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SCHOLASTIC ACHIEVEMENT  
OF URBAN AND RURAL FRESHMAN HIGH SCHOOL PUPILS  
OF EQUAL INTELLIGENCE QUOTIENTS,  
AS MEASURED BY CERTAIN TESTS

by

*H. L. Emmert*

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B. A., Mt. Morris College, Mt. Morris, Ill.  
1924

Presented in Partial Fulfillment of the Requirements  
for the degree of Master of Arts.

Montana State University

1938

*W. R. Frazee*

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Chairman of Board  
of Examiners.

*W. G. Bateman*

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of Examiners.

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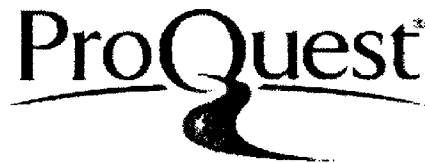


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W. L. Emmert

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## APPENDIX

## CHAPTER I. THE PROBLEM, ITS PURPOSE AND LIMITATIONS

The Broad Aspects of the Problem. Educators have, for a number of years, made a more or less concerted attack upon the rural, one-room school. Horace Mann inaugurated this movement about one hundred years ago, and many others have kept up the attack. In spite of this bombardment, the rural American citizen, entrenched in his traditional independence and self-sufficiency, has steadfastly, and somewhat successfully, withstood the siege. He has emphasized the inherent right of a group of free-born citizens to have its own little school, no matter how humble, and has resented the tendency of the town or centralized school to alienate his children from the soil.

Many of the problems which have arisen during the historical development of the American public school system have been solved or outgrown. This controversy between the proponents of the one-room and the centralized school has, however, continued unabated from earlier days and still is one of the important issues. Business and industry have gone through similar stages but have rather thoroughly evolved from the individual enterprise to the large corporation with its centralized control and its division and specialization of labor.

Some of the same advantages which have accompanied consolidation in the business and industrial fields apply to centralization in the field of education. Some of these advantages are the reduction of overhead costs, superior administration, the ability to obtain and hold better-trained teachers, the possibility of greater specialization of instruction, the advantage of superior equipment, and a wider and more varied program and curriculum. These

advantages are measurable to a great extent and statistics have been compiled in support of them.

The ultimate results, however, are abstract qualities in the lives of the pupils. Such things as character, citizenship, increase in the capacity for the enjoyment of life, and habits of thought and work are not so easily measured. In spite of their abstractness, they should furnish the final criteria in the controversy concerning consolidation. One of these qualities which can be rather accurately measured is the degree of scholastic achievement attained by individual pupils. A comparison of the achievement in grade and high school subjects of pupils who are products of the one-room and the consolidated school should be of value in a final solution of the controversy. Impartial and objective measurement of the educational achievement in these schools is made possible by the recent development and improvement of intelligence and objective tests.

That there is still some question in the minds of educators as to which type of school produces superior achievement can be illustrated by a statement made by John M. Foote, State Supervisor of Rural and Elementary Schools, Louisiana, in presenting a survey of the National Education Association comparing the results of instruction in one-room and consolidated schools.<sup>1</sup>

"Probably the most significant movement in rural education in recent years is that which establishes the consolidated school in place of the one-teacher or small institution now commonly prevailing . . . . Justification for the change has been based almost wholly upon the favorable administrative conditions prevailing in the centralized school. The broad assumption has been made and widely accepted that the results of elementary instruction in the large type of school are superior because of the well-known administrative differences."

Numerous studies have been made and many more are needed to settle this

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1. John M. Foote, "A Comparative Study of Instruction in Consolidated and One-teacher Schools", National Education Association, Addresses and Proceedings of the Sixty-first Annual Meeting, LXI, 1923, p. 812, Washington, D. C.

issue and thus to clear the way for a consideration of the two types of schools from the administrative and social standpoints.

The Purpose of the Study: In spite of the tendency toward objective measurement of educational achievement in the two types of schools, there is still a tendency on the part of school men to assume, without a factual basis, that the results of teaching in the one-room schools are inferior to the results in the larger schools. Statements are frequently heard in high school circles, such as, "One cannot expect too much of Pupil X; he graduated from a little country school." "Pupil Y writes terrible compositions; it is too bad that he could not have attended the city grade school". Such statements imply a wholesale condemnation of the rural school that should be made only if the carefully determined facts justify this opinion.

On the other hand, advocates of the small country school seldom have factual data to justify their opinions. With the development of the objective test and its greatly increased use in the school program, it is time that studies should be made which will remove the question from the realm of controversy and settle it by scientifically determined facts.

Studies of rural and urban grade school achievement have been made in other states and one study of national scope was conducted. In connection with this nation-wide study, conducted under the auspices of the National Education Association, Charles M. Reinoehl<sup>2</sup> conducted an investigation in several counties of Montana in 1921. In 1931, Earl F. Sykes<sup>3</sup> made a survey of Judith Basin County, in which he compared the achievement of rural and urban pupils. These are the only two studies of the problem which have been made in

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2. Charles M. Reinoehl, "A Study of Instruction in Montana's Rural Schools", in Intermountain Educator, LII (May, 1923), pp. 358-359.

3. Earl F. Sykes, An Educational Survey of the School Children of Judith Basin County, Montana, Masters Thesis, Montana State University, (Missoula, Montana, 1931).



Montana. The State Department of Public Instruction has fallen in line with the general movement throughout the country, and, for some time past, has been supporting a program of consolidation which has been gradually working toward the elimination of a large number of one-room rural schools. In spite of this movement, there are at present in Montana, between twenty-two hundred and twenty-three hundred rural, one-room schools.

It is the purpose of this study to obtain data based on careful objective measurement of achievement, which will indicate the present status of the one-teacher schools in comparison with the centralized schools of Broadwater, Fergus, and Gallatin Counties, and, in-so-far as these counties are representative, indicate the general situation in the state.

