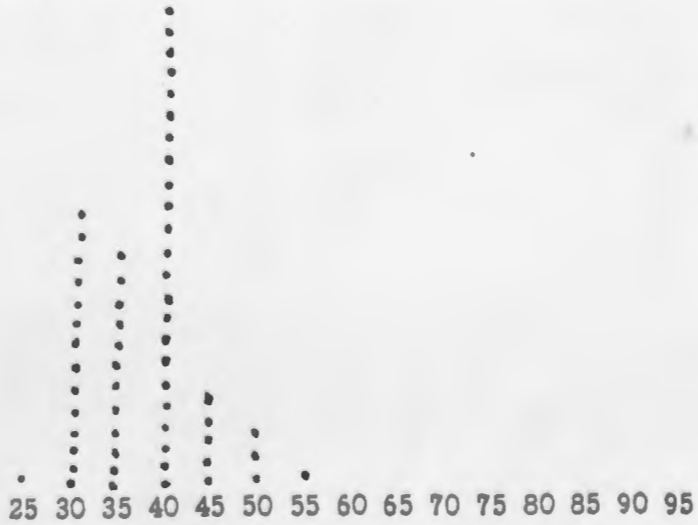

Fig. 2. Grading Same Paper, Using Scale
Same as Figure 1 excepting that the normal school students used a scale in grading the same handwriting sample.

The same experiment was made with a class of forty-nine students in a university college of education, all of whom were teachers of extended experience. The following diagrams show that the results were essentially the same as with the normal school class.

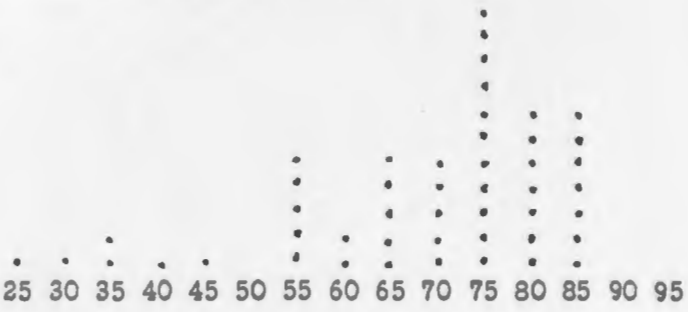

Fig. 3. Grading a Paper Without Using Scale
Distribution of grades given to the same sample of handwriting as used in Figures 1 and 2, by 49 college students, no scale being used.

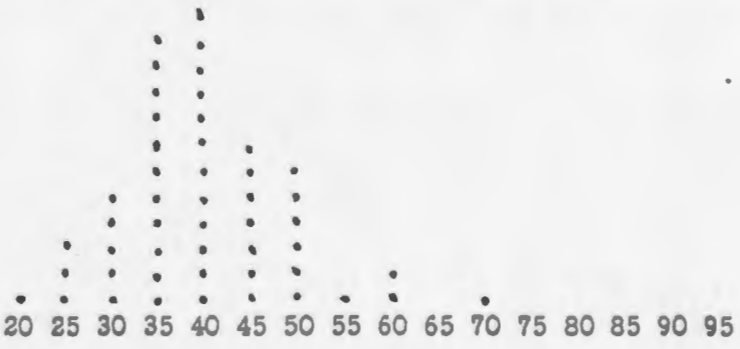

Fig. 4. Grading Same Paper, Using Scale
Same as Figure 3 excepting that the college students used a scale

This experiment clearly demonstrated to these classes the fact that judgments of teachers are far more reliable when a standard scale is used. Many investigations which have been made in recent years have demonstrated the wide variation and lack of standards in evaluating school work, rating teachers, promoting pupils, etc. When a county superintendent in South Dakota reported the failure of a boy to pass the eighth grade the irate parent flashed before him the pupil's monthly reports showing his grades from month to month never fell below 90 and averaged over 95! What was the trouble? Either the teacher did not have any definite or fair standard of

evaluating his work or the teacher was dishonest. The latter alternative may be dismissed.

There was a time when such measures as miles, feet, inches, and other measures of definite value were unknown. Primitive people can only evaluate distances in such vague terms as "very far," "many days' journey," etc. In this early period of development economic values, weights, bulk, etc., were similarly vague. A horse was worth "heap-much," a large quantity was "like the leaves in the forest," Civilization was possible only when definite, quantifying processes of evaluation were discovered and generally accepted. While the analogy can not be pressed, in a general way it may be said that education is emerging from the stage of "very good" in handwriting to "number 14" in the Thorndike scale, or "85 in the Ayres scale;" when "poor in composition" is supplanted by a definite measure as "rated number 5 in description, Harvard-Newton Scale;" when "passing in third grade spelling," is "Ayres Scale, 84 in J, 79 in K," etc.

Take the instance of the handwriting sample which was judged by the classes as just described. Let us say it is rated 40 with the Ayres scale. The pupil can use the scale and see that that is a fair rating. Indeed, it is a great stimulus to the pupil to have such a scale before him and permit him to measure his progress. This sample was taken from a fourth grade pupil in St. Paul. The Ayres standard for the fourth grade is 46. This is the median score of thousands of samples of fourth grade handwriting obtained from many cities. The median of practically all of the fourth grade pupils taken in 1917 in St. Paul is 49. Such a report as the following could be made:

Report of _____ Fourth Grade

Handwriting. . . . . .Score 40

(Ayres standard score 46, St. Paul standard score 49.)

Such a report would be intelligible to any well trained grade teacher in the United States. It would have definite significance to superintendent, supervisor, teacher, pupil, and parent.

Use of Standard Tests

Figure 5 shows the improvement made by six third grades in reading in a South Dakota city. These grades are designated by rooms as A, B, C, D, E, and F. The lower curve represents the scores made by the six third grades in December; the upper curve shows the standings of these same grades in the following May.

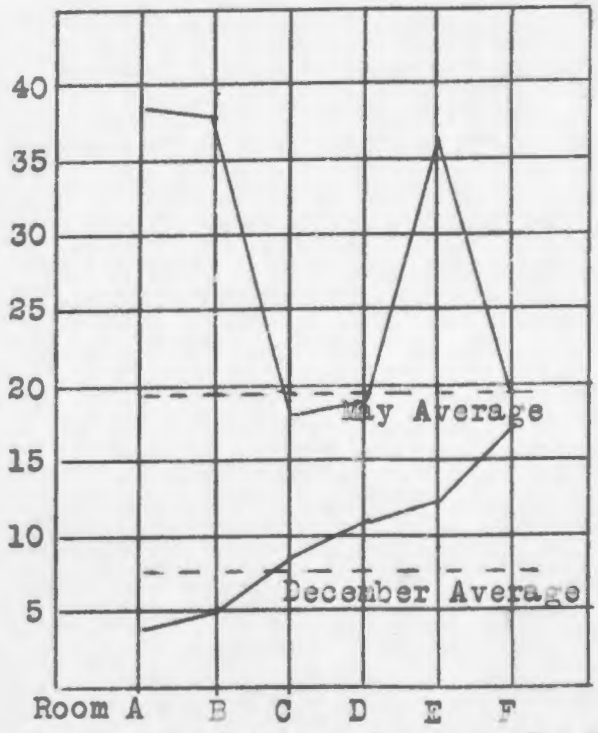

Fig. 5. Comparison of Reading Scores in Six Third Grades, December and May.

The following table gives the scores of each of the third grades:

Room	December score	May score	Improvement
A	3.8	38.3	34.5
B	5.0	37.7	32.7
C	8.7	17.9	9.2
D	10.9	18.8	7.9
E	12.4	36.3	23.9
F	17.2	19.4	2.2

It is quite noticeable that while all third grades improved in the five months' interval, not all grades improved equally. It is a remarkable fact that room A which ranked lowest in December, with a score of 3.8, improved the most both relatively and absolutely (34.5 points), finishing in first rank. The teacher of room A was considerably stimulated by the low ranking of her class in the December scores. She set deliberately to work to improve her grade and Figure 5 shows that she accomplished her purpose, this in spite of the fact that the children of her room, who were from the poorer homes, were thought by the rest of the teachers to be incapable of normal improvement. Is it not an excellent thing for a teacher to know the comparative standing and the improvement made by her pupils? On the other hand, room F which ranked first in December, with a score of 17.2, improved the least, both relatively and absolutely (2.2), finishing the school year with rank four. Similar studies in any city are almost sure to reveal equally illuminating facts.

Superintendents and teachers find the scientific use of standard scales and tests splendid instruments for evaluating their methods. Are the customary methods employed in teaching the four fundamental operations in arithmetic the best that can be evolved? The fact to be mentioned presently that one city gave twice the time to arithmetic that another city gave and got poorer results shows that great improvement in methods is possible. An experiment was made in the fifth grades in two South Dakota schools to test the efficacy of a certain form of number drill. The following table shows the results, school W being the one employing the special drill, school M using the customary number work, both schools devoting the same amount of time to arithmetic work between the October test and the April test.

	School W		School M	
	Speed	Accuracy	Speed	Accuracy
		Addition		
October Score	6.5	43%	6.4	39%
April Score	7.6	58%	6.4	43%
Change	+1.1	+15%	0	+ 4%
		Subtraction		
October Score	6.8	51%	6.6	58%
April Score	8.7	78%	8.1	61%
Change	+1.9	+27%	+1.5	+ 3%
		Multiplication		
October Score	5.9	44%	5.7	53%
April Score	8.1	68%	5.3	73%
Change	+2.2	+24%	- .4	+20%
		Division		
October Score	4.1	39%	3.9	36%
April Score	5.2	67%	5.0	60%
Change	+1.1	+28%	+1.1	+24%

From this table it will be seen that in the process of addition school W improved in speed from 6.5 examples to 7.6 examples, making an improvement of 1.1 examples; the increase in accuracy was from 43% to 58%, a gain of 15%. On the other hand school M made no improvement in speed, remaining at a score of 6.4 examples; and it increased in accuracy from 39% to 43%, a gain of only 4%. School W showed a decided gain in accuracy over school M in all operations and a superior gain in speed excepting in division, where the schools tied.

It is quite evident from these data that the particular system of drills employed in school W gave better results than the customary methods employed in school M. In a similar way scientific measurement may be employed in other phases of education as well as in arithmetic.

Significant Situations Revealed

Work of this kind often reveals many interesting and significant situations and opens the way to remedying defects thus discovered. A few scattered cases may make this clearer.

One fifth grade in city A in South Dakota was found to be better in thought getting in silent reading than any sixth grade in the city and than several seventh grades. Was this a fact worth discovering?

A seventh grade in city S in Minnesota was found to be twelve points higher in speed in writing than the median for that grade in the city but six points lower in general quality. Was a discovery of this sacrifice of quality for speed worth knowing?

City number fifteen in Indiana spent one hundred thousand minutes in arithmetic in the grades, city number eight in the same state spent fifty-two thousand five hundred minutes in arithmetic. The pupils in city eight, however, worked twelve percent faster than those in city fifteen and were equally accurate. Was an investigation into the methods in use in city fifteen in order? Without this scientific study how long would it have been before such an investigation would have been made?

Two twins looked and dressed very much alike. They were rated by the personal judgments of their teachers as equal in ability. Careful tests, covering several months, showed them to be mentally very unlike, and educationally at least fifteen per cent apart. Was there a need for an objective, impersonal measure and did this startling showing help the teacher in revising not only her estimate but also her teaching?

On what definite facts do you base your judgments as to the qualities of your teachers or your teaching? Do you know how your ten year olds are distributed in the grades, in subjects, and in rate of progress? One leading superintendent in South Dakota said, after co-operative investigation with us and study for a year, "If all the information we have obtained concerning the actual work going on in our schools had been valueless, though it was far from that, the work was well worth the while in the spur and the quickened interest it gave all of us, superintendent, supervisors, teachers,

and pupils."

Work proposed for 1917-18.

For the year 1917-18 the Bureau of Research of the Northern Normal and Industrial School will undertake work along four lines as follows: A. studies in arithmetic; B. studies in handwriting; C. studies in spelling; D. studies in reading.

A. Studies in Arithmetic. The Courtis standard tests in arithmetic have been used widely in measuring the results of school work in the four fundamental processes. In several states they have been used by superintendents in co-operative investigation. Standard state scores have been established in some states. It is proposed to make a similar use of the tests in South Dakota. If a number of superintendents and principals will give the tests during the current year and send the results to the Bureau of Educational Research, comparative studies will be made and the results will be issued in printed form. Each school officer will thus be able to know the ranking of his own school in reference to the South Dakota standard which will be developed. No general publicity is given by this Bureau as to the results of tests in any school or city. Schools and cities are designated by symbols in all tables or published statements. The use of the Courtis Arithmetic Tests is advised in grades five to eight.

B. Studies in Handwriting. In the field of handwriting an opportunity will be afforded for the use of one of the newest educational scales produced by Dr. L. P. Ayres, of the Russell Sage Foundation, the Gettysburg edition of his handwriting scale. The test sheets used in obtaining the samples of pupils' handwriting are especially prepared in order to render uniform and standard the conditions of testing from school system to school system. The use of this test is advised in grades three to eight.

C. Studies in Spelling. The study in spelling will be largely concerned with words in common use in English writing. The list of words used will be selected from the studies of recognized authorities. The use of this test is advised in grades three to eight.

D. Studies in Reading. Reading is considered by many the most important single subject in the common school curriculum. Conflicting methods in teaching reading are the subject of much discussion and controversy. Definite data obtained through careful investigation are needed in this field. The Reading Scale Beta for the Understanding of Sentences has been widely used as a test of thought-getting ability. It is hoped that a South Dakota reading standard may be determined and that scientific methods of testing results in reading may be encouraged. These reading tests are devised for grades three to eight or nine, one set being for grades three to five and the other for grades six to eight or nine.

Dates for Giving Tests. That relatively uniform conditions may be obtained it is urged that two tests be planned, one in the early fall and the other in the late spring. Progress in learning may then be measured and fall and spring standards derived for the state.

It is urged that these tests be given during the last week in September or the first week in October so that the results can be treated, as a whole, as October 1st scores, and that the tests to be furnished for the spring be given the last week in April and the first week in May so that the results may be treated as May 1st scores. Any school not giving the tests at approximately the same dates and under other uniform conditions will lose the opportunity to make comparisons with other schools as to conditions and progress.

Special Aid. Frequently school executives are unable to secure adequate assistance in compiling the data obtained by means of standard tests. The Bureau will arrange and compile gratis any and all materials included in the four proposed fields. In these fields all that the co-operating members need to do, is to conduct the giving of the tests and to return all materials to the Bureau where the compilations will be made. By special arrangements the school will furnish an expert to give tests and any instructions relative to this work.

Supplies for Tests. Arrangements have been made for furnishing all materials for the four outlined fields of work through the Bureau. The approximate costs for testing twenty-five pupils are :

Courtis Standard Arithmetic Tests, Series B. . . . . 40 cents

Handwriting. . . . . 15 cents

Spelling. . . . . 5 cents

Reading. . . . . 30 cents

Additional Tests. Although it seems best for common educational interests that an intensive study be made along a few lines only, prospective members who are interested in other fields of work may receive suggestions and other aid from the Bureau on tests in the following school subjects: reading (vocabulary), language, composition, grammar, arithmetic (Woody tests), geography, United States history, algebra, and Latin.

Correspondence Invited. Persons desiring to become identified with the Bureau should determine what line or lines of investigation they wish to follow and write for further information regarding the problems in which they are interested. The Bureau will be glad to answer questions regarding any of the proposed studies.

Address all communications to Bureau of Educational Research, Northern Normal and Industrial School, Aberdeen, South Dakota.

4. The giving of the tests. Full and complete instructions for each test were furnished each room teacher or principal who gave the tests. These instructions were as follows:

Handwriting

DIRECTIONS FOR GIVING
AND SCORING
TESTS

BUREAU OF EDUCATIONAL
RESEARCH

THE NORTHERN NORMAL AND
INDUSTRIAL SCHOOL

ABERDEEN, SOUTH DAKOTA

State Pub. Co., Pierre, S. D.

DIRECTIONS

Materials. 1. Paper with a stanza of simple poetry printed at the top.

2. For grade 3 two well sharpened pencils.

3. For grades 4-8 pen and ink.

Method of Giving Test. 1. Distribute to each pupil one sheet of the paper.

2. Have the pupils write the information called for in appropriate blanks at the top of the page.

3. Have the children read the stanza through silently several times so that they may write it easily without looking back at the printed form too frequently.

4. Give the following instructions to the class: "I am going to test your handwriting. You will be given three minutes in which to write. If you fill one page turn the sheet over and write on the other side. You will be graded both on the amount you write and how well you write. You must, therefore, write as well as you can, and also as fast as you can. When I say 'Ready,' see that your paper is properly placed and that your pen is inked. When I say 'Start,' begin to write and continue to write until I say 'Stop.' Remember: Fast work and good work! Ready! Start!"

Give exactly three minutes. The time can be kept with the second hand of an ordinary watch. The teacher will find it advantageous to start the children at the beginning of the minute when the second hand is on the 60 mark.

Before taking up the papers have each pupil count the number of letters he has written. He should write this number at the top of his test sheet.

The Ayres Scale. The Ayres scale was arranged on the principle of legibility, i. e., the time required for the reading of a specimen of handwriting determined where it should be placed on the scale. The specimens at the right are quickly read. Those at the left require a longer time for the reading of the same number of words. In using the scale, this fact must be kept in mind.

Method of Scoring. The method of using the scale is a method of comparison. Arrange the papers of the class in an alphabetical order. Take the first child's paper and place it beside the lower part of the scale. If you judge the handwriting to be better than the specimen under 20, compare it with those under 30 and so on up the scale until you find the section it is most nearly like.

In making the comparisons it is best to pass on up the scale until you reach specimens which are clearly superior to the one you are grading. You then go back on the scale until you reach the section again which you deem most like the writing you are grading. Several movements up and down the scale may be necessary to fix the correct score.

If you judge the writing to be not so good as the specimen on the scale but better than the one next lower on the scale, give it a value intermediate between the two.

In order to use the scale effectively, it is necessary to keep in mind exactly what it is supposed to measure. Your judgment should not be based on similarity of form, of slant, of alignment, of spacing, or of beauty. The Ayres scale is a scale for legibility, i. e., ease of reading and the judge should keep this fact constantly in mind. On your ability to do this will depend your efficiency in using the scale. If

judgment is made on the likeness of any other element, the result will be unsatisfactory.

Final Score. When you have located the specimen satisfactorily, write the name of the pupil on the class record sheet and write the score beside the name in the column marked "First Judge." Do not put any mark on the child's paper. Secure similar markings for each paper from two other persons who know how to use the scale. When all the marks of the three judges have been recorded on the class record sheet, make out the "final score" for each pupil. For this "final score" choose the value intermediate between the other two scores. Thus, if a composition is graded 45, 55, and 60 by three judges, the intermediate value is 55 and this would be the "final score" of the writing.

Class Score. (1) Arrange the final scores in a column in order of magnitude, placing the highest score at the top.

(2) Divide this column by drawing a horizontal line through a score or between two scores so that as many scores appear above the line so drawn as appear below it.

(3) In a similar fashion, divide the scores falling below the line into two halves. When this is done, three-fourths of all the scores of the class will appear above the line just drawn.

(4) The score immediately above this line will then be considered the score for the class, because three-fourths of the class will equal or exceed that score.

DIRECTIONS FOR

TESTING SPELLING ABILITY

In Grades 3 to 8

Bureau of Educational Research,
Northern Normal and Industrial School
Aberdeen, South Dakota

THE TEST.

The tests consist of 50 words divided into three lists, two of fifteen words each and one of twenty words. The lists are as follows:

List 1.	List 2.	List 3.
bill	also	action
boat	anyway	arrest
every	begin	important
gold	both	position
grand	brought	private
hard	build	progress
inside	change	prompt
kind	drill	publish
line	driven	result
pay	file	select
place	fix	serve
seven	great	sometimes
sister	income	suppose
wind	picture	surprise
work	railroad	term
	says	
	steamer	
	teach	
	true	
	trust	

METHOD OF GIVING THE TEST

These words should be pronounced by the teacher to the children as an exercise in written spelling. One list should be given each day. The children should not know about the words previous to the spelling exercise. There should be no previous practice in the spelling of these particular words and the spelling test should be kept out of sight of the children.

At the top of each test paper the child should write his name, sex, age in years and months, grade, school, and the date of the test.

These tests may be written on any paper of convenient size and, if possible, the same sheet should be used for all three lists, each list being properly headed. Immediately after each test the sheets should be collected and the scores recorded on "Class Record Sheet Number 1."

METHOD OF SCORING THE TEST.

Individual Scores.—The paper of each child should be scored for the number of words correctly spelled. This score should be recorded at the top of the test paper.

Arrange the names of the class alphabetically on the class score sheet. Copy from the individual test sheets the number of words correctly spelled by each child each day. In the column marked "Total" record the total number of words spelled correctly during the entire test. In the column marked "Per Cent" record the per cent of all words correctly spelled.

Class Score.—As there are fifty words in the three lists the value of each word is two per cent. Thus if a pupil spells thirty-two words correctly, his score in per cent will be 64.

The totals are found by adding each of the four columns, including records from all of the children in the class.

The "class percentage for each list" is found as follows: To find the class percentage for list 1, multiply the number of children by 15 (the number of words in list 1), and divide the total correct spellings in that list (shown as total in list 1)

by that product. Suppose there are fifty children in the class and the total number of correct spellings in the first test, list 1, is 270, the percentage of the class for list 1 will be 60 [270÷(30×15)]. The percentage for list 3 will be found in exactly the same way as for list 1 as there are fifteen words in list 3. In list 2 it should be observed that there are twenty words and therefore 20 should be substituted for 15 in making the computations.

At the bottom of the columns headed "1st list," "2nd list," and "3rd list," respectively, will be placed the class percentage for each list. At the bottom of the column headed "total" will be placed the class percentage for the three tests. This is the total class score. This is found as follows: Multiply the number of children in the class by 50 (the total number of words in the three lists) and divide the total number of correct spellings in all three lists by this product.

These directions will not be found difficult if they are followed literally and one step is taken at a time.

When the individual children are recorded on Class Record Sheet No. 1, count the number of children making 100 per cent and record opposite 100 on Class Record Sheet No. 2. Proceed similarly with the number of children making each score.

Grade and City Scores.—Grade and city scores can be made in a manner similar to the making of class scores.

In returning the results to the Bureau of Educational Research, include the individual test papers as graded and all class record sheets made out.

FORM 9

DIRECTIONS FOR GIVING AND SCORING TESTS IN READING

ARRANGED BY
BUREAU OF COÖPERATIVE RESEARCH
COLLEGE OF EDUCATION
THE UNIVERSITY OF MINNESOTA

VISUAL VOCABULARY

DIRECTION FOR GIVING TEST

I. Preliminary Test

1. See that each child has at least one, preferably two, well sharpened lead pencils.

2. Distribute to each child a copy of the test.

3. Have each child write in the proper place his name, sex, age in years and months, city, grade, school, teacher, and the date of the test. Inspect papers to see that this is correctly done.

4. Doing the test: Direct the children to look at the Preliminary Test. Say to them: "On this page are some words. The reading at the top tells you to do something to these words. Read the lines at the top and do what it says to do. Read the instructions two or three times if necessary. When you have finished, bring your papers to me so that I can see whether you have done the work correctly or not."