Statement of the Problem: Practically all of the studies made, to date, have measured achievement in grade school work, the tests having been given in the grades during the school year.

It is generally assumed that grade-school preparation plays a large part in scholastic success in high school. This assumption is indicated by the widely applied promotion practices, which consider that a pupil is not qualified to enter high school until he has satisfactorily completed the work of the eight grades. It is possible that this assumption is invalid, and this possibility should be kept in mind in the interpretation of the results of this study.

The urban and rural pupils of the study have been paired on the bases of intelligence, sex, and within the same school systems, and so far as possible, with little difference in chronological ages. The purpose of pairing on these bases has been to eliminate as many factors as possible that might affect high school achievement other than that of rural and urban preparation. The pupils in each pair were subjected to identical school environment for a

similar period of time, pursued the same subjects with the same texts, and, in most cases, they were of the same sex. Differences in enthusiasm for their work, home environment, and other factors, no doubt, enter the case; but since the selection was a random one, the probability is that these factors counterbalance each other to a great extent, and may be disregarded.

Specifically, the study attempts to show the differences in achievement made in several high school subjects. More broadly, it indicates general scholastic achievement and, as such, is comparable with the results of similar studies made in grade school subjects.

The problem has been formulated and carried out so as to answer these questions:

(a) Do high school pupils prepared in rural, one-room schools reach as high a degree of achievement as those who are prepared in larger urban schools?

(b) Is there any difference in the degree of achievement in one high-school subject as compared with others?

It is hoped that the findings of this study may prove of interest and value to high school teachers and that it may raise pertinent issues for those interested primarily in grade-school work.

Definitions and Delimitations: It has been the practice in the United States Census Reports to refer to towns of twenty-five hundred or less as rural. Obviously, in Montana, this classification would place the greater share of the population in the rural group; For the purposes of this study the term, rural school, refers to the one-teacher type of grade school which is still common in the open country and small communities.

The term, urban school, refers to all grade schools employing more than one teacher. The two-room school, in Montana, is usually located in some

small community center or village, and the physical equipment and library facilities often approximate more closely that of the smaller, centralized schools than it does that of the one-room school.

The field of this study has been limited to three counties of the State of Montana, namely: Fergus County, Gallatin County, and Broadwater County. These counties were chosen because of their accessibility to the investigator, and because a fair proportion of the pupils attending high school had graduated from one-room schools. Two of the schools, Gallatin County High School and Fergus County High School, are representative of the larger type of high schools in the state. Belgrade, Manhattan, Three Forks, Willow Creek, and Broadwater County High Schools are representative of the high schools of the second and third class districts.

The Freshman year of work was chosen because it would logically depend more fully upon grade school preparation than the other three years of secondary school work. The number participating in the study is further limited by the necessity of picking from these ninth-grade pupils those urban and rural school graduates who could be paired on the bases of intelligence, sex, and similarity in chronological ages. The urban-trained pupils in these schools outnumbered the rural-trained pupils by a ratio of more than two to one. This greatly reduced the number of pupils available for comparison.

## CHAPTER II. REVIEW OF RELATED STUDIES

General View of the Field: Since the inception and consequent improvement of the objective test, a considerable number of studies have been made relative to the comparative achievement of the rural one-room school and the centralized or city school. The greater part of these studies has been in the field of achievement in grade school-subject matter. Without a doubt, the inspiration for a large portion of the interest in this field has been the justification of consolidation. It may be that this has colored the interpretation of results to some extent.

Although there have been a number of studies made in counties and school systems, the principal sources of data are the results of the testing programs of the larger surveys. One of the chief weaknesses of the survey reports is the general assumption of intellectual equality of urban and rural groups, or the ignoring of the intelligence factor completely. Again, the conclusions are quite commonly based upon comparison of grades in school. Norman Frost, in a Teachers College, Columbia University study of the subject, points out four reasons why comparison on the basis of school grade classification is invalid. These are:<sup>4</sup>

1. Rural school terms are often shorter and attendance is less regular.
2. In some states, the school system is organized upon the basis of seven grades.
3. Grade standards assume that the tests are given at the same time of the year, which is not the case.
4. In the use of grade standards, retardation is not considered.

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4. Norman A. Frost, A Comparative Study of Achievement in Country and Town Schools, Teachers College, Columbia University Contributions to Education, No. 111, Teachers College, Columbia University, (New York, 1921), p. 1.

Timon Covert, Assistant Specialist in Rural Education, Bureau of Education, who has made several summaries of the educational achievement of one-teacher and of larger rural schools, after reviewing the studies made, has come to the conclusion that several important questions should be kept in mind when comparing the scores made by pupils of the two types of schools:<sup>5</sup>

1. Have the pupils' intelligence ratings been established?
2. Are the pupils accomplishing all that they are capable of doing; that is, has their achievement age been considered in relation to their mental age?
3. Have the pupils' chronological ages always been considered in the comparisons to be made?"

Many of the studies reviewed by Covert have not taken into account the factors which he has concluded are important in investigations of this nature. A testing program where intelligence and chronological age are considered, and these factors are controlled in relation to the achievement of pupils should tend to either confirm or to raise a question as to the validity of some of the sweeping studies where these things have been ignored.

The most extensive investigation yet made, was the study directed by the Department of Rural Education of the National Education Association,<sup>6</sup> in 1921-1922, to determine the comparative results of instruction in one-teacher and consolidated schools. A number of states have made surveys, including data relative to this problem. Numerous studies have been made in county surveys and surveys of single school systems. In the following paragraphs, a summary of the findings for Reading, Arithmetic, Spelling, and Handwriting has been attempted. The data used in the tables have been taken from Timon Covert's

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5. Timon Covert, Educational Achievements of One-teacher and of Larger Rural Schools, Rural School Circular, No. 18, Department of the Interior, (Bureau of Education, Washington, D. C., November, 1926), p. 2.

6. Foote, op. cit., pp. 812-817.

Bureau of Education summary<sup>7</sup> of the studies made in this field and from some of the state surveys.

Reading Abilities: In the National Education Association Study of 1921,<sup>8</sup> 135 consolidated schools were compared with 374 one-teacher schools, in 19 states. The findings indicated that the consolidated-school pupils made higher median scores in both reading rate and comprehension in each grade than did the pupils of the corresponding grades of the one-teacher schools. The ages of the pupils were found to be about the same, grade for grade, but the intelligence was assumed to be the same. The greatest difference in both rate and comprehension appeared in the 8th grade.

Table 1. COMPARISON OF MEDIAN SCORES IN GRADE READING IN 29 STATES

Grade	3		4		5		6		7		8	
	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.
Arizona Survey					P	S					S	P
Indiana Survey					S	P			S	P	S	P
Kansas Survey	S	P	S	P	S	P	S	P	S	P	S	P
Kentucky Survey					S	P			S	P	S	P
Missouri Study	General Results - all grades: Urban-S; Rural-P											
N. E. A. Study (19 states)	S	P	S	P	S	P	S	P	S	P	S	P
New York Survey	S	P	S	P	S	P	S	P	S	P	S	P
Oklahoma Survey	S	P	S	P	P	S	P	S	P	S	P	S
Texas Survey	S	P	S	P	S	P	S	P	S	P		
Virginia Survey	S	P	S	P	S	P	S	P	S	P		
Louisiana Study	General results- all grades: Urban-S; Rural-P											

(In Table 1 and the following tables of the chapter, "S" indicates "Superior" and "P" indicates "Poorer".)

State surveys unusually make a comparison of the achievement of rural schools and larger schools. In Table 1 is a summary of all data pertaining to reading that could be obtained from these surveys, indicating the general findings. The superiority indicated in this table has been obtained from a

7. Timon Covert, Educational Achievements of One-teacher and of Larger Rural Schools, United States Government Report, Department of the Interior, (Bureau of Education Bulletin, 1928, No. 15).

8. Foote, op. cit., p. 815.

comparison of median scores made on reading tests. The medians themselves are not comparable because of the fact that different tests were used in the different studies. In many instances the superiority consists of only a few tenths of a point difference. In comparatively few cases are the differences quite large.

In the case of the Arizona Survey,<sup>9</sup> very little measurable difference was found between the two types of schools. The survey attributed this to the fact that exceptionally high standards were maintained in rural schools throughout the state.

The Oklahoma one-room rural schools consistently outranked the larger schools, except in the third and fourth grades. In the only other instance where the rural schools outranked the larger schools, it was by a comparatively small amount. This was in the case of the fifth grade in Arizona.

Comparison of the median scores for Kentucky, New York, Texas, and Virginia, indicates that the pupils of the larger schools were, grade for grade, approximately one year ahead of the pupils of the one-teacher schools.

The findings of less comprehensive, but, in some cases, more thorough studies, in general, bear out the findings of the state surveys. McCracken<sup>10</sup> found that the consolidated schools made the highest showing in reading in Logan County, Ohio. The greatest showing in favor of the centralized schools was in the seventh grade.

Chapman and Eby<sup>11</sup> determined that the one-room pupils of northern Ohio had medians only slightly lower than the medians of the Cleveland schools.

9. Foote, op. cit., p. 815.

10. C. C. McCracken, Logan County and Bellefontaine, Ohio, School Survey, summarized in Covert, op. cit. p. 6.

11. J. Crosby Chapman and H. L. Eby, "A Comparative Study, by Educational Measurements, of One-room Rural-School Children and City-School Children," Journal of Educational Research, II, (October, 1920), pp. 636-646.

The rural pupils of Santa Clara County, California<sup>12</sup> compared favorably with those of San Jose, except in the reproduction of thought.

Frost<sup>13</sup> found that the pupils of the six-month rural schools in Madison County, Kentucky, were inferior in reading abilities, but that the pupils of nine-month schools were favorably comparable to the centralized schools.

Jungck<sup>14</sup> found no marked difference between the two groups of his study. Reinoehl, in his study of Montana counties,<sup>15</sup> concluded that the pupils of consolidated schools read more words per minute and comprehended what they read much better than those from one-teacher schools.

In "certain West Virginia Counties,"<sup>16</sup> in Spokane County, Washington,<sup>17</sup> and in Bourbon County, Kansas,<sup>18</sup> the pupils of consolidated schools excelled in reading ability.

In his 1931 study, Sykes<sup>19</sup> found that, in general, the rural pupils of Judith Basin County, Montana, were one year and eight months below the urban pupils, educationally.

A summary of all investigations must conclude that the larger, centralized

12. Richard Zeidler, "Tests of Efficiency in the Rural and Village Schools of Santa Clara County, California", The Elementary School Journal, XVI, (June, 1916), pp. 542-555.
13. Frost, op. cit., p. 21.
14. Frederick William Jungck, Comparative Ability of Rural and City School Children as Shown by Certain Standard Tests, Ph. B. Thesis, University of Wisconsin, (June, 1920)
15. Charles M. Reinoehl, "A Study of Instruction in Montana's Rural Schools", Intermountain Educator, LII, (May 1923), pp. 358-359.
16. J. B. Shouse, "Some West Virginia Performances in the Second Grade", School Journal and Educator, LII, (May, 1923), pp. 358-359.
17. C. W. Stone and J. W. Curtis, "Progress of Equivalent One-room and Graded-School Pupils", Journal of Educational Research, XVI, (November, 1927), pp. 260-264.
18. Paul E. Twining, A Comparative Study of the Academic Efficiency of Pupils in Certain Urban and One-teacher Rural Schools of Bourbon County, Kansas, Masters Thesis, Kansas State University, Lawrence, Kansas, 1928.
19. Sykes, op. cit.



schools rather consistently produce better achievement in reading, although in many instances, the difference is not as marked as might be expected, considering the superior advantages of the larger schools.