5. Have each child as he completes his work bring forward his finished page. Look it over at once to see if he has followed directions. Check the use of each direction. Where directions have not been followed, call the child's attention to that part before giving the Scale R2 Test.

II. Scale R2

1. The preliminary test should have prepared each child to perform the Scale R2 Test correctly. Direct them to turn to Scale R2.

2. Say to the children: "On this page are some words. The reading tells you to do something to these words. Read the lines and do what it says to do. Read the instructions two or three times if necessary. When you have finished, bring your papers to me at the desk. At the signal 'get ready' take up your pencil and look at me. At the signal, 'start,' begin work."

3. Have each child as he completes his work bring his paper forward. Keep the time for each pupil. To keep time satisfactorily requires two persons, one to call the time as the papers are handed in, the other to record the time on the papers. The record can best be made by noting on each sheet in hours, minutes and seconds, as 10-15-30, the time of beginning the test and the time each individual finishes. By subtracting, the exact time occupied in the test can be determined.

DIRECTIONS FOR SCORING

Computing Individual Scores

1. Arrange the papers from a single class alphabetically in a pile.

2. Take from the pile the first paper and read through the child's markings until you come to a line in which an error or omission occurs. Place to the left of this line a figure indicating the number of errors and omissions in that line. Read through the remaining lines and indicate in a similar manner the number of errors and omissions. The highest numbered line which the child does with one (or no) omission or error is taken as his score. Draw a line under the figure on the page indicating this score. Check this score on the first page in the blank indicated. Then proceed in a similar manner with each of the other papers of the class.

Class Scores

1. Use class record sheet number 1.

2. Enter in the wide space at the left the name of the pupil and at the appropriate places the figures indicating the number of errors and omissions in each line.

3. Add the numbers in each column and place the sum at the bottom of the score sheet. Find the percentage of error by dividing the sum thus obtained by five times the number of pupils in the class. The score of the class may be taken as the line in which the percentage of error is 20.

4. If no single line gives exactly 20 per cent of error, the actual class score will be intermediate between the two lines which gives nearest 20 per cent of error. By means of Table I, this intermediate value may be calculated.

For example, if a fourth grade class has only 16 per cent of error in line 25, then its rating should be somewhat more than 25. By referring to the table, it is found that 16 per cent of error indicates an additional value of 2.3 to the value of the line. This 2.3 should be added to the 25, giving 27.3 as the ability of the class in question.

Or, if a sixth grade class is found to make only 5 per cent of error in line 35, but 28 per cent of error in line 45, then the score for this grade falls above 35 and below 45. Calculating from the percentage nearest 20, namely 28, and by referring to the table, we find that 3.9 should be subtracted from the set in question. Subtracting 3.9 from 45 gives 41.1 as the correct score for the class in question. A more correct rating can often be obtained from the two scores nearest 20 per cent.

UNDERSTANDING OF SENTENCES

DIRECTIONS FOR GIVING TESTS

I. Preliminary Test

1. See that each child has one, preferably two, well sharpened lead pencils.

2. Distribute to each child a copy of the test.

3. Have each child write at the proper place on the first cover-page his name, sex, age in years and months, city, school, grade, teacher, and date of test. Make certain that this is properly done before proceeding with the test.

4. Doing the test: Have the children look at the Preliminary Test. Say to them: "On this page are some sentences. Below the sentences are some questions. You are to read through the sentences and then write correct answers to the questions. You need not write complete sentences, but your answers must be definite. Read the instructions and sentences as often as necessary. When you have finished bring your paper to me so that I can see whether you have done the work correctly."

5. Have each child as he completes his work bring his paper forward. Look it over at once to see if he has followed instructions. Do not give Scale Beta 1 until each child understands how to do the preliminary test correctly.

II. Scale Beta 1.

1. The preliminary test should have prepared each child to perform Scale Beta 1 test correctly. Direct the children to turn to Scale Beta 1.

2. Say to the children: "On this page are some selections to be read and below each selection are some questions to be answered. Read the selection and write answers to the questions. Your answers need not make complete sentences but they must be clear and definite. Read the selections and questions as often as necessary but work continuously until you have finished. When you have finished bring your papers to me at the desk. At the signal, 'get ready,' take up your pencil and look at me. At the signal, 'start,' begin work."

3. Have each child as he completes his work bring his paper forward. Keep the time for each pupil.

DIRECTIONS FOR SCORING TESTS

Individual Scores

Read through each paper and note omissions or wrong responses, placing at the left an X for each error. Accept as correct for each question in each set the answers indicated as right in the following key:

BETA I

Set I, Element 1. Short
2. Two
3. Mary

Set III, Element 1. The author, An author
2. The printer
3. Went down the road, or equivalent (call went on, or went on to Boston wrong)
4. Two other boys, or two boys
5. Nine o'clock

Set IV, Element 1. Pollen from plants and weeds, Pollen from plants. Pollen from weeds, Pollen.

2. Two per cent, 2 per cent, 2. One out of fifty, One in fifty, or equivalent. Call A small per cent or A small number, or A few, wrong.

3. By living in certain places, By going to live in certain places. By finding a place where there is no pollen from weeds.

4. Coal range and gas range.

5. For broiling, Broiling, To broil with, etc.

Set V, Element 1. Money and wealth.

2. He might have land; He could own property; He could own houses. He could have jewels, or gold and silver. Might have mines, etc.

3. Paper money, A ten dollar bill. Call wrong any answer that confuses paper money with coin such as "a silver dollar," "a ten dollar gold piece," "a nickel," "a penny."

4. Right responses are such as: If he has to work for a living; If he has to work afternoons and evenings to help his mother; When the father dies; When their parents die; If his father died and to work; If his father died or if sick; His father might die; His father may die; If his father died he has to work; If his father or mother died; If a boy's father dies he has to earn money for his mother; When someone dies in their family; Help support the family; The condition is in case his father died; If his father died he might have to go to work; If his father died he might have to work.

Wrong responses are such as: Playing ball, etc.; Going with bad boys: To work: To earn money; Have to work out to get money; Because to help their mother.

5. Right responses are such as: He would have to work all the time; He would work instead of going to school; He might have to work to support the family; He would have to go out to work; He would have to work; He would have to work afternoons and evenings; work; A boy would work; He had to work afternoons and evenings; To work afternoons and evenings; Working or making his living.

Wrong responses are such as: By the boy not working if his father lost his job; By not doing what his father told him; Sickness; Makes the father work; Loafing and doing nothing; Go with bad companions; Bad and not doing lessons; Idling; Go away and not come back until night.

Set VI, Element 1. The common man.

2. Napoleon.

3. Conceal and deny them; Deny them; Conceal them; Suppress them.

4. Napoleon.

5. The qualities and powers of other men in the street; The same tastes as are in the common man; An enumeration of a considerable number (5) of the "tastes" as "good society, good books, fast traveling, dress, dinners, servants," etc.

Set VII, Element
1. Three, or enumeration of the three.
2. General plots, counsels and marshalling of affairs. (If two of these are given, give full credit, if but one, count it 0.)
3. In discourse (most frequent error here due to confusion between serve and use and ignorance of meaning of affectation).
4. We should envy him. Envy the prisoner. Would want to change places with him. Would want to be a prisoner.
5. Activity of body or mind at which a man can succeed.

Class Scores

1. Use Record Sheet No. 2.

2. Copy from individual score sheet upon Record Sheet No. 2 the name of each pupil and the number of errors made by him in each element of each set.

3. Total the figures for each set in the broad column immediately at the right of the set in question.

4. Total these results at the bottom of the page in the line marked "Total number wrong." Divide the several totals by the product of the number of individuals times the number of questions in the set. Thus in Set I, let the total number of errors be twelve and the number of individuals in the class twenty. Since the chances of error in Set I are three, you multiply 3 by 20 which gives 60. This 60 you divide into 12 which gives .20 or 20%, the per cent of error made by the entire class in Set I. Set I is then the score for the class if, as is likely, the following set gives a higher percentage of error. In any case, the class score is the number of the set which gives 20% of error.

5. If no single set gives exactly 20% of error, the actual class score will be intermediate between the two sets which gives nearest 20% of error. By means of Table I, this intermediate value may be calculated by the method described under 4 on page 3.

TABLE I

To Estimate the Degree of Difficulty at Which 20 Per Cent of Errors and Omissions Would be Found from Any Given Percentage of Errors and Omissions Between 8.0 and 40.0.

Given percentage	Add	Given percentage	Add	Given percentage	Add	Given percentage	Subtract
8.0	8.4	12.0	4.9	16.0	2.3	20.0	0.0
.1	8.3	.1	4.9	.1	2.2	.1	0.0
.2	8.2	.2	4.8	.2	2.1	.2	0.1
.3	8.1	.3	4.8	.3	2.1	.3	0.1
.4	8.0	.4	4.7	.4	2.0	.4	0.2
.5	7.8	.5	4.6	.5	2.0	.5	0 3
.6	7.8	.6	4.5	.6	1.9	.6	0.3
.7	7.7	.7	4.5	.7	1.8	.7	0.4
.8	7.6	.8	4.4	.8	1.8	.8	0.4
.9	7.5	.9	4.3	.9	1.7	.9	0.5
9.0	7.4	13.0	4.2	17.0	1.7	21.0	0.5
.1	7.3	.1	4.2	.1	1.6	.1	0.6
.2	7.2	.2	4.1	.2	1.5	.2	0.6
.3	7.1	.3	4.0	.3	1.5	.3	0.7
.4	7.1	.4	3.9	.4	1.4	.4	0.7
.5	7.0	.5	3.9	.5	1.4	.5	0.8
.6	6.9	.6	3.8	.6	1.3	.6	0.8
.7	6.8	.7	3.7	.7	1.2	.7	0.9
.8	6.7	.8	3.7	.8	1.2	.8	0.9
.9	6.6	.9	3.6	.9	1.1	.9	1.0
10.0	6.5	14.0	3.6	18.0	1.1	22.0	1.0
.1	6.4	.1	3.5	.1	1.0	.1	1.1
.2	6.3	.2	3.5	.2	1.0	.2	1.1
.3	6.2	.3	3.4	.3	0.9	.3	1.2
.4	6.2	.4	3.3	.4	0.9	.4	1.2
.5	6.1	.5	3.3	.5	0.8	.5	1.3
.6	6.0	.6	3.2	.6	0.8	.6	1.3
.7	6.0	.7	3.1	.7	0.7	.7	1.4
.8	5.9	.8	3.0	.8	0.7	.8	1.4
.9	5.8	.9	3.0	.9	0.6	.9	1.5
11.0	5.7	15.0	2.9	19.0	0.5	23.0	1.5
.1	5.7	.1	2.8	.1	0.5	.1	1.6
.2	5.6	.2	2.7	.2	0.4	.2	1.6
.3	5.5	.3	2.7	.3	0.3	.3	1.7
.4	5.4	.4	2.6	.4	0.3	.4	1.7
.5	5.3	.5	2.6	.5	0.2	.5	1.8
.6	5.2	.6	2.5	.6	0.2	.6	1.8
.7	5.2	.7	2.4	.7	0.1	.7	1.8
.8	5.1	.8	2.4	.8	0.1	.8	1.9
.9	5.1	.9	2.3	.9	0.0	.9	1.9

Set VII, Ele

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TABLE I—(Continued)

Given per-centage	Sub-tract	Given per-centage	Sub-tract	Given per-centage	Sub-tract	Given per-centage	Sub-tract
24.0	2.0	28.0	3.9	32.0	5.6	36.0	7.2
.1	2.1	.1	3.9	.1	5.6	.1	7.3
.2	2 1	.2	4.0	.2	5.7	.2	7.3
.3	2.2	.3	4.0	.3	5.7	.3	7.3
.4	2.2	.4	4.0	.4	5.7	.4	7.4
.5	2 3	.5	4.1	.5	5.8	.5	7.4
.6	2.3	.6	4.1	.6	5.8	.6	7.5
.7	2.4	.7	4 2	.7	5.8	.7	7.5
.8	2.4	.8	4.2	.8	5.9	.8	7.5
.9	2.4	.9	4.2	.9	5.9	.9	7.6
25.0	2.5	29.0	4.3	33.0	6.0	37.0	7.6
.1	2.6	.1	4.3	.1	6.0	.1	7.7
.2	2.6	.2	4.4	.2	6.1	.2	7.7
.3	2.7	.3	4.4	.3	6.1	.3	7.7
.4	2.7	.4	4.5	.4	6.1	.4	7.8
.5	2.7	.5	4.5	.5	6.2	.5	7.8
.6	2 8	.6	4.6	.6	6.2	.6	7.8
.7	2 8	.7	4.6	.7	6.3	.7	7.9
.8	2.9	.8	4.7	.8	6.3	.8	7.9
.9	2.9	.9	4.7	.9	6.3	.9	8.0
26.0	3 0	30.0	4.7	34.0	6.4	38.0	8.0
.1	3 0	.1	4.8	.1	6.4	.1	8.0
.2	3.0	.2	4.8	.2	6.5	.2	8.1
.3	3.1	.3	4.9	.3	6.5	.3	8.1
.4	3.1	.4	4.9	.4	6.6	.4	8.1
.5	3.2	.5	4.9	.5	6.6	.5	8.2
.6	3 2	.6	5.0	.6	6.6	.6	8.2
.7	3.3	.7	5.0	.7	6.7	.7	8.3
.8	3 3	.8	5.1	.8	6.7	.8	8.3
.9	3 3	.9	5.1	.9	6.7	.9	8.3
27.0	3 4	31.0	5.1	35.0	6.8	39.0	8.4
.1	3 5	.1	5.2	.1	6.8	.1	8.4
.2	3.5	.2	5.2	.2	6.9	.2	8.5
.3	3.5	.3	5.3	.3	6.9	.3	8.5
.4	3.6	.4	5.3	.4	7.0	.4	8.5
.5	3.6	.5	5 4	.5	7.0	.5	8.6
.6	3.7	.6	5.4	.6	7.0	.6	8.6
.7	3.7	.7	5.4	.7	7.1	.7	8.6
.8	3.8	.8	5.5	.8	7.1	.8	8.7
.9	3.8	.9	5.5	.9	7.2	.9	8.7

IN MAKING RETURNS TO THE BUREAU OF COÖPERATIVE RESEARCH AT THE UNIVERSITY OF MINNESOTA, INCLUDE THE CHILDREN'S PAPERS AND THE CLASS RECORD SHEETS COMPLETE.

Standard
Research Tests
in Arithmetic

Folder B
Series B

Folder B

Instructions for giving, scoring, and tabulating the Courtis Standard Research Tests in Arithmetic.

EXPLANATIONS.

The Courtis Standard Research Tests are neither examinations nor teaching devices, but tools for research work. Series B should be used not more than four times a year, to measure ability in the four operations with whole numbers. Exactly the same tests should be given to all grades, and scientific care should be taken with the timing. Use a watch having a second hand. Start each test just as the second hand reaches the sixty mark. There should be as few examiners as possible, say one to every twenty classes.

INSTRUCTIONS TO EXAMINERS.

1. For each room, prepare as many bundles of papers as there are rows of seats, putting into each bundle as many papers as there are seats in each row.

2. Begin by saying, "My purpose this morning is to measure how well you can add, subtract, multiply and divide. I have here some printed tests. They are not examinations because exactly these same tests have been given to all the grades from the third through high school. If you treat the tests as though they were a game, you will enjoy them. Do your best for the honor of your school. I am going to give each of you a set of these papers, but do not look at them until I tell you to do so. Will the boys and girls in the front seats please distribute them for me?"

3. Distribute the papers by putting a bundle on the first desk in each row and letting the children do the rest.

4. Have the children fill out the blanks at the bottom of the first page. Write the date in figures, and the time to the nearest half hour; thus: 9-25-1913-10:30.

5. Have the children read instructions for Test 1 out loud in concert.

6. "Now please listen closely. In these tests it is important that we all start at the same time and stop at the same time. We can do this easily, if you follow my instructions exactly. Lay your papers on your desks in position to work the examples. Take your pencils in your right hand, and when I say 'Get Ready,' raise your pencil hand in the air as if you were going to ask a question. (Illustrate, by suiting the action to the words). Do not look at the tests but watch me. Then when I say 'Start,' you can bring your pencil down, and everyone will start at the same time. When I say 'Stop,' I want you all to stop at once, and to raise your hands again so that I can see that you have stopped. Now I think we are ready to try the test."

When the second hand of the watch reaches the 55 second mark say "Get Ready for the Addition Test. Hands Up. Eyes this Way." Exactly at the 60 mark say "Start."

ALLOW EXACTLY EIGHT MINUTES.

"Stop. Hands up." Make sure all have stopped. "Count how many examples you have finished, and write the number in the score card in the corner under the number attempted. Do not count examples you have begun but have not finished. Your score is the number of the examples you have finished. I am coming to your desk to see that you have written it in the right place."

7. Read the answers from an Answer Card (be sure the form number corresponds with that of the tests), and have children check answers right or wrong, counting the number right, and writing it in their score cards.

8. In similar fashion give and score the other tests.

For Test 2, Subtraction, allow exactly FOUR minutes.

For Test 3, Multiplication, allow exactly SIX minutes.

For Test 4, Division, allow exactly EIGHT minutes.

9. Give Tests 1 and 2 the first day, and Tests 3 and 4 the next. All may be given at one time if desired.

10. Have the children copy the scores from the separate tests, recording them in the proper spaces on the cumulative record card. See sample individual record sent with this order.

11. Have the children draw graphs of their scores, following the instructions at the bottom of the record card.

INSTRUCTIONS FOR SCORING AND TABULATING.

12. The teacher should rescore all papers having exceptionally low or high scores. Mark I. N. F. (Instructions not followed) all papers where the children have used the wrong operation (addition for multiplication, etc.)

13. On a Class Record Sheet (No. 1 Red), fill out all the blanks on both original and duplicate. Record the total number of children in the class.

14. Hold the package of test sheets in your left hand, and with your right, take off each sheet in turn, one sheet

at a time, glance at the score for Number Attempted, Test 1, and lay the sheet on the table before you. Put in one pile all papers having a score of 5 examples attempted; into another pile, all papers having a score of 6 examples attempted, and so on, making as many separate piles as there are different kinds of scores. Papers having a score of I. N. F. or in which the score through absence or other cause is blank should be put in a pile by themselves.

Then, one pile at a time, resort the papers in each of these piles on the basis of their scores in number of examples right. (For instance, if there were six papers each having a score of twelve examples attempted, these would be sorted into piles of twelve right, eleven right, and so on.) Next count the number of papers in each of these piles and record the numbers in the proper vertical column of the table. (That is, if there was one paper with a score of 12 attempted and 12 right, two papers with a score of 12 attempted and 11 right, and three papers with a score of 12 attempted and 9 right, a figure 1 would be written in the column headed 12, and in the division containing the small figure 12; a figure 2 in the division containing 11, and 3 in the division containing 9.) When all the scores have been entered, find the sum of the figures in each vertical column and in each horizontal row. If the work has been accurately done, the sum of the horizontal totals will just equal the sum of the vertical totals.

15. In similar fashion distribute and record the scores for each of the other tests.

16. Find Median Class Scores—see Folder D.

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17. Copy class medians from Record Sheet No. 1
Record Sheet No. 3.

18. Draw graph of the results in the Supervisory Gra
Sheet.

Standard Individual June Scores in Number of Examples Attempted (Rate)

Grade	Test 1 Addition	Test 2 Subtraction	Test 3 Multiplication	Test 4 Division
3	3	4	3	2
4	5	6	5	4
5	7	8	7	6
6	9	10	9	8
7	11	11	10	10
8	12	12	11	11

Standard accuracy = 100%.

Median Efficiency (1915) Eight Grade

Test No. 1 5%
Test No. 2 13%
Test No. 3 6%
Test No. 4 20%

"Measure the efficiency of the entire school, not the individual ability of the few"

COURTIS STANDARD TESTS

Computations.

Folder D
Series B

General Explanations.

Preliminary Warning. If much of what follows seems new and strange to you, do not be dismayed but carry out the instructions "One Step At A Time."

In any measurement of a group of school children, the scores obtained will show a great range of variation, and it becomes necessary to replace the individual scores with a single measure. The one in common use is the Average, but for teachers and superintendents a measure expressing the "efficiency" of teaching is of greater value, while for scientific purposes the Median score, and the Variability, may also be needed. Accordingly instructions for computing all of these are given in this folder. It should *be noted particularly,* however, that but *very few persons are expected to complete all the work here outlined.* For ordinary school purposes the computation of the efficiency *alone* will probably suffice, for the efficiency shows how far the training of the class has been completed.

The short approximate methods to be described save a great deal of time and labor, and should be followed by all. Those unfamiliar with the principles should follow the instructions

mechanically. Explanations will be found in Thorndike's Mental and Social Measurements, Second Edition, pages 42 to 63.

There is, of course, no reason why the average rate and accuracy may not be found by the long methods in ordinary use, but it is hoped that all who use the tests will study the instructions below and carry the same out carefully, that the results of all may be uniform and comparable.

Instructions for Computing Efficiency.

The word efficiency as applied to education has, only too frequently, but little meaning. As used in connection with the Courtis Tests, however, it has a very definite meaning as soon as the following definition has been accepted: **The efficiency of any teaching process which has a measurable product is the per cent of the total product that measures up to the standard for the grade.** The steps in determining efficiency of teaching are:

1. Definition of a standard product.
2. Measurement of the entire product.
3. Computation of the per cent of the total product which equals or exceeds the standard.

1. Definition of Standards.

For the Courtis Tests, Series B, the following standards are proposed. Those who consider them too high or too low are free to adopt others as they may see fit, but hereafter "Efficiency" will be understood to mean efficiency in terms of the following:

Tentative Standards.*

June (or Mid-year) Standard Individual Scores in Series B, Arithmetic Tests.

Grade	Test 1 Addition	Test 2 Subtraction	Test 3 Multiplication	Test 4 Division
3	3	4	3	2
4	5	6	5	4
5	7	8	7	6
6	9	10	9	8
7	11	11	10	10
8	12	12	11	11

*The actual scores of classes vary from these standards as much as four examples higher or lower. (Eighth Grade).

2. Measurement of the Entire Product.

If the procedure for giving Series B has been followed (see instructions in Folder B) the distribution of the scores according to the instructions on Record Sheet No. 1 gives the proper data from which to compute the Efficiencies.

3. Computation of Efficiencies.

For each test find the sum of all the frequencies[1] equal to or exceeding the standard. Multiply this sum by 100 and divide by the total number of scores. The result will

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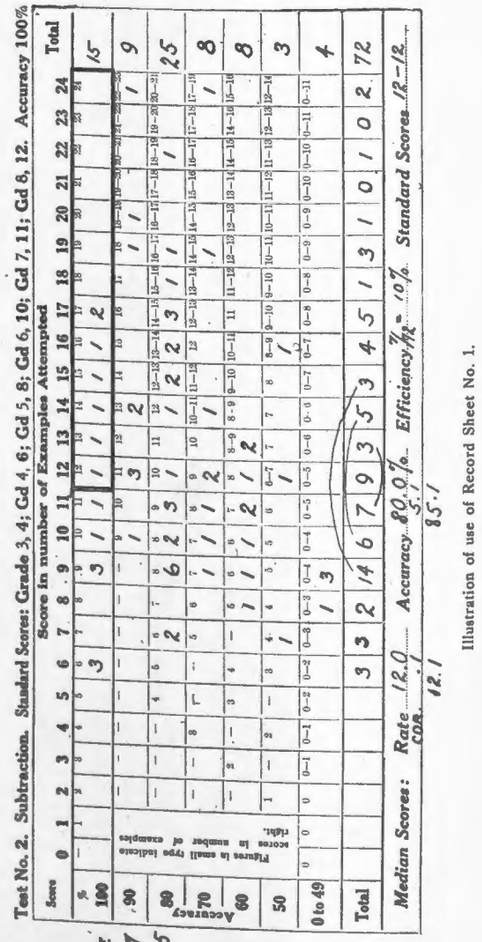
[1] Frequencies are the numbers which show how often a given score occurs. In the illustration on the next page, the figure 6 in the column headed 9 is a frequency. For it means that six children had scores of nine examples attempted and eight right. The figures 3, 3, 2, 14, etc., are the frequencies for Rate, and 15, 9, 25, etc., the frequencies for Accuracy.



Test No. 2. Subtraction. Standard Scores: Grade 3, 4; Gd 4, 6; Gd 5, 8; Gd 6, 10; Gd 7, 11; Gd 8, 12. Accuracy 100%

Score in number of Examples Attempted

Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
%																										
100																									1	9
90													3		2											
80										1		3	1			2	2	3		1						25
70									1	1	2		2		1											
60								1	2			2		2		1										8
50							1	2																		8
0 to 49						1												2								3
Total					1																					4
							1							2	2	3	1	3	1	1	1	0	1	0	2	72

Figure in small type indicates scores in number of examples attempted.

Median Scores: Rate 12.0 Accuracy 12.1 Efficiency 9.7% Standard Scores 12–12

Div. 17 25

Illustration of use of Record Sheet No. 1.

be the efficiency for that test.

That is, on the Record Sheet upon which the distribution for a class has been entered, (Record Sheet No. 1).

a. Find from the data given along the top of each table the standard score for the grade and test.

b. In the 100% division just underneath the figures showing the score in number of examples attempted, draw a heavy vertical line over the red line to the left of this score, and then extend this line horizontally to the right to the column marked Total.

c. Count the number of 100% scores falling within the rectangle thus formed.

d. Find the total number of scores.

e. Multiply the result in (c) by 100 and divide by (d), carrying the results to tenths. This quotient is the efficiency, or the per cent of the total product that equals or exceeds the standard.

ILLUSTRATION.

The figure on page 4 shows the actual scores of an eighth grade class, measured in April, 1914, as to its ability in Test 2, Subtraction. There were 72 children (lowest right hand total) in this class. The totals of the vertical columns show the distribution for rate. Three children attempted six examples, 3 tried seven, 2 eight, 14 nine, etc. The totals of the horizontal rows show the distribution for Accuracy. Fifteen children had 100% accuracy, nine 90 to 99% accuracy, 25 had 80 to 89% accuracy, etc. Note that (3+3+2+14+, etc.,)=72=(15+9+25+, etc.). This check should always be applied at the time the papers are distributed.

The efficiency of this class was 9.7%: for

a. The standard score for the grade (8th) is 12 examples.

b. Note the heavy line drawn to the left of twelve and then to the right forming a rectangle with the heavy red lines at the top and end of the table.

c. There are seven scores in the rectangle. (1+1+1+1+1+2=7).

d. 7×100=700. 700÷72=9.7.

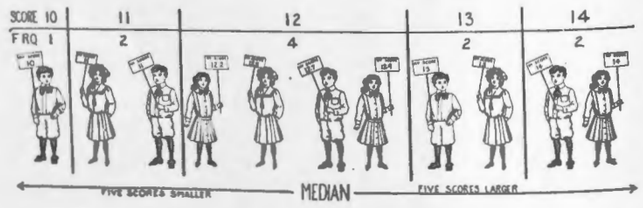
Note that a 100% teacher would be one who succeeded in getting all the scores into the rectangle. At present (1914) the efficiency of teaching varies from 5% to 20%.

The value of such measures of efficiency is self-evident. Care should be taken in comparisons from school to school, however, to make the "times" comparison with caution. To attain an efficiency of 5% in Addition is comparatively easy. To raise the efficiency to 10% without any change in the time allowance may require three or more times the effort. The second school may be, not twice as efficient as the first, but many more times as efficient. If conditions differ in the two schools it may even be less efficient from certain points of view. On the other hand, as a statement of actual conditions, it is a FACT that one school actually turns out twice as many children up to standard in Addition as the other, and it is in this sense that the measure should be taken.

Instructions for Computing Approximate Medians.

A median is defined as the mid-measure, the measure such that there are just as many scores larger as there are smaller.

Illustration of Median Score.



Approximate Median, 12.0; Correction ¾ or .7; True Median, 12.7; Average 12.2 (+.5=12.7)

The steps in finding the median are:

A. Find half the sum of the frequencies.

If there are 37 children in the class, the 19th score in order of magnitude would be the median score; for there would be eighteen score larger and eighteen smaller. If there were 36 children in the class, the 18th score would be taken as representing the nearest approximation to the middle measure.

B. Begin at the lower end of a distribution and add the frequencies in order until the addition of the next frequency would make the sum greater than the half-sum obtained in **(A).** Record the sum to this point in very fine figures just after the last frequency added. The median score is evidently in the group of scores whose addition would make the sum too large. Note the score opposite this group and record it.

C. Occasionally the sum of the frequencies to a certain point will yield a number exactly equal to the half sum obtained in **(A).** In this case the approximate median is still the score opposite the **frequency whose addition would make the sum too large: that is, the next higher score.**

ILLUSTRATION. (See page 4.)

The median rate is 12 examples: for

A. The half-sum is 36 (72÷2).

B. The sum of the frequencies less than the half-sum is 35. (3+3+2+14+6+7=35). 35+9 would be larger than 36. Therefore the 36th score, or median, falls in the group of nine scores of 12 each.

In similar fashion for accuracy, 4+3+8+8=23. 23+25 would be greater than 36. Therefore the median falls in the group of 25 scores having an accuracy of from 80-89%. The approximate median accuracy is therefore, 80%.

Instructions for Computing Score in Examples Right.

In former records scores were kept in attempts and rights. Those desiring to compare present results with those from former trials should change the score in Accuracy to score in Rights by multiplying the median rate by the median accuracy.

ILLUSTRATION: Median Rate 12; Median Accuracy 80%; Score in Examples Right, 12×80%=9.6 examples right.

The computations described above yield of course, approximate results: that is, they may be lower than the true scores by a small amount, but in no case will the difference be greater than one example, and in most cases less than half an example. Where greater precision is desired, however, the True Medians may be found.

Instructions for Computing the True Medians.

The medians found above are called approximate medians because 12 examples, as used above, may mean anything from exactly 12.0 examples to 12.99 examples; 80% accuracy anything between 80% and 89.9% accuracy. As long as the rate of individuals in the class varies from six to twenty-four examples, as in the illustration, it is enough to know that the median rate is about 12 examples, but it is possible to carry the computations further. This is known as "correcting the approximate median" and the result is the "true median."

To find the correction, subtract the sum in **(B)** page 7 from the half-sum found in **(A)**, and divide the remainder by the number of scores in the group in which the median falls, carrying the result to two decimal places. Write the result to the nearest tenth, under the median score, as shown in the figure. Add the correction to the approximate median to obtain the true median.

ILLUSTRATION: Rate.

1. The half sum, 36, minus the partial sum of the frequencies, 35=1.

2. The remainder, 1, divided by 9, the number of scores in the group in which the median falls=.11. Therefore the correction is .1 and the true median 12.1 examples.

Accuracy.

1. 36—23=13.
2. 13÷25=.52.
3. In this case one further operation is necessary, since the size of the divisions in the column headed Score differs by tens (60%, 70%, 80%, etc.) instead of by units (12, 13, 14, etc.). The rule is. multiply the correction by the size of one division. .52×10%=5.2%. The correction is therefore 5.2%, and the true median 85%. The true score in Rights is 12.1×85%, or 10.2 examples.

Special Cases.

When more than half the class have perfect accuracy the median is 100%.

No correction can be applied in such cases, as 100% is the limit of accuracy. Note that the row on the record sheet marked 100% means 100% only, while 90% means from 90.0% to 99.9%.

When more than half the class have accuracies of from 0 to 49%, the approximate median is 0, and the correction is found as in other cases except that the size of the step is 50% instead of ten. For instance, in a certain class of 50 pupils 40 had accuracies of from 0 to 49%. The median score was the 25th score. The approximate median was 0, the correction 25/40 x 50% or 31%. The accuracy was, therefore, taken as 31%.

Variability.

Two classes may have the same median score but differ markedly in the efficiency of their grading. That is, in one class the children may be of nearly equal ability: their scores may cluster closely around the median.

In the other class some of the children may have very high scores and others very low scores. In such a class there are few children of median ability. The measure of the range of variation is the Median Difference (M. D.), of the individual scores. That is, the score of each child in a class could be subtracted from the median score and the differences arranged in order of magnitude without regard to sign. Then the median differences could be selected. Practically, the M. D. is found by a short, approximate method.

Instructions for Computing the Variability.

Beside the frequencies of any distribution, write opposite the score in which the median falls, the frequency of that score. Opposite the next score above the median, write the sum of the frequencies one step above and below

the median. (To aid in keeping track of the frequencies to be added, join them by curved lines as in the figure.) Opposite the next higher frequency, write the sum of those two steps from the median, and so on until the sum of these results (called Differences) *exceeds* the half sum found in **(A)**. Find from these Differences, the approximate and true median difference following exactly the same method as that given above for finding the median rate. Note that the first frequency written in the difference column represents scores which have zero difference from the median; the second frequency represents scores having differences ranging from .5 of a division to 1.5 divisions, and so on. In finding the median difference, therefore, count *zero*, .5, 1.5, 2.5, etc., according to whether there are one, two, three, or four, etc., numbers in the column of Differences.

ILLUSTRATION. The method will be illustrated for accuracy as the median difference for rate offers no unusual difficulties.

1. The median falls in the 80% group, so the frequency of this group, 25, is written along the left hand margin of the table opposite the 80%, as the first frequency of the Differences.

2. Sum of the frequencies *one* step away from the median is 17. (9+8=17).

3. 25+17=42, or more than the half-sum, 36. The approximate median difference is therefore .5. (Count zero for 25, and .5 for 17.)

4. To find the correction, take 25 from 36 (=11), and divide the 11 by the frequency in which the median falls. (11÷17=.64). The correction is therefore .6 and the true median difference .5+.6=1.1 *divisions*.

5. Since the size of each division is 10, (60%, 70%, 80%, etc.), multiply 1.1 by 10% (=11%). The true median difference is therefore 11%. That is, when the statement is made that the median

accuracy of the class is 85%, the statement must be further qualified by saying that the range of individual variation within the class is so great that the central half of the class will be found only between the limits 74%-96% (85+11 and 85-11).

The median Difference for Rate is 2.9 examples.

In comparing the variabilities of classes having different median scores, it is necessary to reduce the median differences to a common basis. This is done by expressing the median differences in per cent, using the medians as bases.

Rule: Multiply the median difference by 100 and divide the result by the median, recording the result to the nearest whole number.

ILLUSTRATION: $(2.9 \times 100) \div 12.1 = 23.9$. The variability for rate is therefore 24%. The variability for accuracy is 13%.

Note: One should be careful NOT *to conclude* that the variability for rate is greater than for accuracy. Each stands by itself. Variabilities in rate may be compared with other variabilities in rate, but are not comparable with variabilities in accuracy, and vice versa. Those who wish to make the longer computations necessary to secure comparable coefficients of variability should consult Thorndike's Mental and Social Measurements.

Measure the efficiency of the entire school, not the individual ability of the few.

COURTIS STANDARD RESEARCH TESTS
Arithmetic. Test No. 1. Addition.

Series B Form 2

SCORE
No. Attempted ____
No. Right ____

You will be given eight minutes to find the answers to as many of these addition examples as possible. Write the answers on this paper directly underneath the examples. You are not expected to be able to do them all. You will be marked for both speed and accuracy, but it is more important to have your answers right than to try a great many examples.

127	996	237	386	186	474	877	537
375	320	949	463	775	787	845	685
953	778	486	827	684	591	981	452
333	886	987	240	260	106	693	904
325	913	354	616	372	869	184	511
911	164	600	261	846	451	772	988
554	897	744	755	595	336	749	559
167	972	195	833	254	820	256	127
554	119	234	959	137	533	258	323

237	564	632	674	421	258	326	267
492	278	263	158	988	885	770	854
679	947	318	745	465	600	753	684
513	522	949	121	114	874	199	358
468	989	746	437	676	726	469	938
731	243	653	426	729	142	643	333
856	334	428	953	235	355	698	493
302	669	456	674	190	947	186	775
925	142	532	329	406	351	173	239

873	622	485	172	236	537	648	584
168	479	871	426	578	227	396	157
332	283	524	951	877	725	389	617
419	791	919	537	916	598	374	624
934	808	722	989	543	906	859	467
493	253	456	565	593	763	191	369
529	419	216	230	956	195	423	511
156	952	862	673	439	480	849	245
224	522	424	258	309	102	342	233

Name _____ (BOY OR GIRL) Age last birthday _____

School _____ Grade _____ Room _____

City _____ State _____ Date _____

Measure the efficiency of the entire school, not the individual ability of the few.

COURTIS STANDARD RESEARCH TESTS

Arithmetic. Test No. 2. Subtraction

Series B. **Form 2**

SCORE
No. Attempted .....
No. Right .....

You will be given four minutes to find the answers to as many of these subtraction examples as possible. Write the answers on this paper directly underneath the examples. You are not expected to be able to do them all. You will be marked for both speed and accuracy, but it is more important to have your answers right than to try a great many examples.

114957187 90271797	94752808 67349640	106089449 16915390	99833978 73160227
115171700 63087381	82484740 48207825	115916913 55536329	72229470 45049173
146246252 52160891	80630266 68164329	124485018 73098624	107419373 65348405
37953635 23913884	137825921 62729490	152695030 85612816	178976226 93060303
97089301 20203267	93994413 54783938	108051861 73463849	163130569 91061255
168354186 70537861	188545364 92471259	120981427 64188045	105755782 90863147

Measure the efficiency of the entire school, not the individual ability of the few.

COURTIS STANDARD RESEARCH TESTS

Arithmetic. Test No. 3. Multiplication

Series B **Form 2**

SCORE
No. Attempted .....
No. Right .....

You will be given six minutes to work as many of these multiplication examples as possible. You are not expected to be able to do them all. Do your work directly on this paper; use no other. You will be marked for both speed and accuracy, but it is more important to have your answers right than to try a great many examples.

8259 28	3467 93	4637 82	2859 47	7436 65
5289 39	6473 740	8529 56	8632 206	5947 62
3268 95	4795 83	7954 74	2386 38	9745 59
6283 47	9624 503	7853 35	4926 620	5873 49
2964 94	8357 87	6249 78	3785 35	4965 19

Measure the efficiency of the entire school, not the individual ability of the few.

COURTIS STANDARD RESEARCH TESTS

Arithmetic. Test No. 4. Division

Series B Form 2

SCORE
No. Attempted _____
No. Right _____

You will be given eight minutes to work as many of these division examples as possible. You are not expected to be able to do them all. Do your work directly on this paper; use no other. You will be marked for both speed and accuracy, but it is more important to have your answers right than to try a great many examples.

24)6984	95)85880	36)10440	87)81867
78)62868	42)17682	63)26460	59)50799
36)16236	87)61161	95)69350	24)10800
63)42903	42)28560	59)29913	78)44538
29)24679	57)51642	38)32300	64)61504
46)34086	75)55500	92)27784	83)26643

5. Testing for Accuracy. Upon receipt of the test papers of the pupils and the score sheets prepared by their teachers a painstaking work of verification was begun. Many papers had to be rescored and score sheets filled anew. In some cases considerable correspondence was necessary to ascertain, verify or confirm some information. Excepting for the fact that many different teachers gave the tests, a handicap which any extensive research of this kind must inevitably possess, the data may be considered accurate and reliable.

6. Resulting Tables. The towns and cities co-operating in this study are as follows:

Aberdeen	Garretson	Wisland
Ashton	Groton	Philip
Belle Fourche	Hecla	Redfield
Bradley	Huron	Sioux Falls
Britton	Kimball	Sisseton
Brookings	Lake Preston	Sisseton (Co.Supt.)
Chester	Langford	Stratford
Clark	Lemmon	Volin
Conde	Marvin	Watertown
Dallas	McIntosh	Waubay
Egan	McLaughlin	Wilmot
Fort Pierre	Miller	White Lake
Freeman	Mobridge	White Rock

These towns and cities are indicated by numbers. The order is not alphabetical. Not all cities and towns completed the work in such form as made the data available for this report.

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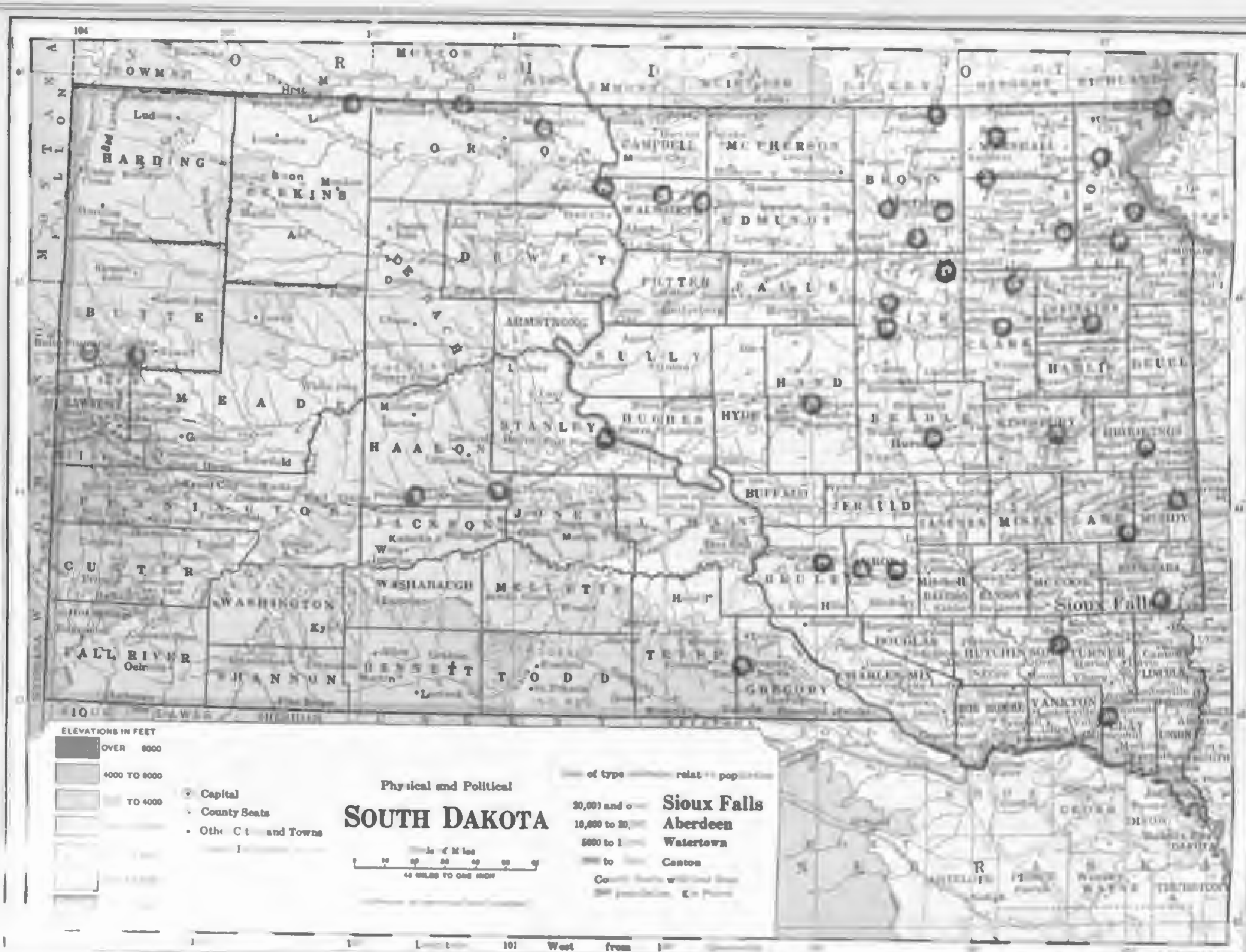

Physical and Political
SOUTH DAKOTA
ELEVATIONS IN FEET
OVER 6000
4000 TO 6000
TO 4000
Capital
County Seats
Sioux Falls
Aberdeen
Watertown
Canton
HARDING
BUTTE
MEADE
PENNINGTON
CUSTER
FALL RIVER
SHANNON
WASHINGTON
WASHABAUGH
BENNETT
TODD
MELLETTE
JACKSON
HAAKON
STANLEY
JONES
LYMAN
TRIPP
GREGORY
BRULE
BUFFALO
JERAULD
SANBORN
MINER
LAKE
MOODY
MINNEHAHA
McCOOK
HANSON
DAVISON
AURORA
DOUGLAS
HUTCHINSON
TURNER
LINCOLN
CHARLES MIX
BON HOMME
YANKTON
CLAY
UNION
HUGHES
HYDE
HAND
BEADLE
KINGSBURY
BROOKINGS
HAMLIN
DEUEL
CLARK
SULLY
POTTER
FAULK
EDMUNDS
McPHERSON
CAMPBELL
WALWORTH
DEWEY
ARMSTRONG
PERKINS
MARSHALL
Sioux Falls

Harvesting in central South Dakota

GEOGRAPHY OF SOUTH DAKOTA

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HISTORY

The first explorers of South Dakota found inhabited by three Indian tribes. The kara or Ree Indians built permanent es in villages along the Missouri River; Kiowas were hunters living in the Black and the Omahas dwelt in the valley e Big Sioux River. The powerful Sioux ns of the east made war upon the various s in Dakota, and before the close of the eenth century they held all of South ota except a small area at the mouth e Grand River held by the Rees.

he first authentic record of the early s of French fur traders to this region es that the French explorer Verendrye n Quebec camped near the present site Fort Pierre in March, 1743. His party a leaden plate bearing an inscription and date. In 1913, school children found the al plate in the city of Fort Pierre. In Thudeau built the "Pawnee House" r the chalk cliff on the bank of the Missouri south of Wheeler. This was the first house built by white men within the state.

Nearly all of the present area of South Dakota was acquired by the Louisiana Purchase in 1803 (Sec. 66). In the following year the Lewis and Clark expedition ascended the Missouri River. The first permanent settlement was a trading post established in 1817 by Joseph La Framboise near the present city of Fort Pierre. The prairie lands were attractive and a farming settlement was established near Sioux Falls in 1857. This was broken up in 1862 by the Sioux raids. The second farming settlement began in 1859 on the fertile lowlands of the Missouri and the James rivers, where the towns of Bon Homme, Yankton, and Vermillion were established. These settlers escaped the Indian raids in 1862 by gathering in the fort at Yankton. Dakota Territory was created in 1861 with Yankton as the capital until 1883. The state grew rapidly after the discovery of gold in the Black Hills, and in 1889 South Dakota became a state.