Arithmetic Abilities: The results of the studies comparing the achievement in Arithmetic, in the two types of schools, show general results similar to the findings of the reading studies. Table 2 summarizes the findings of state surveys.

Table 2. COMPARISON OF MEDIAN SCORES IN ARITHMETIC IN 26 STATES

Grade	3		4		5		6		7		8	
	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.
Kansas Survey	S	P	S	P	S	P	S	P	S	P	S	P
Kentucky Survey					S	P			S	P		
Missouri Study							S	P	S	P	S	P
N. E. A. Study (19 states)	S	P	S	P	S	P	S	P	S	P	S	P
New York Survey	S	P	S	P	S	P	S	P	S	P	S	P
Oklahoma Survey	S	P	F	S	S	P	P	S	S	P	P	S
Texas Survey					S	P			S	P		
Virginia Survey	S	P	S	P	S	P	S	P	S	P		

The table shows uniformly higher achievement in the larger schools except in the case of Oklahoma, where the one-room school shows superiority in the fourth, sixth, and eighth grades.

A large number of studies of more limited scope has been made. A summary of a number of typical ones will serve to indicate the general findings.

The Oakland County, Michigan survey<sup>20</sup> finds the rural schools slightly lower in achievement in every grade but the sixth.

In the Travis County, Texas study,<sup>21</sup> the scores of the rural schools were compared with the scores of pupils in Boston, Detroit, and city schools of Iowa. The rural medians were lower in every case.

20. Rural School Survey of Oakland County, Michigan, (September, 1923), summarized in Covert, op. cit., p. 2.

21. A Study of Rural Schools in Travis County, Bulletin of the University of Texas, (December, 1916), summarized in Frost, op. cit., pp. 7-8.

E. H. Taylor<sup>22</sup> conducted a study in a county of Illinois comparing the rural grades with the grades in a study made by Courtis. The results show that the rural scores are consistently lower. In grades three and four, the rural scores are approximately "one grade below the urban third and fourth grade scores"; the rural scores in grades five and six are "almost two grades below the urban scores"; the rural scores in grade seven are "more than one grade" but "less than two grades below" the urban scores; and the rural scores in grade eight are at least "two grades below" those of urban pupils.

Zeidler's Santa Clara County, California study<sup>23</sup> shows that the rural schools of the county rank consistently lower than twenty small western cities and lower than Butte or Salt Lake City. The inferiority is in many cases quite great.

A "Typical County of Pennsylvania" study<sup>24</sup> compared the rural medians with Courtis standards and found these medians to be about two grades below standard.

Haggerty, in a study of five Indiana counties, found the district schools to be more efficient than the graded.

Foote, in a Louisiana study<sup>25</sup> and Frost, in Madison County, Kentucky,<sup>27</sup>

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22. E. H. Taylor, "A Comparison of the Arithmetical Abilities of Rural and City School Children", The Journal of Educational Psychology, V, (October, 1914), pp. 461-466.
  23. Zeidler, op. cit., p. 554.
  24. Charles L. Harlan, "A Comparison of the Writing, Spelling and Arithmetic Abilities of Country and City School Children", Educational Administration and Supervision, II, (November, 1916), pp. 560-572.
  25. M. E. Haggerty, "Achievement in Small and Large Schools of New York", Rural School Survey of New York State Educational Achievement, (1922), pp. 210-213.
  26. John M. Foote, A Study of Arithmetic in Rapides Parish, Louisiana State Department of Education, (Bulletin No. 11, September, 1919).
  27. Norman A. Frost, A Comparative Study of Achievement in Country and Town Schools, Teachers College, Columbia University Contributions to Education, No. 111, Teachers College, Columbia University, (New York, 1921), p. 1.

indicated that the rural pupils were poorer in arithmetic achievement than the pupils of the larger schools.

Jeffries' investigation in Sumner County, Kansas,<sup>28</sup> found the urban freshman high-school pupils to be poorer in arithmetic than those from the rural schools.

In a Junior High School study in Emporia, Kansas,<sup>29</sup> no significant difference was found in the mathematical abilities of the two groups.

Jungck<sup>30</sup> found that there was little significant difference in those subjects requiring mechanical drill, such as, the fundamental processes of arithmetic and speed in reading.

Montana rural pupils<sup>31</sup> were found to be inferior in every grade, while a study of eight counties of West Virginia<sup>32</sup> shows the rural pupils to be superior in addition. Twining<sup>33</sup> found that the rural pupils in the eighth grade of Bourbon County, Kansas, exceeded the urban pupils by one to two months of progress in arithmetic tests, while Stone<sup>34</sup> discovered the opposite to be true in Spokane County, Washington.

Summarizing, the state surveys unanimously found the rural pupils inferior in arithmetic accomplishment, with the exception of Oklahoma, where they exceeded in three grades. When the smaller studies are compared, however, the results are not so uniformly favorable to the urban schools. Eight

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28. John A. Jeffries, A Comparative Study of Pupils from Rural and Urban Grades in the Freshman Year of High School in Sumner County, Kansas, Masters Thesis, Kansas State University, Lawrence, Kansas, (1926)
29. Humphrey, J. Jones, A Comparison of Intellectual Development of Rural and Urban Students in Junior High School of Emporia, Kansas, Masters Thesis, Kansas State University, Lawrence, Kansas, (1926).
30. Jungck, op. cit., pp. 58-59.
31. Rejnoehl, op. cit., p. 359.
32. Shouse, op. cit., p. 359.
33. Twining, op. cit., p. 68.
34. Stone and Curtis, op. cit. p. 263.

studies show the rural pupils to be inferior. Four studies show them superior and two studies show no significant differences. The preponderance of evidence seems in favor of the urban pupils. The state surveys definitely indicate superiority of urban pupils in arithmetic. The results of the more specialized studies that were reviewed are not so conclusive. This may indicate that some vital factors, such as those emphasized by Covert, were not taken into account in the survey type of study.