Report on Handwriting

1. Fall Tests. The handwriting tests were given in South Dakota cities and towns about October 1, 1917. For various reasons data from a number of co-operating schools are not given in this report. Each city in these lists is designated by the letter C and a number, and each town by the letter T and a number. Neither list is arranged alphabetically.

The handwriting attainments of the children in these cities and towns rank considerably below those of cities in general as will be seen from the tables and graphs.

The report shows the median scores for the school children in each city and town, by grades, the quartile range and the per cent of variability. As these terms may not be familiar to all they are explained and illustrated as follows:

2. Median Explained. The median, or middle score, is used instead of the average for several reasons, principally because a few very good scores or a few very poor scores disturb the position of the average but not of the median.

The method of computing the median may be illustrated as follows:

%	No. pupils
80	1
75	1
70	2
65	1
60	2
55	4
50	7
45	5
40	15
35	17
30	18
25	6
20	1

Here are the distributions for quality for the seventh grade in city 7. There are 80 pupils in this grade. One ranked 80%*, or more than 80% but less than 85%; one ranked 75%, or more than 75% but less than 80%; two ranked 70%, or more than 70% but less than 75%, etc. The median pupil is the 40th. (This is, strictly speaking, the mid-point.) To find the score of the 40th pupil we may begin at the bottom and count upwards. 1+5+18 = 24.

* Strictly speaking these are not per cents. Ayres derived his scale by distributing his carefully rated samples in four equal steps on each side of 50, getting 20 as his lowest and 90 as his highest.

The 40th is in the group of 17 who score from 35% to nearly 40%. He is the 15th in the group. Let us suppose these 17 are evenly distributed from 35 to 40.* The 15th pupil in the group will have a score of 15/17 of 5% more than 35%. This is 39.4%, the median score.

This may be verified by counting downwards from the highest ranking pupil to the 40th. 1+1+2+1+2+4+7+5+15= 38. Two more will make 40. The second pupil downwards into the group of 17 is the median. 2/17 of 5% less than 40% is his score. This is 40%-.6%or 39.4%.

3. Quartile Range. By quartile range (Q) is meant the distribution of half of the class about the median, one quarter above and one quarter below. As this value is highly significant the method of calculating it is illustrated as follows:

Take the case of the 80 seventh grade children. The score of the 20th child from the bottom is the mark of the first quartile (or quarter, designated Q1). This score is computed exactly as was the median. Beginning at the bottom 1+ 6 = 7. The 13th of the 18 in the next is Q1. As we assume that the 18 children are scattered along evenly from 30% to 35%, the 13th of the 18 will score 13/18 of 5% more than 30%. 13/18 of 5 = 3.6. 30%+3.6%= 33.6%or Q1. Now the third quartile (Q3) will be the score of the 60th pupil. Adding from the bottom: 1+6+18+17+15 = 57. The 60th will be the third in the group of 5 scoring from 45 to 50. As the 5 are assumed to be distributed evenly from 45 to 50 the 3d will score 3/5 of 5+45 or 48. This is Q3.

The middle half of the pupils, from the 20th to the 60th, range in scores from 33.6% to 48% or 14.4%. The quartile range will be one half of this or 7.2%. Thus we see that the middle quarter of the class vary 7.2% from the median.**

* If this sentence is understood there will be little difficulty in what follows.
** If the distribution is normal Q is the same as the "probable error" (P.E.).

4. Percentage of Variability. This is a measure which takes into account both the median and the quartile range. It is found by dividing the Q by the M. From an inspection of the fraction Q/M it will be seen that the smaller the Q or the larger the M (both marks of superiority) the smaller will be the quotient or percentage of variability.

5. Distributions. One of the greatest discoveries of this century in education is the fact of individual differences. It was an underlying assumption of the pedagogy of the past that all children, save idiots and imbeciles, could make equal progress if they worked hard enough. The use of mental measurements has clearly revealed a wide range of variability in intellectual capacity. A group system of instruction, however, must be based upon a fairly close classification. Too wide a range of abilities in the same class seriously interferes with successful teaching. This is less true, perhaps, in the case of writing than in most other subjects. The following table shows the distribution of the 80 seventh grade pupils in quality of writing by grades according to the Ayres standard.

	Under 2	2	3	4	5	6	7	8	Over 8
Grade									
Ayres Standard	38	38	42	46	50	54	58	62	66
No. Children	35	12	11	4	5	4	3	2	4

From this it will be seen that although the 80 pupils were classified in the seventh grade 35 of them had less than second grade ability, 12 had less that third grade ability, etc. Only three in the group had seventh grade ability. It should be remembered that the Ayres scores are rather high and are mid-year or May scores whereas these samples were taken in October. It should be remembered, too, that Ayres' standards are median scores, not the passing scores.

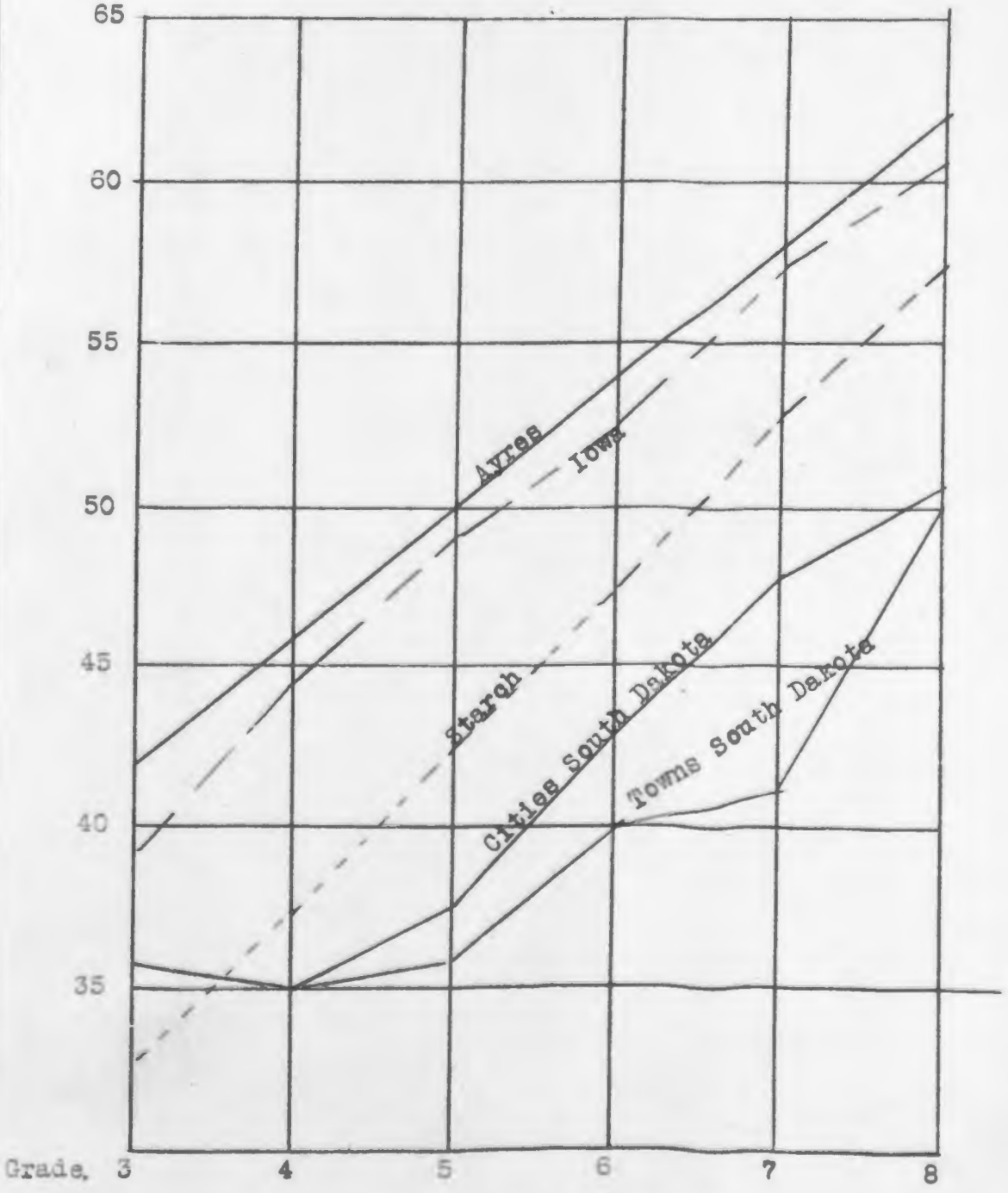
6. Handwriting-October, 1917, scores.

Cities	Third Grade						Fourth Grade						Fifth Grade					
	Quality			Speed			Quality			Speed			Quality			Speed		
	MED.	Q	% VAR	MED.	Q	% VAR	MED	Q	% VAR	MED	Q	% VAR	MED	Q	% VAR	MED	Q	% VAR
C1	31	3.9	12.3	22	3.1	14.0	30	3.7	12.3	41	11.7	28.6	34	4.6	13.6	68	11.8	17.4
C2																		
C3	41	7.3	17.1	61	4.7	7.7	38	5.1	13.5	77	8.1	10.5	43	7.5	17.4	89	7.4	9.1
C4	34	8.6	25.1	29	9.9	34.1	31	5.3	17.0	38	6.6	17.3	34	7.4	21.3	51	8.8	17.1
C5	33	6.4	25.6	41	12.9	31.4	33	5.8	17.5	53	6.2	11.7	32	2.8	8.7	58	10.0	17.4
C6	36	6.4	17.7	28	3.4	12.2	35	5.8	16.7	41	7.6	18.5	36	5.9	16.2	60	10.8	18.2
C7							42	6.7	15.8	41	7.5	18.3	35	10.2	29.2	61	8.9	14.6
C8	33	3.0	18.5	34	4.2	12.8	42	5.7	13.6	32	7.9	24.7	38	4.5	12.0	45	10.3	22.8
C9	32	5.4	16.8	30	12	40	34	7.8	22.8	55	7.9	14.3	36	7.2	19.8	68	12.3	18.3
C10	42	9.2	21.8	31	8.4	27	38	7.7	20.2	42	10.6	25.2	41	9.3	22.3	78	13.2	17.0
C11	34	6.6	19.3	35	8.2	23.4	33	5.3	15.9	30	5.1	17	44	5.9	13.3	41	8.3	20.4
C12	37	5.8	15.9	38	8.7	23.1	33	3.3	9.9	52	7.5	14.4	42	11.7	27.9	62	13.4	21.4
C13							37	3.8	12.8	70	6.2	8.8						
Median	36	6.8	18.8	31	7.8	25.1	35	5.6	16	45.8	7.3	14.8	37.6	6.5	17.7	60.6	14.7	23.6
Towns																		
T1	30	6.5	13.0	36	5.7	15.6	39	4.8	12.3	58	7.5	12.9	42	2.8	6.7	68	15.3	22.3
T2	36	4.5	12.5	35	6.4	18.2	32	9.2	28.7	75	17.5	23.5	36	6.2	17.2	105	13.7	13.0
T3																		
T4	36	4.7	13.0	37	11.2	30	29	2.2	7.6	51	13.4	26.2	31	4.1	13.1	55	10.0	18.2
T5	38	3.7	9.8	37	8.7	23.6	23	2.5	10.8	30	15.0	50.0	37	2.5	6.8	48	8.1	17.0
T6	34	5.7	16.6				30	5.8	19.3				28	0.5	1.8			
T7	42	3.5	8.3	63	12.5	19.8	44	8.2	18.4	70	11.2	14.5	33	4.5	13.8	78	13.7	17.6
T8																		
T9	33	4.5	13.6	38	6.7	17.5	34	6.2	18.2	34	10.0	29.4						
T10	55	4.1	11.6	62	10.0	14.0	42	5.3	12.8	84	8.6	10.2	39	2.0	6.6	46	5.0	10.9
T11	31	5.2	15.9	43	12.5	29	33	2.7	8.1	45	13.7	30.4	36	6.7	18.5	66	5.1	7.7
T12	47	7.2	15.3	26	4.7	14.2	36	3.6	10.0	31	7.9	23.1	42	2.8	6.7	38	10.6	28.2
Median	36	5.5	15.2	36	10.1	30.8	35	6.3	17.9	554	16.8	28.2	359	5.3	14.8	581	14.7	25.3
State Median	36	6.4	17.9	33	10.4	31.5	35	5.9	16.8	467	11.6	24.7	372	6.4	17.2	523	14.7	23.7
Ayres Median	42			44			46			55			50			64		

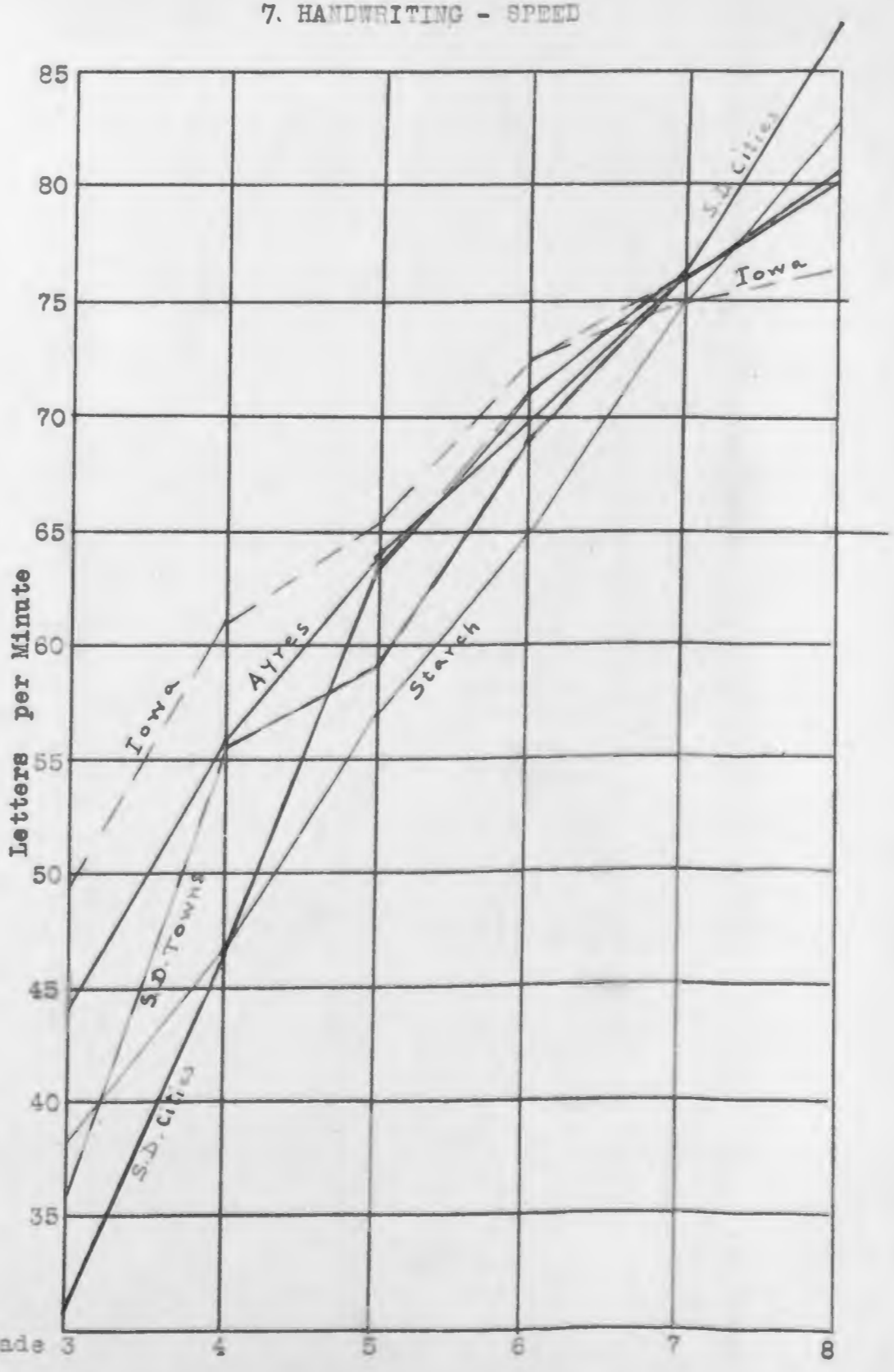
6 Handwriting-October, 1917, scores.

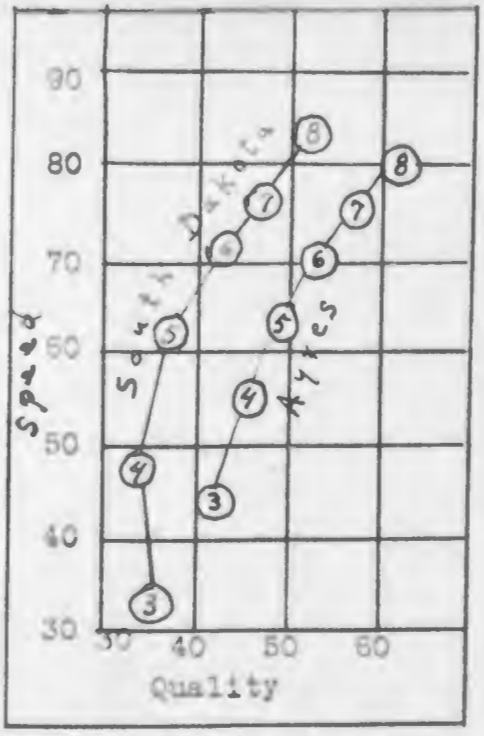
Cities	Sixth Grade						Seventh Grade						Eighth Grade					
	Quality			Speed			Quality			Speed			Quality			Speed		
	MED	Q	1. VAR	MED	Q	1. VAR	MED	Q	1. VAR	MED	Q	1. VAR	MED	Q	1. VAR	MED	Q	1. VAR
C1	41	5.6	13.9	78	8.2	10.5	44	8.3	19	79	9.8	12.4	42	10.0	23.5	74	10.9	14.6
C2																		
C3	45	9.0	20.0	99	11.2	11.3												
C4	39	4.2	10.8	56	6.8	10.4	48	8.0	16.9	76	7.0	9.2						
C5	39	3.6	9.3	73	3.3	4.5	45	7.9	15.4	82	11.4	13.8	48	7.3	15.2	85	9.9	11.7
C6	42	7.7	18.3	73	9.5	13.0	53	9.4	17.8	81	8.4	10.0						
C7	41	7.8	19.0	94	2.5	2.7	39	7.2	18.3	82	13.1	23.2	64	11.0	17.1	89	11.0	12.4
C8	43	5.9	13.9	82	7.8	9.5	46	8.3	17.9	92	10.0	10.1	49	6.5	13.2	108	10.6	9.8
C9	39	12.2	31.2	62	3.8	6.1	43	7.3	16.9	81	14.7	18.1						
C10	52	10.5	20.2	61	9.9	16.1	62	16.3	26.2	64	10.1	15.8	54	15.9	29.2	73	16.2	22.1
C11	41	10.6	25.8	58	10.5	18.0	42	6.2	14.6	72	11.6	16.0	43	7.4	17.2	102	14.1	13.7
C12	38	4.9	12.8	69	7.2	10.4	47	10.6	22.6	78	14.1	18.2	42	5.3	12.3	88	7.2	8.2
C13													59	11.3	19.2	98	15.8	16.2
Median	43	15.7	36.7	717	15.2	21.2	483	11.4	23.6	764	12.5	16.4	514	10.7	20.8	887	13.5	15.2
Towns																		
T1	45	7.0	17.7	725	6.9	9.5	48	16.7	35.1	76	8.9	11.7	41	14	33.9	72	9.8	13.5
T2							43	3.6	8.4	85	16.1	19.0	52	12.0	22.8	79	15.0	19.0
T3																		
T4	42	3.8	8.9	70	10.0	14.3	52	9.6	18.3	78	8.4	10.7	58	8.4	14.6	89	4.5	5.1
T5	36	4.1	11.4	53	4.2	7.9	37	3.2	8.7	84	5.9	7.0	32	2.5	7.7	65	12.5	19.2
T6	43	3.3	7.6				50	9.2	18.4				55	8.8	16.0			
T7	61	4.2	6.9	84	6.5	7.7	50	6.2	13.0	80	12.5	15.6	50	0	0	55	0	0
T8																		
T9	47	3.5	8.4	54	19.7	36.5							48	6.2	13.0	55	23.3	42.3
T10	64	4.1	6.4	62	8.1	12.9	45	5.3	11.8	55	8.8	16.0	61	10.3	16.8	71	7.5	10.5
T11	35	8.7	24.9	78	10.3	13.2	33	3.0	9.1	64	9.3	14.6	41	9.0	22.0	72	7.4	10.2
T12	46	1.3	2.8	51	6.7	13.1	36	3.5	10.0	78	8.9	11.4	44	5.7	13.0	81	18.2	22.4
Median	40	8.2	20.5	689	14.5	21.0	416	7.6	18.2	765	8.9	11.6	50	9.8	19.6	757	11.0	14.5
State Median	43	9.5	22	712	14.2	20.0	472	11.3	23.8	764	12.4	16.2	506	10.6	20.9	841	13.4	14.8
Ayres Median	54			71			58			76			62			79		

7. HANDWRITING - QUALITY

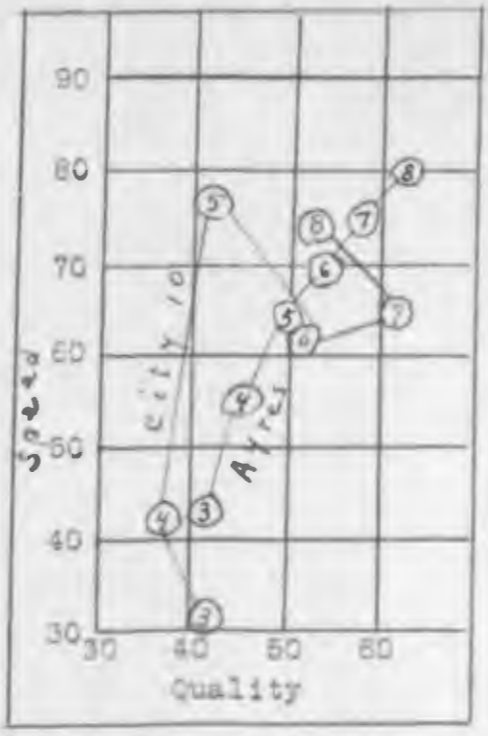


7. HANDWRITING - SPEED

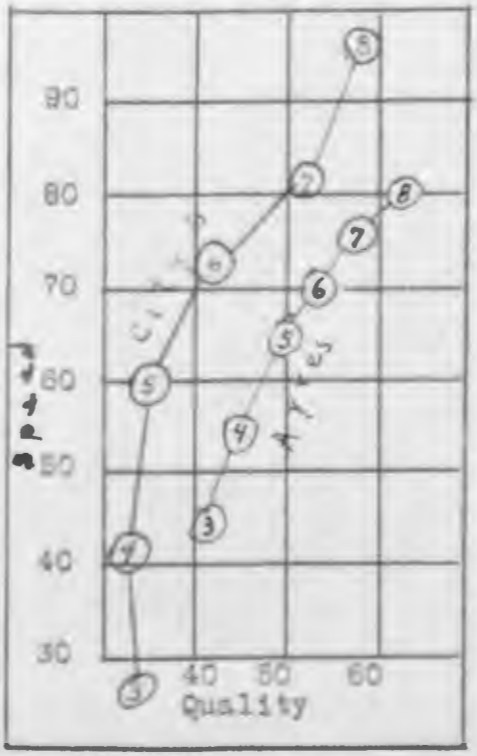




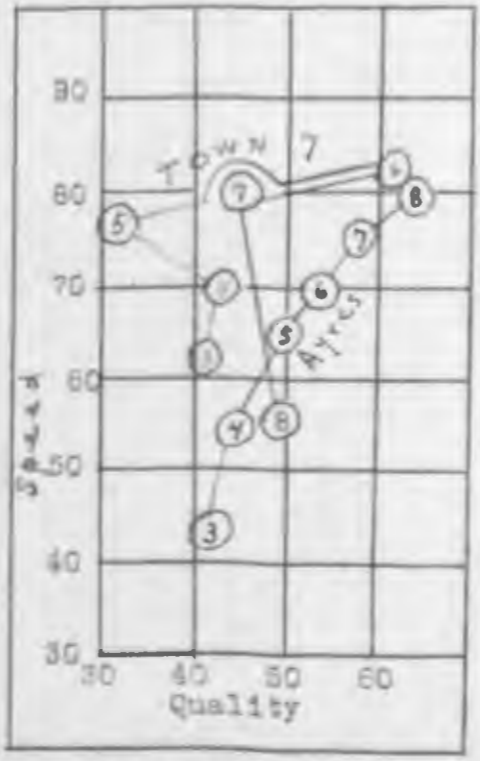
Ayres and South Dakota



Ayres and City 10



Ayres and City 6



Ayres and Town 7

8. Comments. As has already been noted the scores in quality are rather low and the speed is low in grades 3 and 4.

There is also too wide a range of variability. The widest range in quality among the schools is in the 8th grade where C7 has a score of 64% and T5 has a score of 32% (lower than second grade standard), a range of 32%. The range in speed in grade 5 is from 105 letters per minute in T2, to 35 in T12. Teachers apparently do not know how well or how rapidly pupils should write.

In many cities and towns there is an almost dead level in quality in grades 3, 4 and 5, in some a retrogression. In T12, the quality runs by grades 47,36,42,46,36,44. In grade 3 the rate is 26--the pupils are drawing, not writing. In T5 also the best writing is done in the 3d grade (and this is below standard). Several schools are sacrificing quality for speed; e.g., T2, 8th grade; C8 in grades 6, 7 and 8.

The graphs on page 39 show the speed and quality of South Dakota cities and towns as compared with Ayres standard. City 6 shows a symmetrical system of scores--all low in quality. City 10 and Town 7 show asymmetrical scores.

9. Recommendations. The first study of handwriting which the teachers of South Dakota need to make is that of the standards of quality and of speed. If the teachers know how rapidly the children should write they would not permit the slow drawing of letters* which some cities and towns show or the lightning like pace in others.

Graphs of each city will reveal anomalies of various sorts. The remedy is usually apparent as soon as the defect is known.

* This probably explains the anomaly shown in the table in the quality of the 4th grades as compared with that of the 3d grade. The latter produce more legible copy but they should be speeded up by one-third.

VIII. Report on Spelling.

1. Fall Tests. The tests in spelling were given about October 1, 1917. The tests consisted of three lists. The first list consisted of fifteen words selected by chance from list J. of the Ayres scale; list two, twenty words selected by chance from Ayres' list M.; and list three, fifteen words selected by chance from Ayres' list Q. The median score on the total of the three lists for each grade in each city is given. This affords a very fair basis for comparison grade for grade and city for city. The median on the first list is also given for the third and fourth grades with an opportunity for comparison with Ayres standard (List J, 84 for third grade and 94 for fourth grade). The same showing is made for the fifth and sixth grades with the second list (Ayres M) and for the seventh and eighth grade with the third list (Ayres Q).

2. Spelling (Per cents)

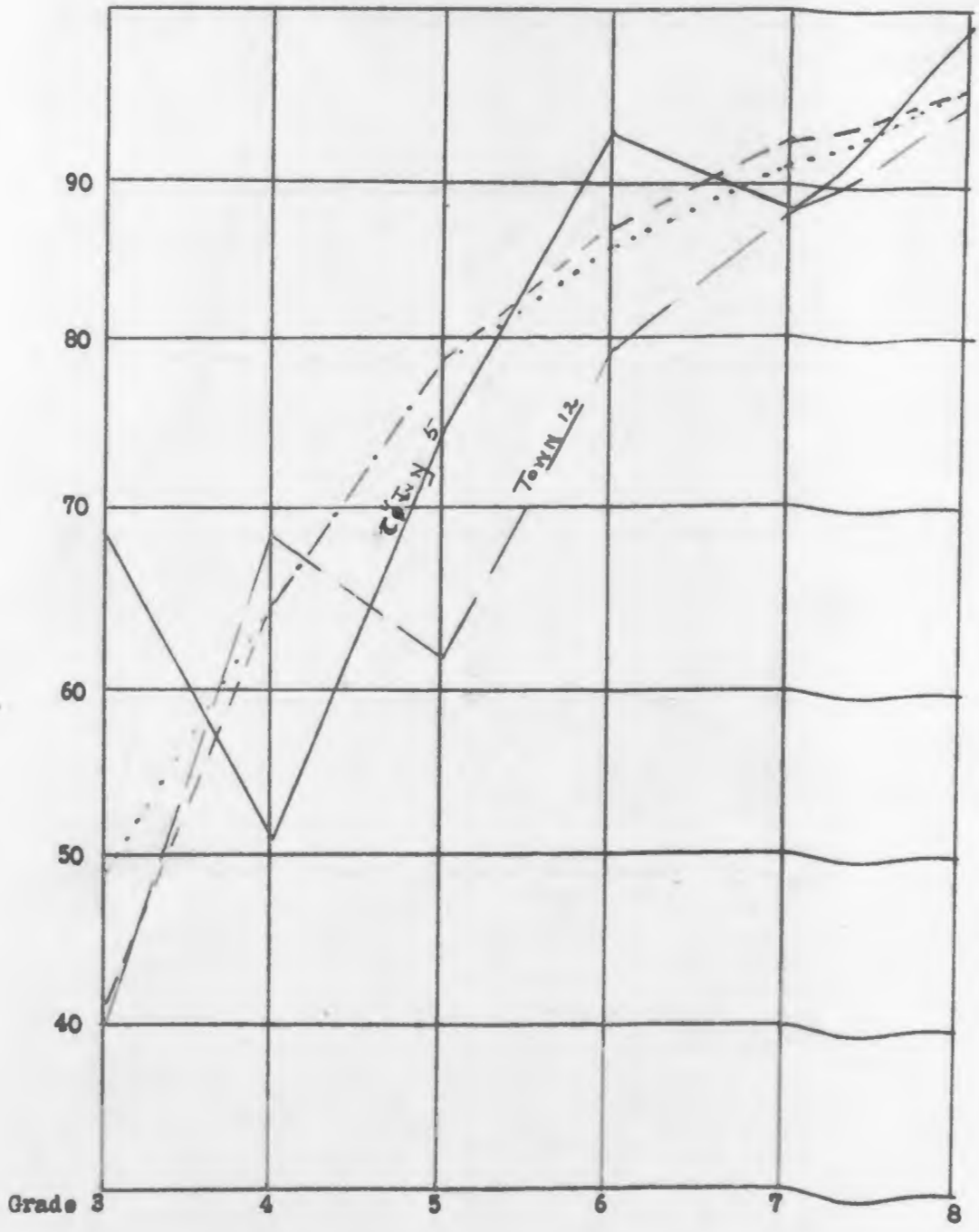
Cities	Third Grade				Fourth Grade				Fifth Grade			
	MED. 50 words	MED (LIST J)	Q (LIST J)	% VAR.	MED 50words	MED. (LIST J)	Q (LIST J)	% VAR.	MED. 50words	MED. (LIST M)	Q (LIST M)	% VAR.
C1	30	64	36.5	57.1	55	98	2.4	5.5	90	97	5.3	5.5
C2					59	100	4.7	4.7	73	83	14.1	17.1
C3	28	62	23.0	37.0	44	89	24.7	27.8	76	87	15.0	19.6
C4	45	79	26.5	33.6	43	100	7.8	7.8	70	90	19.5	21.5
C5	49	91	14.2	15.5	61	100	3.8	3.8	66	86	16.8	19.4
C6	31	62	30.3	49.1	85	98	5.5	5.6	76	93	9.7	10.4
C7					55	97	11.9	12.2	72	89	13.7	15.3
C8	54	84	16.1	19.1	77	100	1.8	1.8	83	93	4.5	4.6
C9	26	44	31.4	71.8	65	97	6.4	6.5	77	91	9.7	10.6
C10	41	88	13.5	15.3	63	100	5.4	5.4	81	91	10.7	11.8
C11	30	79	21.3	26.8	72	100	0	0	81	96	7.1	7.4
C12	55	97	12.5	12.8	75	100	.17	.2	80	96	6.5	6.8
Median	*40.5	74.5	23.3	**31.3**	*64	99.1	5.8	5.8	*78	93.4	9.2	9.8
Towns												
T1	35	50	13.5	27.0	89	100	5.0	5.0				
T2	54	100	7.4	7.4	69	100	1.3	1.3	83	93	8.3	9.0
T4	45	83	17.6	21.1	58	99	7.5	7.8	80	100	8.7	8.7
T5	66	100	5.5	5.5	51	100	20.0	20.0	74	84	9.8	11.6
T6	51	99	15.6	15.8	55	98	15.0	15.2	71	88	3.3	3.7
T7	48	95	7.4	7.7	63	100	1.3	1.3	77	91	11.4	12.5
T9	51	95	6.0	6.3	64	100	3.9	3.9	0	46	87.0	88.2
T10	69	100	7.8	7.8	80	100	7.4	7.4	91	100	0.6	0.6
T11	36	90	17.4	19.3	91	100	1.7	1.7	80	76	7.6	10.0
T12	40	72	13.1	18.2	68	100	4.3	4.3	63	75	7.5	10.0
Median	*49	94	13.9	14.7	*64	100	3.0	3.0	*78	88.2	11.6	13.1
State Median	*48	77.3	23.9	30.9	*64	99.7	5.3	5.3	*78	91.6	11.7	13.7
Ayres Median		84				94				93		

* Average.

2. Spelling (Per cents)

Cities	Sixth Grade				Seventh Grade				Eighth Grade			
	MED. 50 words	MED. (LIST M)	Q (LIST M)	% VAR.	MED. 50 words	MED. (LIST Q)	Q (LIST Q)	% VAR.	MED. 50 words	MED. (LIST Q)	Q (LIST Q)	% VAR.
C1	87	97	4.7	4.8	98	100	2.7	2.7	99	100	0	0
C2	85	99	2.5	2.5	90	97	6.1	6.3	95	96	5.2	5.5
C3	78	95	8.6	9.0	96	100	4.5	4.5	98	93	14.2	15.2
C4	83	98	4.2	4.3	95	98	10.3	10.4				
C5	86	100	4.6	4.6	91	100	3.3	3.3	98	100	0.9	0.9
C6	84	95	8	8.4	91	92	10.1	11				
C7	80	96	8.5	8.8	89	91	11.2	12.2	96	98	4.6	4.7
C8	93	100	3.7	3.7	91	86	13.4	16.1	96	95	5.0	5.3
C9	81	92	10.4	11.3	85	85	13.5	14.7	95	95	7.3	7.6
C10	87	97	6.3	6.5	92	93	3.7	4.0	97	100	3.2	3.2
C11	81	98	5.6	5.7	92	93	9.4	10.2	97	100	2.2	2.2
C12	87	98	4.7	4.8	96	99	5.4	5.4	96	96	5.0	5.2
Median	*86	96.2	6.9	7.2	*91	93.9	9.5	10.1	*96	100	4.6	4.6
Towns												
T1					93	94	12.2	12.9	89	94	14.3	15.2
T2	90	100	4.2	4.2	90	94	18.6	19.8	98	100	7.7	7.7
T4	87	98	3.3	3.4	92	76	20.0	26.2	98	100	7.4	7.4
T5	93	100	3.1	3.1	88	97	10.0	10.3	100	#100	#0	#0
T6	93	98	2.5	2.6	93	97	5.4	5.5	97	100	0.9	0.9
T7	90	x100	x0	x0	92	93	12.6	13.7				
T9	80	92	3.8	4.1		91.5	2.4	2.5	93	90	2.7	3.0
T10	93	98	2.2	2.2	96	98	3.0	3.0	98	100	4.6	4.6
T11	90	76	2.2	2.8	94	91	8.3	9.0	96	95	3.6	3.7
T13	79	92	13.2	14.4	88	96	11.4	11.7	95	96	2.1	2.2
Median	*87	94.9	10.3	10.9	*92	94.6	10.8	11.4	*96	97.2	5.7	5.9
State Median	*86.9	95.5	7.8	8.1	*91.9	94.0	9.6	10.2	*96	99.8	4.7	4.7
Ayres Median		96				92				96		

* Average x Only 5 pupils # Only 2 pupils

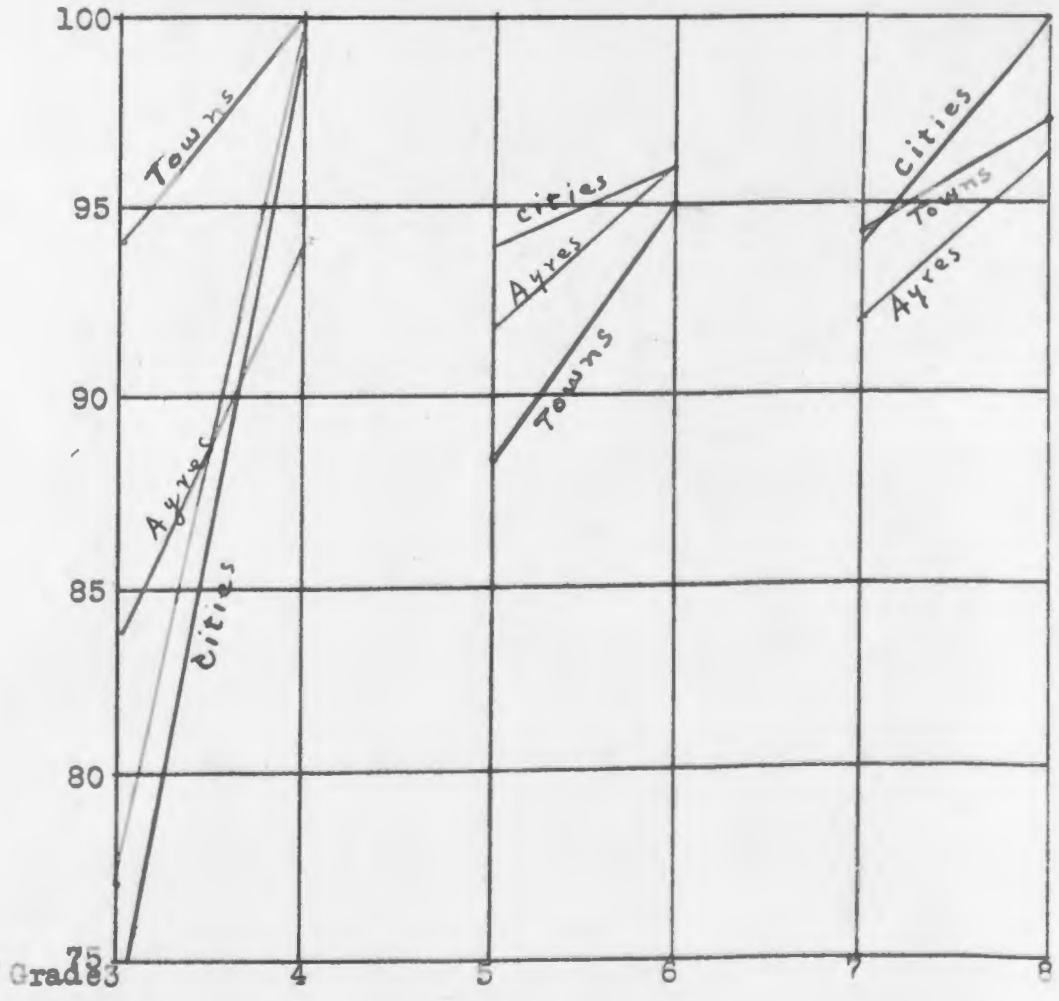


2. SPELLING

— — — — = City Average - Total List

. . . . . = Town Average - Total List

2. SPELLING


100
95
90
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75
Towns
Ayres
Cities
cities
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Grades
3
4
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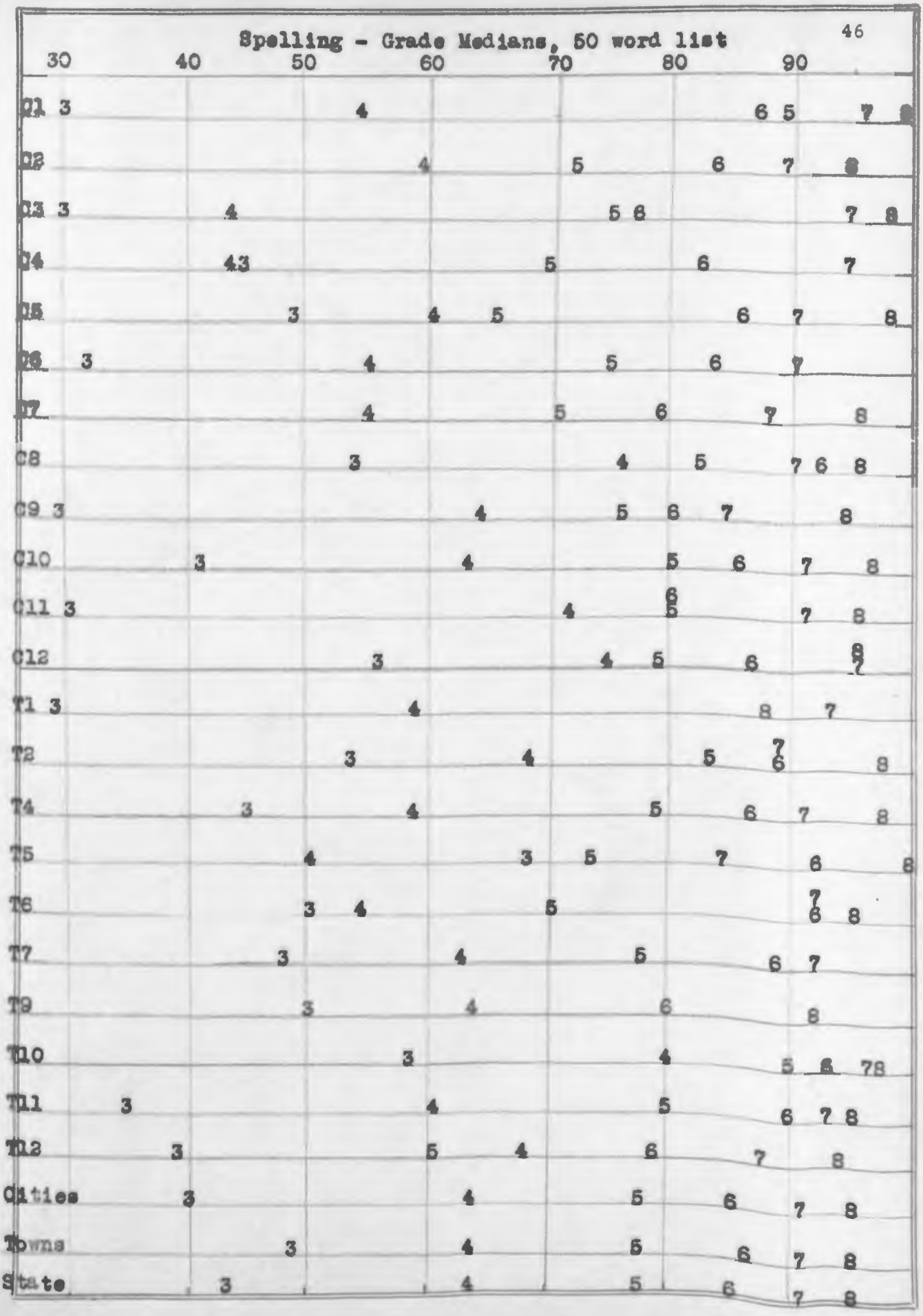
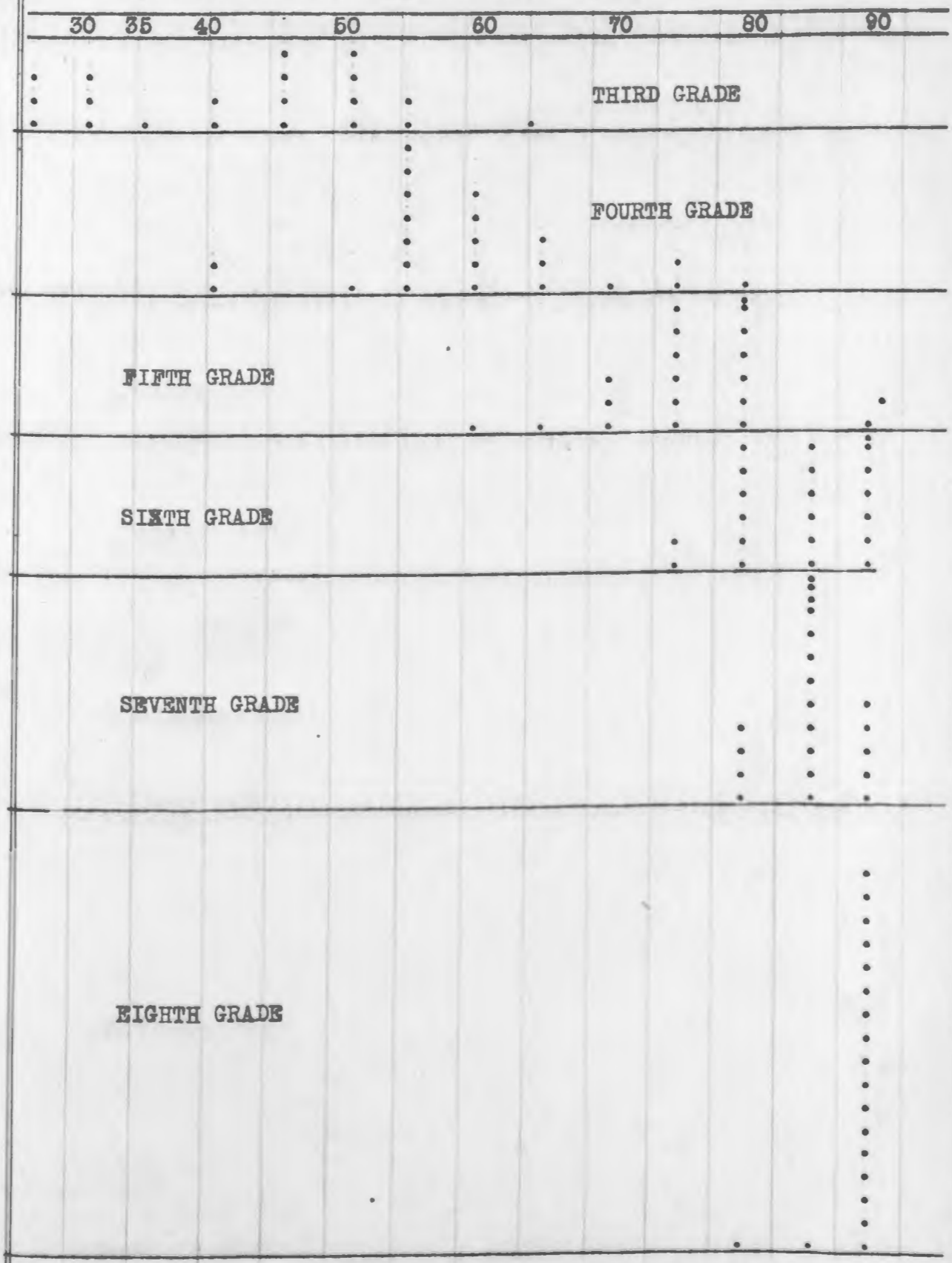
Spelling - Grade Medians, 50 word list



SPELLING--Grade Medians, 50 word list
Each dot represents a city or town. 30 means from 30 to 34.