Spelling Abilities: A review of the spelling investigations reveals that the pupils hold their own more often than in reading and arithmetic. The state surveys, summarized in Table 3, show the urban pupils rather consistently superior. In only two instances are the rural pupils superior, and, in grades three and seven in Wisconsin, there was no difference. However, the differences, in most cases, were smaller than the differences in the arithmetic and reading studies. In the specialized investigations, about equal numbers of studies indicate the superiority of urban pupils and the superiority of rural pupils.

Table 3. COMPARISON OF MEDIAN SCORES IN SPELLING IN 26 STATES

Grade	3		4		5		6		7		8	
	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.
Indiana Survey					S	P			S	P	S	P
Kentucky Survey					S	P			S	P	S	P
North Carolina					S	P			P	S		
Oklahoma Survey					P	S	S	P	P	S	S	P
West Virginia					S	P			S	P	S	P
Wisconsin Survey	Same		S	P	S	P	S	P	Same		S	P
Missouri Study	General results - all grades:: Urban - S; Rural - P											
N. E. A. Study (19 states)	S	P	S	P	S	P	S	P	S	P	S	P

Theisen,<sup>35</sup> in reporting the Wisconsin Study, used in the table, states,

35. William W. Theisen, A Report on the Use of Some Standard Tests for 1916-17, State Department of Public Instruction Studies in Educational Measurement in Wisconsin, (1918), Bulletin No. 1., P. 17.

"Rural children...when compared with other classes of Wisconsin schools . . . are not conspicuously poorer nor better than the pupils in the cities and villages".

The Spokane County, Washington survey<sup>36</sup> finds the pupils of the large-type school to be 2.7 percent more efficient than those in the surrounding one-room schools. This figure has more significance because the pupils were paired on a basis of intelligence test scores and chronological ages, although the method of obtaining differences, used by the investigators, is of questionable validity.

Other studies which found the urban pupils superior were: Oakland County, Michigan<sup>37</sup> - the urban children were superior in every grade but the eighth; Harlan's Pennsylvania Study<sup>38</sup> - the urban children had a superiority of from 17 - 14 words per hundred; Reinoehl's Montana Study<sup>39</sup> - the consolidated pupils were superior; Jones' Emporia, Kansas Study<sup>40</sup> - the high school pupils from urban grade schools were superior.

On the other hand, a number of investigations found results favoring the rural pupils. Some of these are: Chapman, A Northern Ohio Study<sup>41</sup> - shows the rural pupils superior to the pupils of Cleveland; Shouse, A West Virginia Study<sup>42</sup> - the one-room pupils spell better; Bourbon County, Kansas<sup>43</sup> - indicates that the rural pupils exceeded the urban by scores indicating an amount of progress from one to two months superiority; Plumas County, California<sup>44</sup> - the rural children were of the average ability

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36. Stone and Curtis, op. cit., p. 263.

37. Rural School Survey of Oakland County, Michigan, (September, 1923), summarized in Covert, op. cit., p. 6.

38. Harlan, op. cit., p. 570.

39. Reinoehl, op. cit., p. 359.

40. Jones, op. cit., p. 52.

41. Chapman, op. cit., p. 645.

42. Shouse, op. cit., p. 359.

43. Twining, op. cit., p. 69.

44. Cyrus D. Head, The Spelling Ability of the Plumas County Children, California State Board of Education, Supplement of California Blue Bulletin, (December, 1919), summarized in Frost, op. cit., p. 14.

of city children throughout the country.

It must be concluded that the spelling issue is not settled. Neither the urban nor the rural group has been found to have unquestioned superiority.

Handwriting: A comparison of the median handwriting scores from a few state surveys will suffice to show the situation. Table 4 shows the data for 26 states.

Table 4. COMPARISON OF MEDIAN SCORES IN HANDWRITING IN 26 STATES

Grade	3		4		5		6		7		8	
	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.	Urb.	Rur.
Kansas Survey	S	P	S	P	S	P	S	P	S	P	P	S
N. E. A. Study (19 states)	S	P	S	P	S	P	S	P	S	P	S	P
Oklahoma Survey	S	P	S	P	P	S	S	P	P	S	P	S
West Virginia	S	P	P	S	S	P	P	S	P	S	P	S
Wisconsin Survey	P	S	P	S	P	S	Same		P	S	P	S

In 13 of the 24 comparisons shown in the table, pupils of the one-room schools scored higher. They scored lower in 10 instances. The differences are not very great and it may be concluded that there is no significant difference in the quality of work.

Of the less extensive studies, three found the urban pupils definitely superior. One found that the urban pupils did a superior quality of work but showed poorer speed, while in Montana schools,<sup>45</sup> the urban pupils were faster but showed a poorer quality. Three studies found no significant difference.

A summary of all of the studies substantiates the statement made above, in reference to the state surveys, that the rural and urban schools seem to be producing about the same quality of achievement in handwriting.

Content Subjects: Not so many studies are available concerning comparative achievement in other grade-school subjects. The studies which have

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45. Reinoehl, op. cit., p. 359.

been made in regard to content subjects, such as history and geography, indicate the superiority of the urban school. The same is true for comparative composition scores.

High School Subjects: Some studies have been made to determine the success, in high school subjects, of pupils from urban and rural schools. Some of the investigations have attempted to determine the quality of preparation for high school work and have tested the pupils' abilities shortly after entering the ninth grade. Ability in English has been more often tested than other abilities. Three studies of this type will serve to indicate the general findings.