3. Comments and Recommendations. On the whole, South Dakota ranks somewhat higher than Ayres standard. There is little difference between the spelling abilities of children in cities and those in towns. C10 is slightly better than normal in all grades in all lists, an almost ideal distribution. Some splendid spelling work is being done here.

Some cities and towns show too high marks considering the grades and lists. It is probable that too much time is being spent in spelling. In some schools it is apparent that too much time is spent in studying very easy words. For example in C1, fourth grade, the pupils got only 55% on the 50 words (state median 64) but got 98% on list J, (Ayres standard 94) the easiest list given. The third grade of this city certainly needs some attention, being far below grade and having an abnormal distribution. There are several other conspicuous cases of this type; e.g., T13, fifth grade; T1, third grade; C9, third and seventh grades; C6, third grade; C3, third and fourth grades, etc. Many other conditions are revealed in this table.

IX. Report on Reading

1. Fall Tests. The reading tests showed the large percentage of variability of the other tests. As in the other tests no one city or town carried off all honors. C8 ranked highest in the third grade but was next to the lowest among the cities in the fourth grade. T10 was highest in the fourth grade, C10 was highest in the fifth grade, C5 in the sixth, C12 in the seventh, and C8, T5, T7 and T10 tied for highest in the eighth grade. The school scores vary from 8.1 to 32.4 in the third grade, from 13.6 to 40 in the fourth grade, from 24 to 47.3 in the fifth grade, from 27.6 to 48.4 in the sixth grade, from 31.8 to 49.5 in the seventh grade, and from 38.3 to 50 in the eighth grade. It will be noted that there is a constant upward progression in these minima and maxima as well as in the town, city and state median scores.

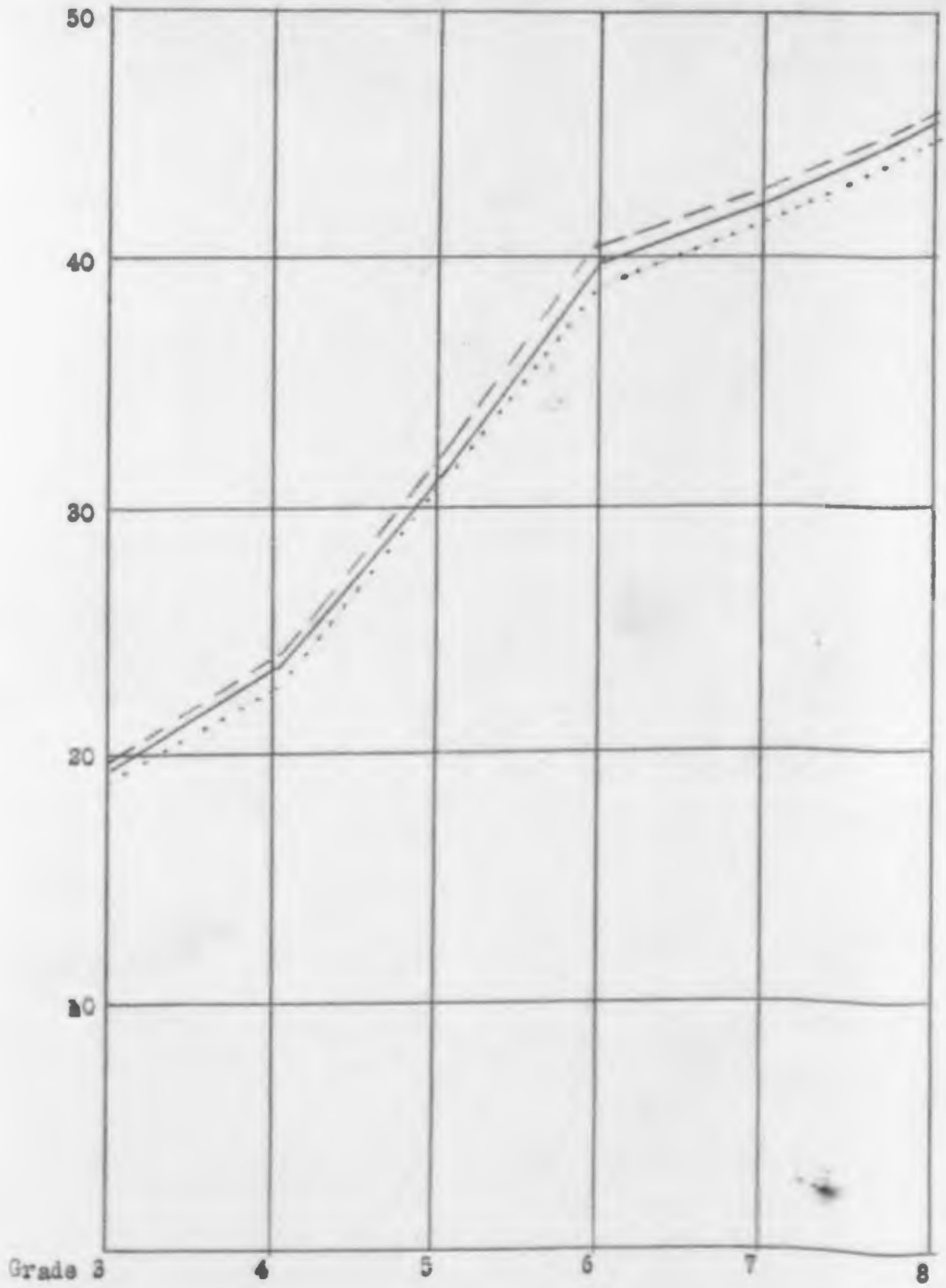
The graphs show that the towns have uniformly lower class scores and with a few exceptions higher percentages of error on each set in the reading test.

3. Reading - October, 1917 Beta I

Cities and Towns	Third Grade Percentage of error					Fourth Grade Percentage of error					Fifth Grade Percentage of error				
	Set I	Set III	Set IV	Set V	Class Score	Set I	Set III	Set IV	Set V	Class Score	Set I	Set III	Set IV	Set V	Class Score
C1						4.8	44.9	77.8	88.6	21.2	2.1	28.7	46.8	66.1	35.1
C2						8.1	33.3	57.1	62.8	24.2	2.	18.7	45.9	43.3	30.7
C3	9.3	50.7	82.0	96.2	17.1	4.8	26.8	54.0	66.2	22.8	.06	20.3	35.6	26.8	29.9
C4	15.7	57.4	89.1	89.8	13.4	7.6	29.8	73.0	80.3	19.6	21.1	25.3	51.3	61.3	27.3
C5	8	65	93	97	16.4	10.1	46.8	74.3	81	16.4	20.3	24.6	44.6	52.8	27.7
C6	6.9	59.5	89.8	88.7	20.5	1.9	27.6	58.4	63.4	27.7	1.9	16.8	21.3	38.3	32.9
C7						2.6	34.4	70	92	23.4					
C8	13.8	66.3	88.1	75.0	22.4	8.9	40.8	69.9	86.1	19.2	2.8	28.3	27.2	54.4	30.3
C9						4	26.8	54.3	61.6	26.7	1.2	24.4	40.8	54.5	28.0
C10	9.8	58.8	87.9	98.8	17.1	4.2	25.7	48.7	54.9	27.2	.98	14.7	29.8	32.8	47.8
C11	1	57	87	90	19.4	3	21.6	70	71.6	29.8		11.1	32.2	48.6	33.7
C12	1.7	43.1	73.8	91.6	20.6		20	38.9	69.4	30	20.3	16.3	13.6	39.1	42.8
C13	3	40	85.4	94.3	21.7		38.8	73.3	72.2	21.7	11.9	29.7	34.3	58.7	37.2
City Ave.	7.84	55.3	84.84	90.29	18.97	5.11	33.85	63.59	73.01	23.79	4.21	20.74	36.6	45.35	33.24
T1	3	67	100		21.6	6	35	74	74	27.5	2	30	48	80	32.3
T2	1.0	27.8	77	83.9	28.1	2.7	35	48	68	18.1	0	11.2	13.7	40	43.7
T3	12.9	37.7	74.4	83.3	18.2	4.5	29	61	86	20.7	3.7	28.8	46.4	66.8	28.2
T4	11.1	83.3	93.8	100	13.7	0	70	96.6	96.6	11.7	3	24.5	71.2	78.9	26.8
T5						3.7	37.7	84.4	93.3	23.1	0	20	13.5	60	30.0
T6	12	61	93	99	15.2	0	80	84	82	21.8	0	43	72	77	24.0
T7	3.5	46	65	62	27	20	28	57	67	26.2	2.2	12.2	28	42	36.1
T8	4.6	26.6	65.7	89.7	23.9	8	23.3	43.3	76.7	28.3	0	28.5	47	53.3	25.5
T10	12	25	43	75	21.2	7	7	30	40	40.0	4	7.5	24.3	40	33.4
T11	31.8	65.7	97.1	97.1	8.1	13.9	40	60	85	18.6	3	28	33.3	20	27.3
T12	111	68.9	93.5	91.1	19.7	5.5	38.3	70	70	21.9	18	30	58	90	31.1
Town Ave.	1003	46.7	86.0	84.92	19.7	6.48	37.12	68.3	79.07	23.8	3.27	28.34	43.7	52.20	30.3
State Ave.	8.94	50.9	85.77	86.6	19.83	5.78	35.36	65.94	76.04	23.49	3.74	23.14	40.1	53.75	31.32

2. Reading - October, 1917 Beta I

Cities and Towns	Sixth Grade Percentage of error					Seventh Grade Percentage of error					Eighth Grade Percentage of error				
	Set IV	Set V	Set VI	Set VII	Class Score	Set IV	Set V	Set VI	Set VII	Class Score	Set IV	Set V	Set VI	Set VII	Class Score
C1	28.5	48.5	86.1	89.7	35.9	12.7	32.7	69.1	75.4	44.3	6.6	29.3	72.6	78	45.6
C2	17.2	48.3	60	83.4	41.5	10.8	50.8	61.6	75	45.9	18.8	25	63	62	40.7
C3	5.4	25.9	57.2	69.7	46.7	17.2	32.9	72.8	71.3	41.5	8.9	30	46.1	40	45.3
C4	21.1	43.2	66.4	81.1	39.4	21.1	34.7	62.2	60	39.4					
C5	15.1	23.2	55.1	61	48.4	23.4	46.2	69.6	76.5	38.3	4.4	22.4	62	52	48.8
C6	19.7	41.9	72.9	85.6	40.1	10.2	34.3	60.5	71.0	46.3					
C7	36.5	56.5	88.5	92	32.6										
C8	14.3	42.3	70.6	72.9	43.4	38.5	43.6	63	63	31.8	9	30	55	56	50.0
C9	21	50	74	97	39.2	7	32.0	40.0	60	46.9	5	32	32	59	44.4
C10	11.6	38.9	54.4	68.8	45.2	6.6	32.5	44.3	44.9	44.2	5.2	22.8	53.7	50.8	48.6
C11	15.4	30.9	60.9	76	42.6	13.6	52.8	66.4	70.4	43.8	10	30.9	34.5	54.5	46.5
C12	23	29	44	51	38.5	4.7	20.9	40.9	54.2	49.5	6.4	27.3	44	62	46.5
C13	24.4	34.4	62.2	72.2	37.8	7.5	25	47.5	51.2	47.5	2	24.2	47.1	31.4	47.9
City Ave.	19.48	39.54	65.56	76.96	40.87	14.44	34.66	58.16	64.41	43.28	7.82	26.39	51.0	54.51	46.43
T1	1	48	77	77	37.8	4	42	60	72	40.6	1	40	55	80	41.2
T2	4.6	36.9	55.4	60	42.4	21.3	42.7	68	76	39.3	0	26.7	55.5	55.5	46.7
T3	32.7	50	70.9	90.9	34.2	38.8	54.2	80.9	74.2	38.6	13	33	51	64	44
T4	32	45.3	78.6	94.6	34.4	22.2	37.5	60	70	38.9	20	37.1	48.6	54.2	40.0
T5	8.5	48.5	80		47.8	0	26	42	54	47.0	0.5	20	35	55	50.0
T6	52	58	78	72	27.6	44	44	64	57	34.4	13	31	41	38	44.5
T7	17	50	53	90	41.7	0	33	55	65	44.0	0	20	0	60	50.0
T8	19.1	35.5	66.9	68.7	40.5										
T9	24	63	84		38.0	16	48	64	72	42.3	0	60	60	100	42.6
T10	12	32	44	44	44.6						0	20	25	30	50.0
T11	36.8	56.6	55	85	36.7	5	36.7	57	67	42.5	0	30	37.7	52.5	45.3
T12	28.9	51.1	95.5	96.7	35.8	13.3	41.3	62.6	72	44.0	23.3	37	60	57	38.3
Town Ave.	22.38	48.33	69.85	77.89	38.46	15.86	40.54	61.35	67.92	41.16	7.75	34.07	42.62	58.75	44.79
State Ave.	20.93	43.93	67.21	77.49	39.66	15.09	37.33	59.61	66.0	42.32	7.78	30.23	46.81	56.66	45.61



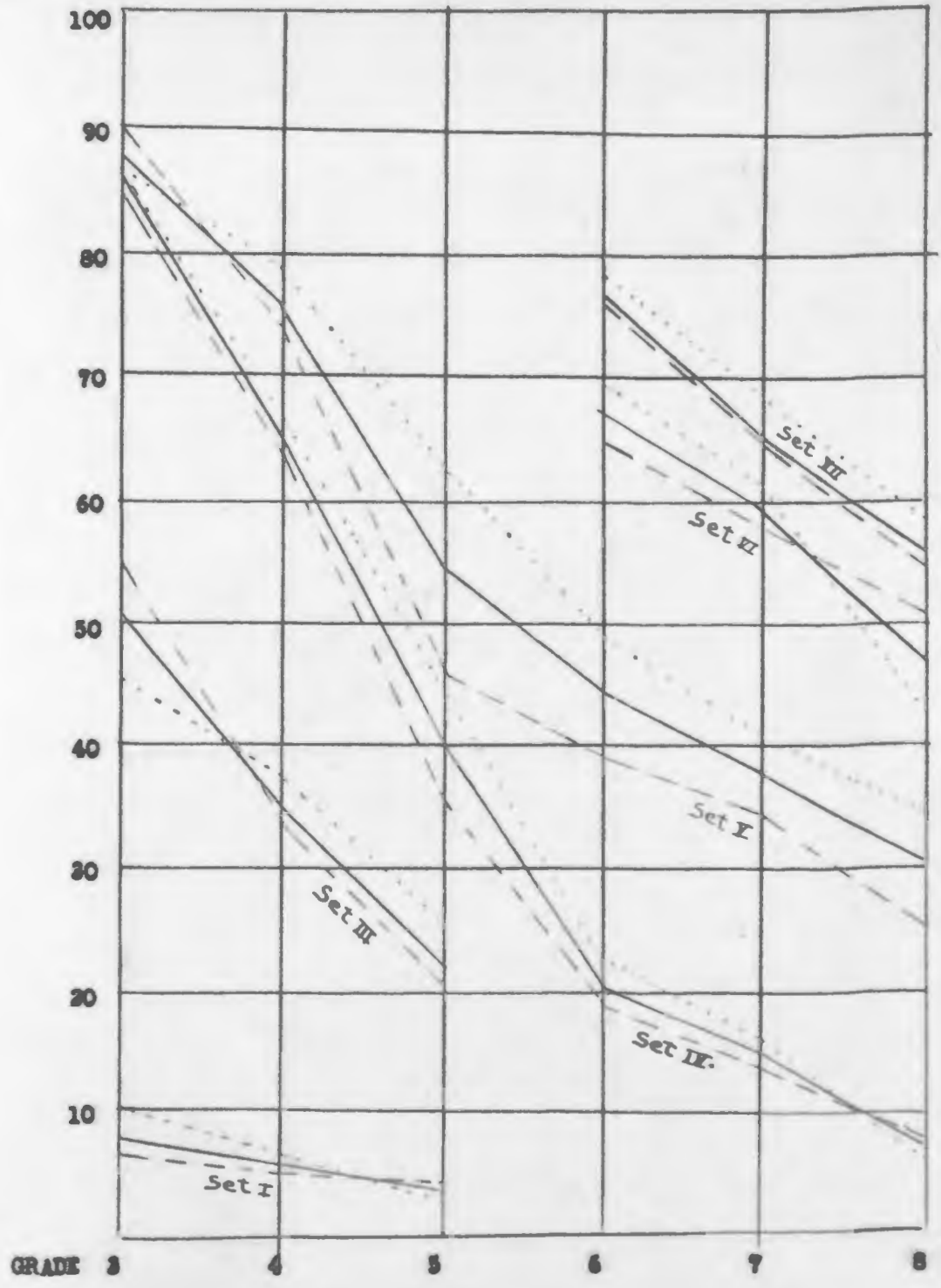
——— = State Class Scores - Average

..... = Town Class Scores - Average

— — — = City Class Scores - Average

READING * QUALITY

Beta I, October 1, 1917



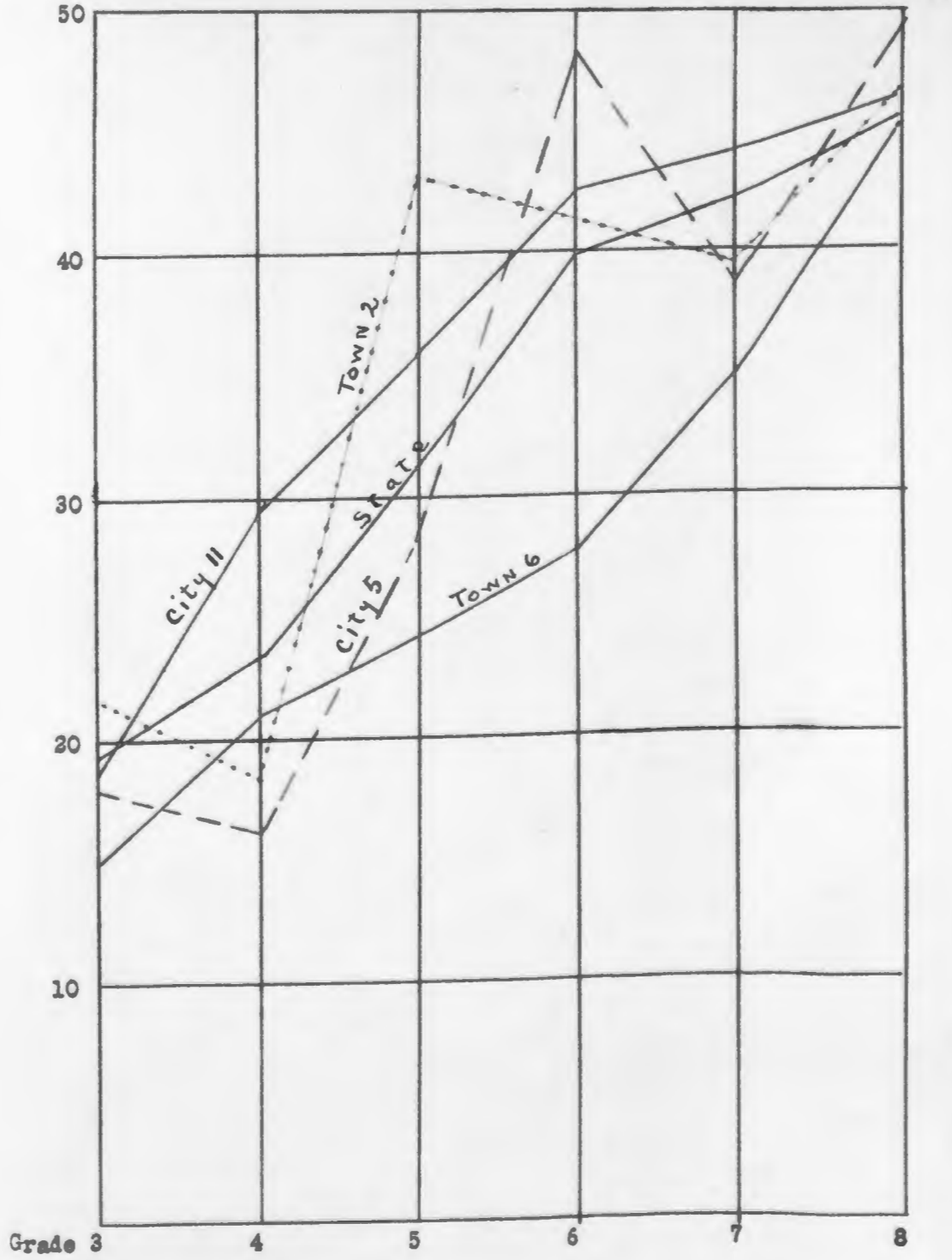
——— = STATE AVERAGE, percentage of error

..... = TOWN AVERAGE, percentage of error

— — — = CITY AVERAGE, percentage of error

READING * QUALITY

Beta I, October 1, 1917



Symmetrical and Asymmetrical Distributions

READING - QUALITY

X. Arithmetic.

1. Fall Tests. The Courtis Stardard tests in the four fundamental operations in arithmetic have been used very extensively and are, perhaps, the best known of all standard tests. The results of the use of these tests in the South Dakota cities and towns in the fall of 1917 are shown in the following tables and graphs.

While the comparison of the scores of children in South Dakota cities and towns with those in Indiana* and Kansas** shows lower scores for the former, it should be borne in mind that the Indiana and Kansas norms were derived from tests given in May and January, respectively, whereas the South Dakota tests were given about October first. It will readily be seen complete and fair comparisons cannot be made. This is particularly true of certain skills which vacation disuse may greatly impair such as making number combinations.

2. Variability. A wide variation in arithmetic abilities is shown in the various cities and towns. The following table shows some city or town having a median about twice as great as that of some other city or town in the same grade. In the table showing speed in addition there are nineteen cases in which a grade in a given city or town has an equal or higher score than that in the grade next higher in the same city or town!