Results of a study made in Iowa,<sup>46</sup> where standardized tests were given during the first month in eight high schools, show that the pupils trained in urban schools made fewer errors in English. Scores on tests given to ninth grade pupils from one-teacher schools and to an equal number from graded village schools, in Spokane County, Washington,<sup>47</sup> indicate an average difference in English ability between the two groups of pupils, equal to 4.9 months of school work in favor of those from graded schools. Studies conducted in the high schools of Sumner County, Kansas,<sup>48</sup> paired the ninth grade pupils on the bases of intelligence and chronological age. The results show that the rural group surpassed in arithmetic abilities, while the urban group was superior in language usages.

Other studies have attempted to measure and compare the achievement in high school subjects of the pupils who have entered high school from

46. W. H. McFarland, English Ability of Town and Rural Pupils, Masters Thesis, University of Iowa, Iowa City, Iowa, 1926, summarized in Covert, op. cit., p. 17.
47. C. W. Stone and J. W. Curtis, "Progress of Equivalent One-room and Graded-school pupils", Journal of Educational Research, XVI, (November, 1927), pp. 260-264.
48. Jeffries, op. cit., p. 54.

the two types of grade schools. An investigation of the high school records of pupils in Illinois<sup>49</sup> shows that the pupils trained in town schools averaged 1.34 percent higher in all high school subjects and 1.74 percent higher in English than the pupils from the one-teacher schools. The Junior High School study of Emporia, Kansas,<sup>50</sup> finds a negligible difference between ninth grade pupils from the two groups. In this study, Jones concludes that the rural group excels in those subjects where memory and close application to text book material is necessary.

These high school studies seem to indicate, as a rule, where a difference in ability to achieve exists, it usually favors the urban-trained pupils. However, the findings are not so sweeping that it would justify the generalization that rural-trained pupils are inferior in achievement throughout the country. Rather, it would indicate the necessity of objective measurement in many school systems or communities before reaching any conclusions in the matter.

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49. Illinois State Teachers Association, High School Records of Rural-trained and of City-trained Children, Illinois State Teachers Association, Springfield, Ill., Research Department, (1926).

50. Jones, op. cit., p. 48.



### CHAPTER III. THE PROCEDURE AND SOURCES OF DATA

Sources of Data: The intelligence quotients, used as a basis for pairing the pupils, were obtained from the principals' offices of the various schools. The tests used were:

The Otis Group Test of Mental Ability, Advanced Examination.

The Otis Self-administering Test of Mental Ability, Higher examination, Form A.

The Terman Group Test of Mental Ability, Form A.

The Kuhlman Anderson Intelligence Test, Grade Nine to Maturity.

The Detroit Advanced Intelligence Test for High Schools and Colleges, Form V.

The selection of suitable achievement tests in high-school subjects presented more of a problem than a similar selection for grade schools would have done. It was necessary to choose tests that measured the actual achievement and progress made in the ninth grade subjects as they are the most commonly classified and taught in Montana high schools. Tests were available which contained more advanced material than ninth grade pupils could be expected to master, or which included the subject matter of several courses as commonly taught in Montana schools. The Iowa State Scholarship Tests<sup>51</sup> were chosen as best meeting these requirements. The subject matter of these tests followed closely the course of study as usually taught in Montana schools. The schools taking part in the study had not recently administered any of the Iowa State Scholarship series of tests. The English Correctness Tests and the Ninth Year Algebra Tests were released by Iowa State College a week before the tests were given for

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51. See Appendix, pp. IV-XXI.

the present study. In the case of General Science, it was necessary to use the test from the previous year.

Description of the Tests: The Iowa Every-Pupil High School Tests are issued yearly, by the State University of Iowa, as a part of a state-wide testing program in Iowa. They are used in the schools of many of the surrounding states. These tests are constructed by or under the supervision of the faculty of the University. The program of testing has been organized and carried out for eight years. They are constructed primarily for the purpose of testing and comparing achievement in the secondary schools. In this testing program, the tests are administered by the school staff of the participating schools. For this reason, direction sheets containing detailed and explicit directions for giving the tests are made and sent out.<sup>52</sup> This insures, in-so-far as possible with group tests of this nature, uniformity of time and procedure.

The English Correctness Test<sup>53</sup> consists of six pages, containing three short themes, such as might have been written by a high school pupil. A large number of errors in spelling, capitalization, punctuation, and word usage are contained in these themes. Definite instructions are given as to the method of correcting these errors, so that the corrections made by the pupils taking the tests, will be uniformly done. A scoring stencil is provided for the teacher who corrects the tests. There are 232 corrections or choices to be made by the pupil, making the highest possible score, 232.

The Ninth Year Algebra Test<sup>54</sup> consists of three parts, dealing with Fundamental Processes, Algebraic Relations and Representations, and Verbal

52. See Appendix, pp. II, XII, and XXII.

53. See Appendix, p. IV.

54. See Appendix, p. XIV.

Problems. There is a total of 53 problems. Twenty minutes is allowed for each of these parts, making a total of sixty minutes for the test. The highest possible score is 53.

The General Science Test<sup>55</sup> consists of 83 multiple choice questions. Each has four possible answers, of which only one is correct. The time limit is sixty minutes and the highest possible score is 83.

Procedure: It was ascertained that the schools, chosen for the study had administered intelligence tests at the beginning of the ninth grade. In one or two instances, it was necessary to furnish intelligence tests for the schools in order to secure the data. Arrangements were made to secure the test results and the tests, themselves. In the case of Fergus County High School, it was impossible to obtain the tests, but the results were carefully tabulated by the vocational guidance supervisor. The test scores and Intelligence Quotients were carefully checked and tabulated. Unfortunately, it was impossible to have the same intelligence test administered in all of the schools, so that the obtained I. Q.'s would be comparable. Table 5 shows the tests which were given in each of the schools, together with the number of pupils tested, and the average I. Q. for each school. It is interesting to note that there is a considerable difference in the average I. Q. in favor of the urban schools except in the case of Manhattan, where the difference between the means favors the rural pupils by 3.96 points.