*M.E.Haggerty: "Arithmetic: A co-operative Study in Educational Measurements." Indiana University Bulletin for March 1, 1915.

**Walter S. Monroe: "A Report of the Courtis Standard Research Tests in Arithmetic in Twenty-four cities." Studies of the Bureau of Educational Measurements and Standards, No. 4, State Normal School, Emporia, Kansas.

Variability in Arithmetic

Speed

	Addition				Subtraction				Multip.				Division			
	5	6	7	8	5	6	7	8	5	6	7	8	5	6	7	8
Max.	7.6	12.4	14.5	10.9	7.6	10	11	14.9	7.7	9.8	12	13	4.5	7.7	9.2	13
Min.	3.7	4.0	5.2	6.5	3.7	5	06	8.5	3.7	4.2	55	65	2.2	2.6	3.8	5.5
Med.	5.6	6.3	7.6	8.6	6.4	7	88	10.6	5.5	6.7	81	97	3.5	4.1	5.6	8.3
							Accuracy									
Max.	85	75	84	82	87	90	93	100	74	80	85	86	63	88	96	100
Min.	25	31	25	25	25	43	50	58	32	32	41	25	25	28	35	63
Med.	40	49	54	60	54	66	75	787	851	63	68	74	39	56	71	83

3. Correlations. A few correlations between speed and accuracy were computed, all being positive but not high. The diagram on page 67 at first glance indicates but slight correlation but computation gives a correlation coefficient of .44.

Arithmetic - October, 1917

Addition — Speed

Cities and Towns	Fifth Grade			Sixth Grade			Seventh Grade			Eighth Grade		
	*Med.	Q	% Var.	*Med.	Q	% Var.	*Med.	Q	% Var.	*Med	Q	% Var.
C1	6.7	1.4	20.8	6.9	1.6	23.2	8.3	2.1	25.3	9.9	1.9	19.1
C2	3.91	.91	23.0	5.2	2.6	51.	14.5	2.2	15.0	10.2	1.8	18.0
C3	5.2	1.4	26.9	6.0	1.3	21.6	8.1	1.6	19.7	8.4	1.2	14.2
C4	5.2	.93	17.5	4.0	1.6	40.0	7.9	1.2	15.1	7.9	1.7	21.5
C5	5.5	1.2	21.8	5.0	1.1	22.0	7.6	2.4	31.6	7.4	1.5	20.2
C6	6.7	1.4	20.8	6.9	1.6	23.2	8.3	2.1	25.3	9.9	1.9	19.1
C7	5.4	1.01	18.5	6.4	1.3	20.3	6.8	1.4	19.3	7.2	1.7	23.6
C8	4.8	1.1	22.9	7.2	.87	12.0	6.3	1.4	22.2	10.0	1.4	14.0
C9				8.3	1.5	18.0	8.5	1.5	18.8	9.7	1.1	12.3
C10				6.3	1.7	27.0	7.0	1.3	18.8	8.8	1.6	18.1
C11	6.5	1.1	16.9	7.3	1.5	20.5	7.6	.92	12.0	10.9	1.6	14.7
C12	5.4	1.3	24.0	5.3	.94	17.7	6.8	1.6	23.5	7.0	2.0	28.5
C13	4.8	.7	14.6	5.5	1.3	23.6	6.4	1.1	17.2			
City	5.6	1.3	23.2	6.2	1.5	24.5	7.6	2.3	30.3	8.8	1.8	20.4
T1	5.6	.4	7.1	4.5	1.4	31.1	8.5	1.0	11.7	6.5	.9	13.8
T2	7.6	1.5	19.7	7.1	.8	11.2	6.2	.7	11.3	6.7	.5	7.5
T3	6.0	1.2	20.0	12.4	1.2	10.0	6.6	1.5	23.0	8.1	1.2	14.8
T4	7.5	.9	12.0							9.0	.5	5.5
T5	6.5	1.6	24.9	4.5	.4	8.8	8.0	1.0	12.9	9.5	1.0	10.5
T6	5.3	.7	1.5	8.3	1.0	12.0	6.7	1.4	20.8	8.2	1.1	13.4
T7	6.0	1.0	17.5	6.5	1.1	20.0	9.0	1.7	18.8	9.0	.25	2.7
T8				6.8	1.2	17.8	5.2	.9	17.3			
T9				5.1	.8	15.7	7.8	.7	9.9	9.1	.9	9.8
T10	3.7	.6	10.5	5.3	.55	10.4	6.0	1.3	21.6	7.5	1.4	18.6
T11	4.5	1.1	24.3	7.7	1.6	20.8	8.3	1.6	19.5	7.5	1.5	20.0
T12	3.7	.4	1.0	4.3	.9	21.9	6.5	2.2	33.8	6.7	2.2	32.9
Town	5.6	1.3	23.2	6.5	1.0	15.3	7.0	1.5	21.4	7.9	1.4	17.7
State	5.6	1.3	23.2	6.3	1.5	23.8	7.6	1.6	21.0	8.6	1.4	16.2

*Attempts

Arithmetic - October, 1917

Addition — Accuracy

Cities and Towns	Fifth Grade Med.%	Q	% Var.	Sixth Grade Med. %	Q	% Var.	Seventh Grade Med.%	Q	% Var.	Eighth Grade Med.%	Q	% Var.
C1	42.0	18.06	43.0	52.0	16.2	31.1	64.5	11.3	17.2	69.2	15.1	23.2
C2	29.6	14.8	50.0	37.5	22.5	59.0	35.3	17.4	49.0	37.5	21.9	58.3
C3	38.2	22.5	58.8	41.3	19.7	47.6	60.3	17.2	28.5	60.1	14.2	23.6
C4	33.0	16.2	49.0	52.2	19.6	37.5	44.3	26.9	60.7	51.4	25.3	49.4
C5	33.0	16.2	49.0	38.6	19.7	51.0	43.3	21.7	50.1	63.3	19.6	30.9
C6	49.0	20.6	42.0	50.3	22.4	44.5	57.4	19.1	33.1	61.6	19.2	31.1
C7	39.3	20.3	51.6	43.0	23.6	54.9	46.9	21.6	46.0	64.1	18.4	28.8
C8	35.4	18.2	51.4	83.3	22.3	26.7	69.0	24.7	35.8	66.7	8.7	13.0
C9				52.8	19.0	35.9	80.3	11.7	14.5	79.1	12.7	16.0
C10				50.0	25.0	50.0	57.2	21.9	38.2	65.6	15.6	25.6
C11	49.0	20.8	42.4	57.5	22.2	38.6	59.0	21.6	36.6	45.0	21.6	48.0
C12	41.6	17.6	42.5	43.7	23.7	54.2	52.0	18.8	36.1	60.0	18.4	30.6
C13	85	16.4	19.4	56.0	13.3	23.7	83.7	7.9	94.3			
City	40.6	21.1	51.8	49.6	21.7	43.8	57.2	22.3	38.9	61.5	22.5	36.7
T1	30.0	15.0	50.0	28.1	14.1	50.0	34.4	22.7	60.6	37.5	18.1	50.0
T2	54.0	15.0	27.6	40.6	23.6	50.1	50.0	20.0	40.0	52.5	17.7	53.5
T3	37.5	21.5	57.0	37.5	15.6	41.7	37.5	22.2	56.2	55.0	15.9	28.9
T4	57.5	23.1	40.2				55.0	13.9	25.2	55.0	2.2	4.0
T5	25.0	16.8	67.2	37.5	23.1	61.7	25.0	12.5	50.0	25.0	12.5	26.0
T6	50.0	20.0	40.0	70.0	12.5	17.9	41.8	12.1	24.1	50.0	22.5	45.0
T7	25.0	12.5	50.0	31.2	15.6	50.0	47.0	23.6	50.1	80.0	.25	3.12
T8				65.0	16.7	25.7	40.0	11.2	28.0			
T9				37.5	15.6	41.7				65.0	27.8	42.8
T10	49.0	27.5	56.1	75.0	12.0	16.0	75.0	24.6	32.8	55.0	24.7	45.4
T11	30.0	15.0	50.0	37.5	18.1	48.3	36.1	17.2	47.6	82.5	30.0	36.3
T12	28.1	14.0	49.8	37.5	15.6	41.7	34.0	22.5	66.1	43.5	17.6	40.0
Town	38.6	19.1	49.2	44.4	20.2	45.4	41.6	21.0	48.1	58.9	14.0	25.9
State	40.2	20.5	40.7	48.6	21.6	44.4	54.0	22.4	41.5	60.1	20.2	33.6

Arithmetic - October, 1917

Subtraction — Speed

Cities and Towns	Fifth Grade			Sixth Grade			Seventh Grade			Eighth Grade		
	*Med.	Q	% Var.	*Med.	Q	% Var.	*Med.	Q	% Var.	*Med.	Q	% Var.
C1	5.0	.9	18.0	6.7	1.3	19.4	10.5	1.3	12.3	9.8	1.3	13.2
C2	5.8	1.37	24.0	6.2	1.2	21.0	8.3	1.8	22.0	10.9	1.1	10.2
C3	4.3	1.9	44.4	6.3	1.4	22.2	8.6	1.3	15.1	9.4	1.2	12.8
C4	6.6	1.5	23.6	5.0	1.1	22.0	8.8	1.3	14.9	10.2	1.5	14.7
C5	6.5	1.2	18.4	7.4	1.4	18.9	9.5	2.0	21.0	10.5	1.5	14.3
C6	6.8	1.5	22.0	8.2	1.4	17.0	9.4	1.9	20.2	11.5	2.8	24.3
C7	6.7	1.3	19.1	9.3	1.3	15.8	8.9	1.2	13.9	10.1	1.0	9.9
C8	6.2	1.3	20.8	9.5	2.2	23.1	7.3	.82	11.2	13.0	2.9	22.3
C9				9.0	1.1	12.2	10.0	1.8	18.0	12.0	1.8	15.0
C10				8.6	1.6	14.8	9.8	1.7	17.3	10.8	1.6	14.8
C11	7.2	1.1	15.2	7.6	.85	11.2	8.4	1.2	14.2	14.9	2.6	17.4
C12	7.2	1.2	16.7	8.6	.93	11.4	9.5	1.5	15.8	10.5	1.5	14.3
C13	6.5	1.4	16.3	7.0	1.2	17.8	6.9	.62	8.9			
City	6.4	1.5	23.4	7.7	1.7	22.0	8.9	1.5	17.0	10.7	2.9	28.1
T1	5.6	.4	7.1	7.5	.8	10.5	8.9	1.2	11.8	9.5	1.4	14.7
T2	7.6	1.5	19.7	8.2	0.7	8.4	11.0	2.0	19.1	11.5	1.6	13.9
T3	6.0	1.2	20.0	7.3	1.7	24.7	7.8	1.5	20.5	9.5	2.5	26.3
T4	7.5	.9	12.0				7.8	1.8	23.0	13.0	2.6	20.0
T5	6.5	1.6	24.9	10.0	6.2	62.5	9.0	2.0	22.2	11.5	.5	4.3
T6	5.8	.7	1.5	9.0	2.1	23.3	8.1	2.4	29.6	10.3	1.0	9.7
T7	6.0	1.05	17.5	7.2	.86	11.9	11.0	2.0	18.1	9.0	.25	2.7
T8				7.0	1.1	15.7	6.0	1.0	16.6			
T9				6.5	1.2	16.3				11.8	.45	3.8
T10	5.7	.6	10.5	6.5	1.2	18.4	6.0	2.0	33.3	8.5	1.0	11.7
T11	4.5	1.1	24.3	8.8	1.5	19.1	8.9	0.9	10.7	8.7	.3	3.4
T12	8.7	.4	15.0	6.3	1.2	19.0	7.8	1.5	19.2	9.2	1.2	13.4
Town	6.5	1.3	20.0	7.3	1.3	17.8	8.3	1.4	16.8	9.9	1.1	11.1
State	6.4	1.4	21.8	7.5	1.5	20.0	8.8	1.5	17.0	10.6	1.9	17.9

*Attempts

Arithmetic - October, 1917

Subtraction — Accuracy

Cities and Towns	Fifth Grade			Sixth Grade			Seventh Grade			Eighth Grade		
	Med.%	Q	% Var.	Med.%	Q	% Var.	Med.%	Q	% Var.	Med.%	Q	% Var.
C1	58.0	16.2	24.8	66.0	28.3	30.5	83.5	9.1	10.8	78.0	11.9	15.9
C2	68.0	26.6	39.1	42.8	19.8	45.0	70.0	25.0	38.7	71.7	11.8	15.5
C3	58.6	21.2	39.9	56.6	27.3	48.0	84.3	17.9	21.2	80.0	13.1	15.4
C4	48.9	22.7	46.4	55.5	19.3	34.9	63.7	19.3	30.4	72.7	15.3	21.0
C5	33.0	16.2	49.2	52.0	16.9	32.5	70.0	12.2	17.4	68.7	10.7	15.5
C6	56.8	25.9	45.6	68.9	24.8	32.9	74.2	15.0	20.2	74.0	14.9	20.8
C7	55.6	29.2	52.4	69.2	16.2	23.5	76.8	14.9	19.8	79.0	16.1	18.1
C8	65.0	19.8	36.0	88.0	19.5	23.7	80.1	8.1	10.1	71.4	17.8	24.4
C9				63.7	10.4	16.3	80.0	9.8	11.0	80.0	13.9	18.4
C10				70.6	15.5	21.9	73.8	18.4	24.9	84.2	17.1	19.2
C11	62.5	21.9	35.0	80.0	14.1	17.6	89.0	20.6	23.0	81.0	17.1	19.5
C12	55.0	17.2	31.3	68.8	19.3	28.2	75.0	13.0	17.3	73.3	12.9	17.4
C13	57.5	26.0	45.2	65.0	15.5	23.8	80.0	10.3	12.8			
City	54.4	24.4	44.8	65.5	17.5	26.7	73.3	14.8	19.6	77.8	13.1	16.9
T1	40.0	16.9	42.2	45.0	18.1	40.2	85.0	33.8	39.4	87.5	9.2	17.7
T2	86.7	14.8	17.1	87.5	14.4	16.4	93.3	8.0	8.5	83.8	13.7	16.4
T3	50.0	21.8	43.6	86.0	28.1	28.0	66.0	19.8	29.7	75.0	13.9	18.5
T4	37.5	22.5	59.1							75.0	10.0	13.3
T5	58.5	17.2	29.8	56.7	7.5	13.2	80.0	13.8	65.0	77.5	18.6	24.0
T6	65.0	13.5	20.0	90.0	20.0	22.2	59.0	14.4	24.4	75.3	7.8	10.8
T7	50.0	20.0	40.0	62.5	8.1	12.9	65.2	15.0	23.0	100	.33	2.3
T8				80.0	12.5	18.6	83.3	23.3	36.9			
T9				65.0	29.2	34.0	71.8	16.7	29.3	80.0	19.9	30.8
T10	80.0	30.8	61.5	63.0	18.0	18.4	86.0	10.0	11.6	85.9	11.7	13.9
T11	40.0	19.0	37.5	64.0	10.0	10.5	61.8	16.7	26.7	75.0	16.7	22.2
T12	47.0	18.1	40.2	83.0	24.3	44.0	79.6	6.6	11.3	77.3	18.6	24.0
Town	51.0	28.7	44.8	62.8	16.8	25.6	70.5	17.9	25.3	75.3	13.6	16.0
State	54.0	24.1	44.6	65.3	17.3	26.4	74.6	15.4	20.6	77.6	13.0	16.7

Arithmetic - October, 1917

Multiplication — Speed

Cities and Towns	Fifth Grade			Sixth Grade			Seventh Grade			Eighth Grade		
	*Med.	Q	% Var.	*Med.	Q	% Var.	*Med.	Q	% Var.	*Med.	Q	% Var.
C1	5.1	1.5	29.4	6.2	.87	14.0	11.0	1.8	16.3	9.5	1.1	11.4
C2	6.1	1.3	21.0	6.3	1.1	17.0	8.5	1.3	15.0	10.5	1.9	17.8
C3	3.7	1.6	29.0	5.8	1.4	24.1	7.5	1.5	20.0	9.3	1.7	18.2
C4	4.6	1.1	23.9	6.7	1.3	19.4	6.6	1.4	21.2	10.0	1.8	18.0
C5	5.9	1.0	17.0	6.7	21.0	31.3	9.5	1.6	18.0	9.5	2.0	21.0
C6	5.9	1.2	20.3	6.6	1.8	27.2	8.0	1.7	21.2	9.7	2.2	22.7
C7	6.7	1.5	22.4	8.1	1.3	16.0	7.8	1.2	15.4	8.9	1.5	16.8
C8	4.5	.85	17.7	9.0	1.1	12.0	7.5	1.4	18.6	10.0	1.3	13.0
C9				7.6	1.9	25.0	12.1	2.5	20.6	11.0	2.5	22.7
C10				7.2	1.6	22.2	9.3	1.9	20.4	10.6	2.2	20.8
C11	3.5	1.0	18.1	7.1	.85	11.9	7.6	1.7	22.3	13.2	1.2	19
C12	5.2	1.3	25.0	6.2	1.2	19.8	8.5	2.1	25.0	9.7	1.3	13.4
C13	5.1	.9	1.7	6.2	1.1	18.0	7.0	1.5	21.0			
City	5.4	1.4	25.9	6.8	1.4	20.5	8.3	1.7	20.4	9.8	1.8	18.3
T1	5.5	1.2	21.8	6.1	1.1	18.0	7.6	0.6	7.8	6.5	1.2	17.4
T2	6.5	1.9	29.2	5.7	1.9	33.3	8.6	1.6	18.6	9.5	1.6	16.8
T3	4.9	1.2	24.5	5.9	1.5	25.4	7.8	1.0	12.8	9.5	1.0	10.1
T4	4.2	0.8	19.0				5.2	1.2	23.0	12.0	3.0	25.0
T5	7.7	1.3	16.7	9.0	2.2	24.4	10.0	1.5	15.0	11.5	.25	2.0
T6	7.0	1.0	14.2	9.8	1.2	12.2	8.8	0.9	10.2	10.3	1.2	11.7
T7	5.6	0.5	8.9	6.3	.67	11.8	10.5	2.2	20.9	9.0	.25	2.7
T8				6.6	1.1	16.6	5.6	1.7	30.7			
T9				4.2	1.0	23.8						
T10	4.3	0.7	16.3	5.5	1.3	23.6	6.5	1.3	20.0	7.0	1.1	15.7
T11	5.6	1.3	23.2	7.6	1.2	15.8	7.4	0.9	12.1	8.5	1.8	21.2
T12	3.8	.45	11.9	4.3	1.2	27.9	5.5	1.3	21.8	8.7	1.0	11.4
Town	5.5	1.4	25.4	6.2	1.5	24.1	7.7	1.6	20.7	9.2	1.7	18.4
State	5.47	1.37	24.7	6.7	1.0	14.9	8.1	1.7	20.8	9.7	1.8	18.7

*Attempts

Arithmetic - October, 1917

Multiplication — Accuracy

Cities and Towns	Fifth Grade			Sixth Grade			Seventh Grade			Eighth Grade		
	Med. %	Q	% Var.	Med. %	Q	% Var.	Med. %	Q	% Var.	Med. %	Q	% Var.
C1	59.5	28.3	47.7	66.2	15.0	22.6	77.5	14.8	19.0	86.0	13.5	15.7
C2	59.0	19.9	33.8	46.4	20.9	45.0	58.0	9.3	16.6	61.5	17.9	29.1
C3	39.0	25.2	64.6	64.5	33.3	51.6	67.5	15.9	23.9	70.0	15.6	22.3
C4	38.7	14.3	37.0	58.0	22.9	30.9	57.2	14.8	25.9	73.3	13.2	18.0
C5	45.0	22.2	49.3	60.0	20.2	33.6	64.4	20.0	31.0	64.0	19.6	30.6
C6	55.0	22.7	41.2	61.6	27.9	45.3	66.5	20.9	31.4	74.8	14.2	18.9
C7	57.5	22.3	38.8	72.3	14.4	19.9	73.1	15.4	21.0	73.6	14.6	19.8
C8	63.0	17.0	26.9	77.7	6.7	8.7	60.0	24.0	40.0	68.3	12.5	18.3
C9				66.6	15.7	23.6	71.2	11.4	16.0	87.2	9.2	10.5
C10				60.9	26.0	42.6	72.3	13.3	17.0	82.7	13.7	16.6
C11	60.0	22.2	37.0	80.0	13.1	16.3	77.0	17.5	22.7	71.0	10.9	15.3
C12	45.5	24.4	53.9	61.0	17.0	27.8	65.0	12.5	19.2	64.3	10.4	16.1
C13	73.7	22.5	30.5	42.5	28.1	66.1	67.5	10.0	14.8			
City	51.4	22.7	44.5	63.9	24.0	60.6	67.8	18.9	33.8	74.1	15.2	20.4
T1	50.0	12.5	25.0	37.5	19.3	51.3	40.6	23.6	58.1	37.3	18.3	49.0
T2	70.0	10.0	14.2	65.8	6.6	10.0	85.0	12.5	14.7	80.5	10.6	13.1
T3	52.0	18.4	35.4	63.0	20.6	32.9	65.0	21.4	32.9	85.0	8.1	95.2
T4	55.0	14.8	26.9				57.8	15.5	27.0	60.0	24.4	40.6
T5	37.5	19.4	51.8	37.5	23.1	61.7	70.0	23.3	33.2	25.0	12.5	26.0
T6	37.5	18.1	49.8	75.0	4.6	6.1	68.3	13.5	19.7	75.0	10.0	13.3
T7	67.0	31.8	49.4	65.0	21.2	32.6	77.0	8.7	11.3	60.0	25.0	41.6
T8				67.3	13.4	19.9	80.0	14.0	17.5			
T9				32.1	16.0	49.8				55.0	15.0	27.2
T10	55.0	15.8	28.7	55.0	13.7	25.0	60.0	21.2	35.3	68.3	22.5	32.9
T11	50.0	22.5	45.0	56.6	14.5	25.6	61.6	23.4	38.0	71.2	17.2	24.1
T12	32.1	16.0	49.8	53.3	28.0	52.7	75.0	20.7	27.6	62.5	9.4	15.0
Town	49.0	21.8	44.4	60.9	12.2	17.7	68.4	18.4	26.8	69.2	15.9	22.1
State	51.1	22.4	43.8	63.2	21.3	33.8	67.9	14.0	22.3	73.5	14.7	20.0