The pupils were paired on the bases of their I. Q.'s, sex, urban or rural grade school training, and, so far as possible, with little differences in chronological ages. The pairing was done between pupils attending the same school system and, in a few instances, between pupils attending different schools which had used the same intelligence tests. In order to obtain the

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55. See Appendix, p. XXIV.

Table 5. INTELLIGENCE TEST DATA  
Ninth Grade Pupils of Seven High Schools

SCHOOL AND TEST USED	NO. PUPILS	URBAN AVG	RURAL AVG.	DIFFERENCE FAVOR URBAN	DIFFERENCE FAVOR RURAL
<u>Broadwater County</u> Otis Group Int. Scale	46	108.39	105.7	2.69	
<u>Pelgrade</u> Terman Group Test	36	107.81	101	6.81	
<u>Fergus County</u> Terman Group Test	217	111.27	107.03	4.24	
<u>Gallatin County</u> Detroit Adv. Int. Test	190	110.68	100.68	10.01	
<u>Manhattan</u> Kuhlman Anderson Test	31	104.68	108.58		3.96
<u>Three Forks</u> Otis Self-Admin. Test	22	107	103	4	
<u>Willow Creek</u> Otis Group Int. Scale	11	106.16	105.6	1.1	
Total No. Pupils	555				

maximum number of pupils for the study, there were a few instances, (seven pairs) where boys and girls were paired together.

The achievement tests were mailed to the schools so as to arrive on May 4 and the request was made that the tests be administered on some day during the school week of May 4th to May 8th, inclusive. Instruction sheets issued by Iowa State University,<sup>56</sup> containing detailed instructions for giving tests, were sent to each school and were supplemented by special instruction sheets for this study.<sup>57</sup> The tests were administered to all of the participating pupils of each school at the same period. The principals

56. See Appendix, p.p. II, XII, and XXII.

57. See Appendix, p. I.

of the schools either supervised the testing themselves, or selected some faculty member to do so.

In some instances, the papers were scored by the teachers. In all instances the papers were rechecked. The resulting scores were tabulated into frequency distributions and the means, medians, standard deviations and standard errors were computed for each group and compared. There was a total of 228 English Correctness scores, 146 Ninth Year Algebra scores and 55 General Science scores used in the comparative study.

## CHAPTER IV. THE EQUATING OF THE GROUPS

The Bases Used for Pairing: Three bases were used in pairing the urban and rural pupils for this study. These were intelligence, as determined by the use of Intelligence Quotients obtained from tests of mental ability given during the first part of the school year, sex, and, so far as possible, chronological age. One of the chief weaknesses of many of the surveys and studies made in a comparison of the achievement of urban and rural pupils has been the ignoring of these factors. It is rather obvious that, in a comparison of scholastic achievement of two groups, if one group has a higher average intelligence, the two groups are not truly comparable. In some of the studies it has been assumed that the two groups are approximately equal in intelligence or else the factor has been ignored. A glance at Table 5 will indicate that, for this study at least, the intelligence was not equal in the two groups and could not have been safely ignored. The urban pupils show a consistently higher intelligence rating except in the instance of the Manhattan pupils.

Calupig made a study <sup>58</sup> of the intelligence, as revealed by tests, of the pupils of the larger high schools of Kansas, as compared with that of the pupils of the smaller high schools. He has found that the pupils of the larger high schools of Kansas have a higher median intelligence. Jeffries <sup>59</sup> found an average difference of ten months in favor of the urban group. Sykes <sup>60</sup> determined that the rural pupils of Judith Basin County, Montana, were mentally three

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58. Isaac A. Calupig, An Analysis of Some Difficulties of Rural High School Pupils in Mental Test Performances, Masters Thesis, Kansas State University, Lawrence, Kansas, (1926.)
59. John A. Jeffries, A Comparative Study of Pupils from Rural and Urban Grades in the Freshman Year of High School in Sumner County, Kansas, Masters Thesis, Kansas State University, Lawrence, Kansas, (1926.)
60. Karl F. Sykes, An Educational Survey of the School Children of Judith Basin County, Montana, Masters Thesis, Montana State University, Missoula, Montana, (1931.)

months younger than those of the third class districts. Wahlquist,<sup>61</sup> found a large difference in favor of urban pupils. These studies would indicate that intelligence is an important factor in making a comparison of the two groups.

It has long been recognized among school men that chronological age has a considerable bearing on school work. The younger pupils in a grade are usually the brightest, since, if they are capable of carrying the work of the grade, their I. Q.'s are quite likely to be higher. Covert has indicated the importance of this factor as may be noted in a previous chapter.

Sex should also be considered. Table 6 indicates that the girls clearly excel in the English Correctness tests. Although many of the highest scores on the English Correctness test were not used in the paired study, most of the extremely high scores were made by girls.

Reference to Table 9 indicates that the girls of the study have an average intelligence quotient slightly more than four points higher than the boys. This may, in part, reveal why these girls average sixteen points higher, and that their median score was 17.24 points higher than the boys' scores in the English Correctness test. But the fact that there is no very significant difference in favor of the girls in Algebra and that the boys hold a small advantage in General Science, would seem to indicate that the sex factor may have had considerable influence on the English scores. A glance at the standard and quartile deviations of the English scores shows little difference between the sexes in the scatter of the scores. Approximately two thirds of the girls' scores lie within the limits 110 - 165. About two thirds of the boys' scores lie within the limits 95 - 148 and the middle 50% of the girls' scores are within the limits 113 - 155 and the middle 50% of the boys' scores are within the limits 97-137. Pearson's Coefficient of Variation Formula indicates that the

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61. John T. Wahlquist, "Intelligence of Rural and Urban Children", The Elementary School Journal, XXVII, (May, 1927), pp. 682-684.

girls are 94% as variable as the boys. Similar consideration shows about the same situation in regard to the scatter of scores in the other two tests.