Arithmetic - October, 1917

Division — Speed

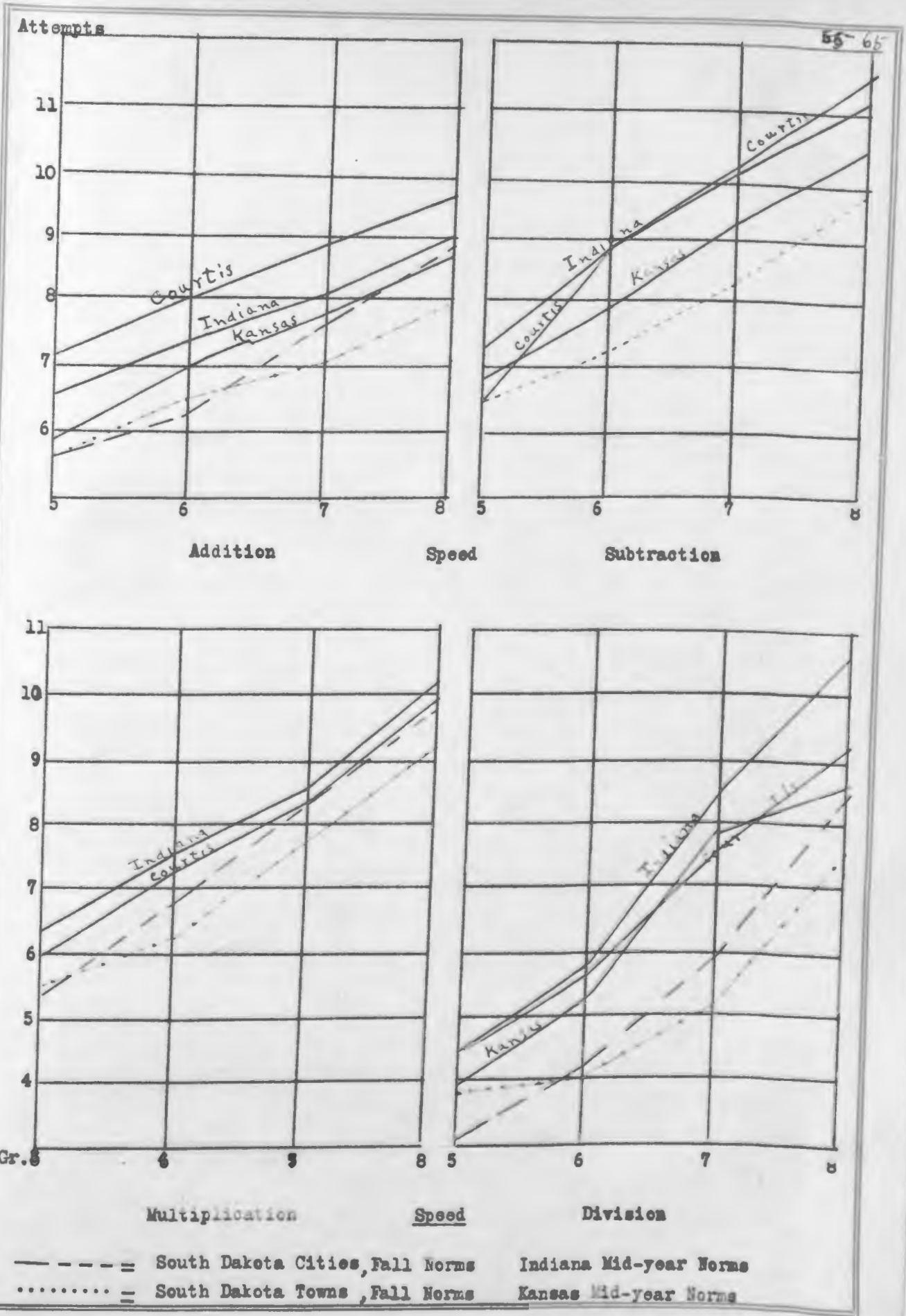
Cities and Towns	Fifth Grade			Sixth Grade			Seventh Grade			Eighth Grade		
	*Med.	Q	% Var.	*Med.	Q	% Var.	*Med.	Q	% Var.	*Med.	Q	% Var.
C1	2.7	1.6	59.2	3.2	.75	23.8	7.0	2.0	28.5	6.1	2.9	47.5
C2	2.7	.49	10.0	2.7	1.7	61.0	4.8	.94	19	9.4	2.4	25.2
C3	3.0	2.4	80.0	3.4	.8	23.5	5.2	1.8	36.7	5.1	1.4	27.4
C4	3.2	.65	20.3	5.1	1.0	19.6	5.1	1.7	33.3	9.0	2.8	31.1
C5	3.2	1.0	31.9	5.1	1.1	21.5	9.2	1.7	19.5	8.1	1.6	19.7
C6	4.2	1.3	30.9	4.8	1.7	35.4	5.6	1.9	32.8	8.8	1.7	19.2
C7	3.03	1.3	40.6	4.8	1.8	36.3	5.8	1.1	19.6	8.3	1.8	22.8
C8	2.9	.85	2.9	7.0	1.6	22.8	7.2	2.4	33.3	8.6	1.6	18.6
C9				5.6	2.1	37.5	7.2	2.2	30.5	8.6	1.9	21.6
C10				7.7	.7	.09	7.7	1.1	16.0	9.0	1.8	20.0
C11	3.7	0.8	21.6	4.6	1.4	30.4	4.6	1.7	36.9	10.1	1.9	18.8
C12	3.0	1.7	56.6	2.4	.47	19.6	7.4	1.7	22.9	6.7	1.0	14.9
C13	2.2	1.1	50.0	3.6	1.3	38.6	5.6	1.7	30.4			
City	3.2	1.3	40.6	4.2	1.5	35.7	5.9	1.9	33.9	8.4	1.7	21.4
T1	3.5	0.4	11.4	3.2	1.1	34.3	3.8	0.9	23.7	5.0	1.3	26.0
T2	4.0	1.4	35.0	5.7	1.4	22.9	6.6	1.8	24.3	10.5	1.8	17.1
T3	4.3	1.2	27.9	4.5	.9	20.0	5.7	1.7	29.8	8.6	2.5	28.4
T4	4.0	1.6	40.0				5.2	1.2	23.0	11.0	3.7	33.6
T5	4.1	.6	14.6	5.0	1.2	24.0	5.0	1.1	22.0	13.0	2.0	15.4
T6	4.0	1.1	27.5	5.0	1.0	20.0	4.2	1.4	33.3	8.5	2.0	23.5
T7	3.5	0.6	17.1	4.7	1.6	34.0	8.1	1.2	14.8	10.	.25	2.5
T8				4.0	.8	20.0	6.3	1.9	30.1			
T9				2.4	.8	33.3						
T10	4.5	0.9	21.1	5.5	1.0	18.1	5.3	1.5	28.3	5.5	1.3	23.6
T11	3.6	2.8	77.7	4.2	1.0	23.8	5.1	0.8	15.6	5.6	1.2	21.8
T12	3.4	.9	26.5	2.7	1.0	37.0	4.5	1.3	29.6	5.7	1.5	53.4
Towns	3.8	1.0	26.3	4.0	1.2	30.0	5.2	1.5	28.8	7.6	2.5	32.8
State	3.5	1.2	34.2	4.1	1.4	34.1	5.5	1.8	32.9	8.3	2.2	26.5

* Attempts

Arithmetic - October, 1917

Division Accuracy

Cities and Towns	Fifth Grade			Sixth Grade			Seventh Grade			Eighth Grade		
	Med.	Q	% Var.	Med.	Q	% Var.	Med.	Q	% Var.	Med.	Q	% Var.
C1	42.6	21.3	50.0	50.0	20.0	40.0	68.7	21.9	31.8	80.0	13.1	16.3
C2	39.4	23.8	60.4	39.1	18.0	46.0	55.0	36.1	65.5	78.0	13.5	16.1
C3	31.2	15.6	50.0	53.3	23.2	43.5	75.2	19.1	33.8	63.7	21.7	34.5
C4	33.0	16.2	49.0	50.0	21.0	42.0	56.8	25.4	44.9	80	15.9	19.8
C5	33.3	17.1	51.3	80.0	22.2	27.7	70.0	23.4	33.4	74.5	10.6	14.2
C6	42.4	23.8	56.1	58.7	23.5	40.0	75.8	24.9	32.8	83.4	15.7	18.8
C7	41.5	29.6	71.8	68.3	28.7	43.3	79.3	22.3	28.5	87.7	17.2	20.7
C8	63.3	34.8	55.1	87.5	14.2	16.2	76.0	20.5	25.6	93.5	9.5	10.1
C9				80.0	21.5	26.8	96.2	12.1	12.5	100	10.9	10.9
C10				50.0	27.3	54.6	75.0	14.2	18.9	90.1	12.2	13.5
C11	50.0	25.5	51.0	70.0	17.2	24.5	90.0	27.5	30.5	79.0	12.7	16.0
C12	41.6	18.3	44.1	56.2	33.6	59.8	67.5	17.0	25.2	82.5	17.9	21.7
C13	57.5	20.9	36.3	38.6	19.7	51.0	85.0	20.0	23.5			
City	39.2	23.2	59.2	57.3	26.2	45.5	74.4	21.7	29.3	82.8	17.8	21.4
T1	40.0	18.1	45.2	32.1	16.0	49.8	60.2	20.8	34.5	100	11.5	11.5
T2	50.0	27.5	55.0	85.0	19.4	22.8	76.6	18.0	24.4	65.0	13.1	20.1
T3	52.0	20.1	38.6	68.6	31.2	49.8	62.1	16.9	27.5	84.1	11.2	13.3
T4	43.7	14.1	33.2				78.5	15.0	20.7	80.0	21.9	27.3
T5	28.1	14.1	50.0	37.5	28.1	74.8	40.0	37.5	67.5	80.0	5.0	62.0
T6	50.0	25.0	50.0	67.5	15.0	22.2	35.4	19.9	56.2	65.0	24.4	37.7
T7	35.0	16.8	48.0	31.2	15.6	50.0	75.0	18.7	24.9	100	.25	2.5
T8				55.0	34.7	44.9	62.5	21.7	34.7	100	8.1	8.1
T9				28.1	14.0	49.8				80.1	24.5	30.5
T10	62.5	6.26	10.1	82.5	28.1	34.2	68.2	13.3	19.5	65.0	24.4	37.7
T11	37.5	20.6	55.2	42.8	24.4	50.0	81.6	20.5	37.4	66.5	17.3	27.7
T12	25.0	12.5	50.0	50.0	25.0	50.0	75.0	22.5	30.1	65.0	19.4	29.8
Town	41.2	20.6	49.0	51.6	25.5	49.4	64.7	18.5	28.7	80.0	17.21	21.5
State	39.4	22.5	57.1	55.5	26.1	46.2	71.1	20.6	28.9	82.6	17.7	21.4


Attempts
11
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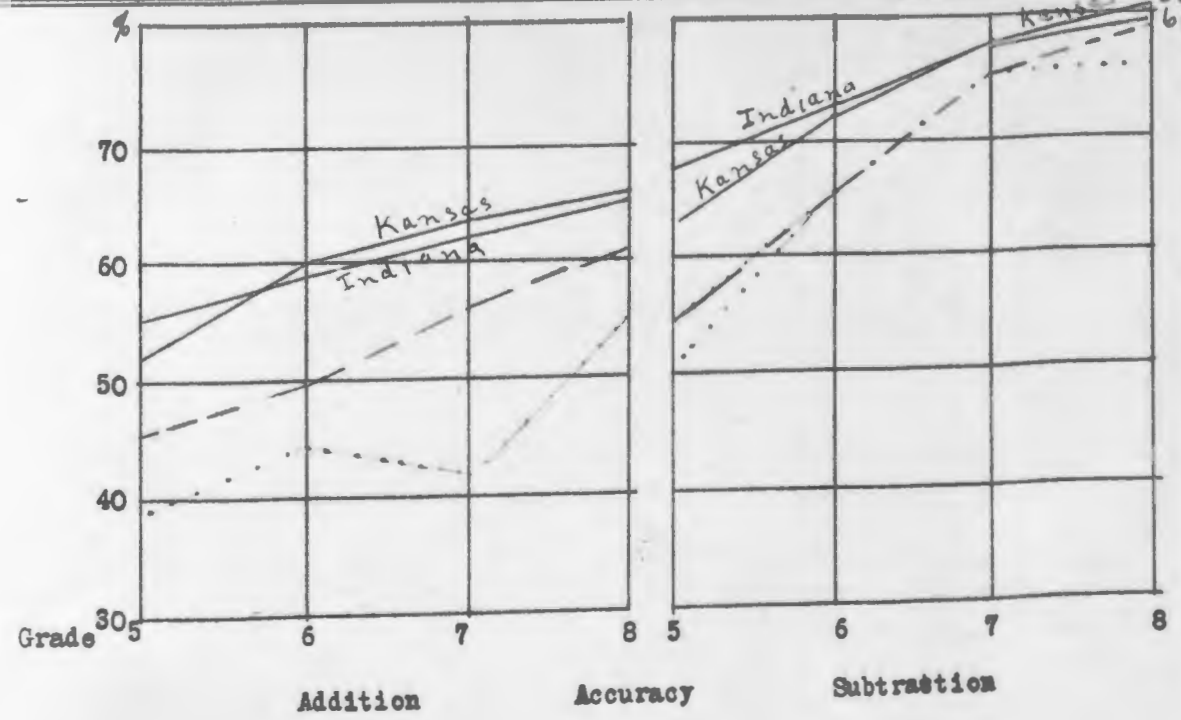
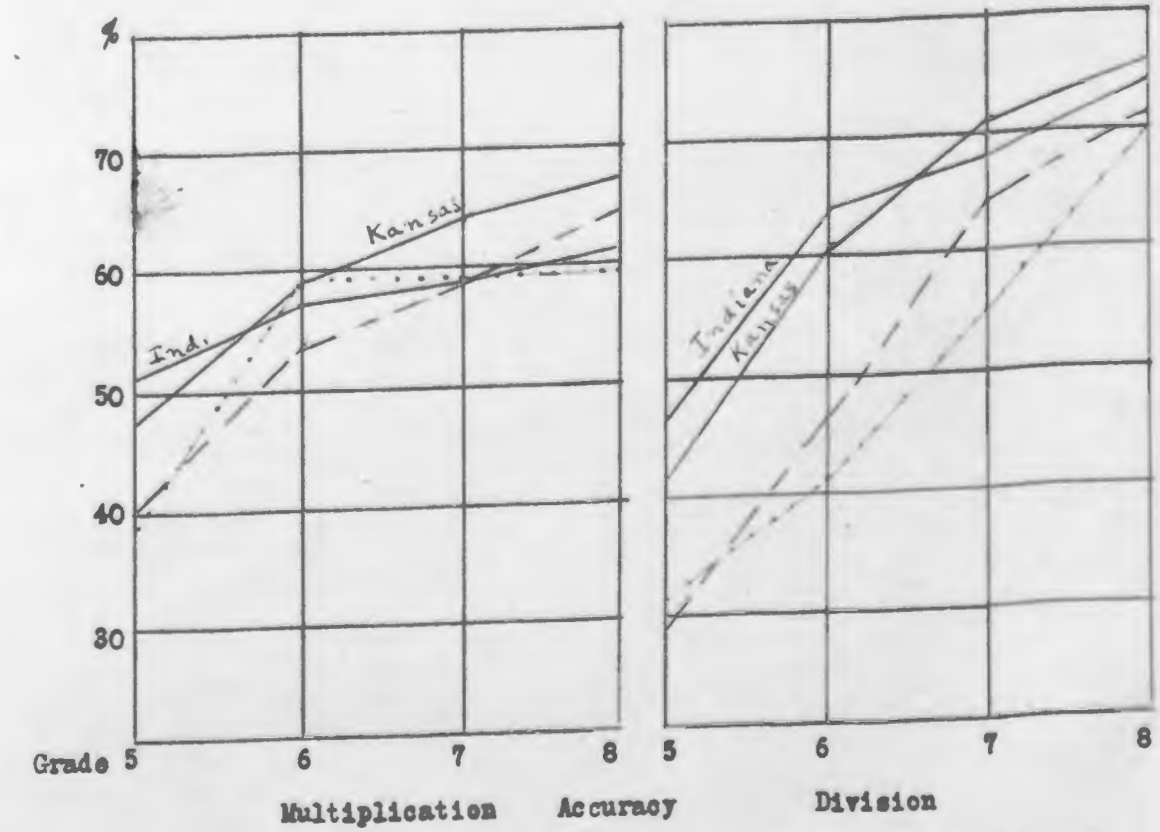
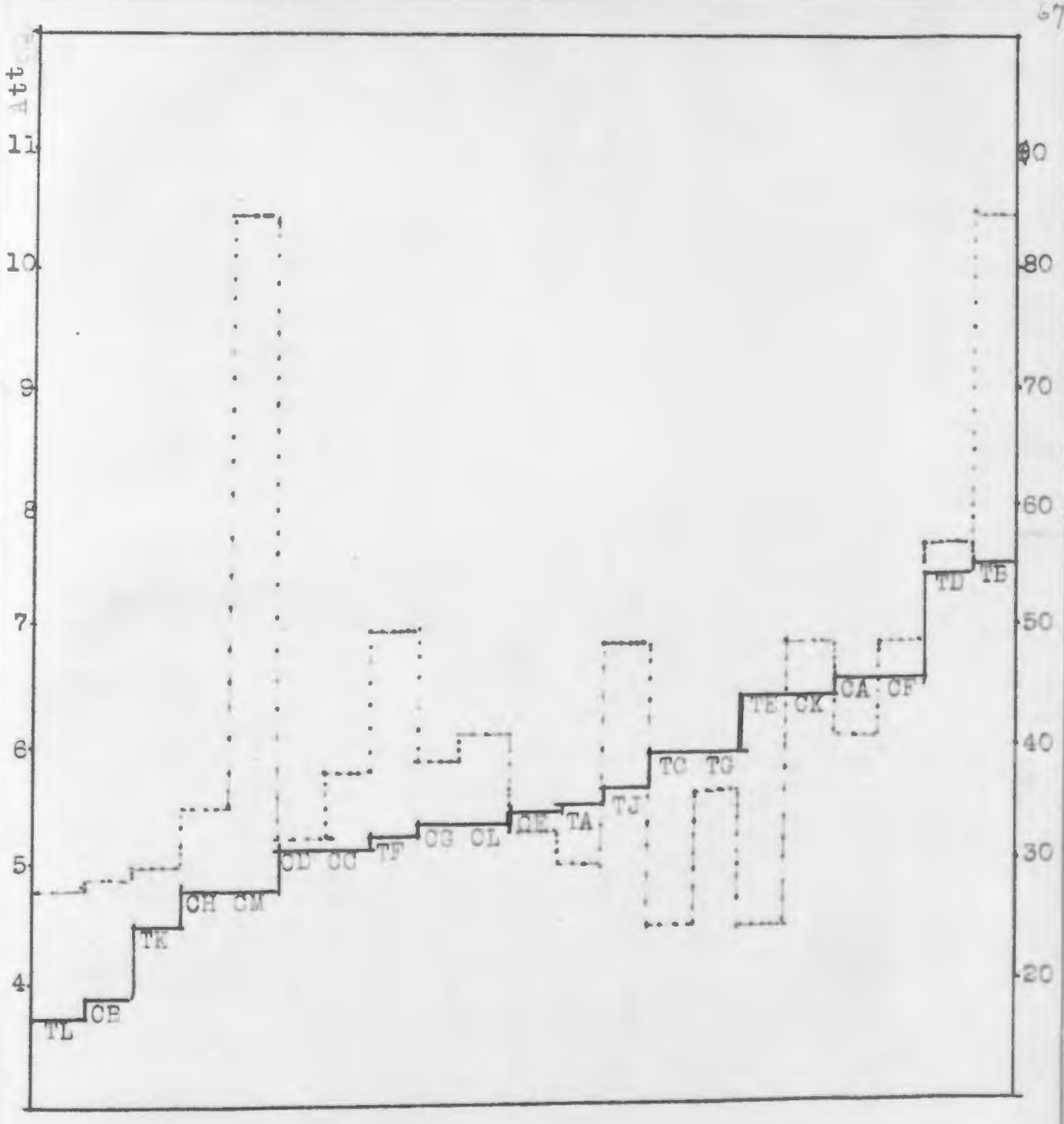
Addition
Speed
Subtraction
Gr.8
Multiplication
Division
South Dakota Cities, Fall Norms
South Dakota Towns, Fall Norms
Indiana Mid-year Norms
Kansas Mid-year Norms





—— - - - - = South Dakota Cities, Fall Norms Indiana Mid-year Norms
..... = South Dakota Towns, Fall Norms Kansas Mid-year Norms



Addition, Fifth Grade

Heavy lines show speed in number of attempts
Dotted lines show accuracy in per cents

CA means City 1; CB, City 2, etc. TA means Town 1; TE, Town 2; TC, Town 3, etc.

XI Correlations.

It has been found in numerous studies* of teachers' marks that students who get high marks in one subject usually get high marks in all other subjects and those who rank high in one grade tend to rank high in all other grades, even on through college. An examination of the correlations between the different subjects in the various grades in this study is somewhat disappointing. The correlations on the whole are little more than those of chance. A grade in a city which ranks high in reading is quite as likely to rank low in spelling, writing or arithmetic. A study of individual children in a given class would doubtless show a high degree of correlation. The following table shows the principal correlations computed.

Correlations between City and Town Medians

Grade.....	3	4	5	6	7	8
Reading and Writing (Qual.)	-.04	.46	.59	.06	.13	.30
Spelling " " "	.30	.42	.28	.06	.34	.14
Spelling and Reading	.39	.50	.64	.04	.27	.58
Reading and Arithmetic			.16[1]	.14[2]	.38[3]	.03[4]

[1] Addition, speed. [2]Subtraction, accuracy. [3]Multiplication, speed. [4]Division, accuracy.

*For bibliography see Hollingworth: "Vocational Psychology," pp. 279,280.

XII. Conclusions and Recommendations.

From the foregoing it is very apparent that the schools as a whole are not making a consistent study of the achievements and abilities of the children in the various subjects in the several grades. Some teachers are doing excellent work in all subjects, some are doing good work in certain subjects but poor work in others and others are doing poor work in all subjects. Until they are confronted with the results of standard objective tests they will have no way of measuring their strengths and weaknesses. They will not know where to place emphasis. Thus in City 11 the 4th grade children are 11% better than the state norm in spelling but are 2% below the norm in writing (quality); in Town 8, 3rd grade, 9% above in spelling but 5% below in reading; in Town 12, 6th grade, 8% above in spelling but 8% below in reading. A great many similar instances could be found from the data in this study.

The superintendent would do well to make a series of graphs of the results in his city or town and then study these together with his teachers. From such a study the places for emphasis would be very apparent.

Second, the writer would suggest an analysis of the time element of instruction. An analysis should be made of the time devoted to each subject and its distribution in the program. It should be remembered that 50 minutes per week for a subject will give different results if given in a single period, if given in two 25 minute periods or if given in five ten minute periods.

Third, a study should be made of the methods in use in each subject. By carefully conducted measurements the methods should be tested for results*

Fourth, this survey is but the beginning of a study. There should be a constant survey of conditions. The norms to be attained should be clearly known by each teacher, at least the norms which have been attained in other schools and systems, and frequent measures taken to note where the pupils stand in relation to such norms. Only be a process of constant evaluation is any progress possible in a consciously directed proceeding. This evaluation should be in definite, understandable terms.

Finally, the writer would not have anyone think that he entertains the idea that the data and criteria of this study are absolute. No pretense is made of perfect accuracy and finality. A single group test in reading, given under conditions which must of necessity have numerous variable elements, cannot give any ultimate measure of ability or achievement. This is equally true of other tests. In measuring an educational attainment many things are often measured besides the one element whose measure is sought. The conclusions which this study reveals, striking though they are in many particulars, are only tentative and symptomic. They are highly indicative of conditions, they are highly suggestive of remedies, but, after all, they are only indicative and suggestive.

*See page 17 of this study.

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