A comparison of the score differences in the three tests must consider the total possible score in each to place them on a comparable basis. The average of 16 points in favor of the girls in the English test is 6.9% of the total possible score. The 1.77 points of superiority of the girls in Algebra is 3.3% of the total possible score. The 2.53 points by which the boys' average exceeds the girls' average in General Science, is 2.6% of the total possible score.

Table 6. PERCENTAGE EVALUATION OF THE DIFFERENCE  
IN BOYS' AND GIRLS' SCORES

<u>Subject</u>	<u>Total Possible Score</u>	<u>Mean Difference</u>	<u>Percent of Possible Score</u>
English	232	16. - girls	6.9
Algebra	53	1.77 - girls	3.3
General Science	96	2.53 - boys	2.6

Table 7. COMPARISON OF THE SCORES OF BOYS AND GIRLS  
PAIRED FOR THE STUDY

	No.	Mean	S. D.	$\sigma$ (av.)	$\sigma$ (diff)	Mdn.	Q	PE.(mdn)	PE.(diff)
<u>English Correctness</u>									
Girls	137	137.48	27.62	2.33	3.73	134.06	21.09	2.15	3.04
Boys	91	121.48	26.12	2.73	(C.R.*= 4.29)	116.82	19.92	2.61	(C.R.= 5.67)
<u>Difference</u>		16 in favor of Girls				17.24 favor of Girls			
<u>Algebra</u>									
Girls	84	17.21	7.75	.846	1.31	16.8	4.67	.51	.95
Boys	54	15.44	7.38	1.004	(C.R.= 1.35)	13.75	4.72	.80	(C.R.= 2.15)
<u>Difference</u>		1.77 favor of Girls				2.05 favor of Girls			
<u>General Sci.</u>									
Girls	25	36.20	10.88	2.18	2.84	35.67	9.05	2.31	2.64
Boys	30	38.73	9.84	1.796	(C.R.= .89)	39.89	5.58	1.27	(C.R.= 1.59)
<u>Difference</u>		2.53 favor of Boys				4.22 favor of Boys			

\* C. R. refers to the Critical Ratio,  $\frac{D}{\sigma(\text{diff.})}$



The girls show definite superiority in English, and less superiority in Algebra, while the boys have excelled, to a smaller degree, in General Science. This indicates that sex should be considered in pairing pupils for a study of this nature.

The Intelligence Factor; Of the total 555 pupils who were tested in mental ability early in the fall, as shown in Table 8, only 462 were present to take the scholastic tests in the spring. A considerable number had dropped school or had moved to other school systems. Others were absent or for some reason did not take part in the testing program. Of these 462 pupils, 232 were pairable on the three bases used. This number was considerably smaller because of the fact that different intelligence tests were used in the schools and only pupils from the same schools, or schools using the same intelligence tests, could be paired; and the urban pupils outnumbered the rural pupils two to one.

Table 8. NUMBER TAKING THE TESTS

SCHOOLS	INTELLIGENCE TESTS			INTELLIGENCE AND SCHOLASTIC TESTS			PUPILS IN PAIRED STUDY		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Belgrade	19	17	36	17	17	34	13	5	18
Broadwater C.	33	15	48	28	10	38	9	12	21
Fergus C.	131	86	214	100	59	159	54	61	115
Gallatin C.	164	26	190	142	25	167	25	25	50
Manhattan	16	15	31	16	15	31	9	9	18
Three Forks	20	2	22	20	2	22	2	2	4
Willow Creek	6	5	11	6	5	11	5	4	9
TOTALS	389	166	555	329	133	462	116	116	232

Although, in a few instances, particularly in the case of the older pupils where the I. Q. was quite low, there was a difference of a number of points in the I.Q.'s of the paired pupils, generally speaking, there was from a few tenths to three or four points difference. In a number of cases, the I. Q.'s were exactly equal. Table 9 shows the mean and median I. Q.'s for the group used in the study. The means and medians in this table have no value other than for a comparison of the two groups, since the I. Q.'s used to obtain them were based upon different tests. The fact that the same number of quotients from each test were used in the urban and rural groups makes the medians and means in the table comparable for the two groups.

The means for the two groups are 107.49 in each case, while the median I. Q.'s are 105.4 for the urban and 105.12 for the rural groups, showing a difference of .28 in favor of the urban pupils.

Both groups are scattered about equally around their measures of central tendency, as indicated by the standard deviation 12.23 and 12.35. About two thirds of the urban I. Q.'s are within the limits of  $107.49 \pm 12.23$  and two thirds of the rural I. Q.'s are within the limits of  $107.49 \pm 12.35$ , or between 95.26 and 119.72 and 95.14 and 119.84, respectively.

A similar situation exists in the grouping of the I. Q.'s around their median. The middle 57.5% of the urban I. Q.'s are within the limits of  $105.40 \pm 8.39$  or between 97.01 and 113.79. The middle 57.5% of the rural I. Q.'s are within the limits 96.16 and 114.08.

A distribution of the differences in I. Q.'s between the members of each pair indicates that there is a mean difference for the entire group of  $1.38 \pm 1.42$ . The median difference for the group is 1.00. On the average, therefore, no pupil differs from the pupil paired with him, in respect to

the intelligence factor, by more than an I. Q. difference of 1.38. The mean of the differences favoring the rural pupils is .88 and the mean of the differences favoring the urban pupils is 1.29, showing a small mean difference in favor of the urban group. The median differences are .85 and 1.00 respectively.

When the boys, alone, are compared, there is a slight difference in favor of the rural boys. The S. D.'s and A. D.'s indicate a similarity in the grouping around the central tendencies. The urban girls have a slightly greater advantage over the rural girls in a similar comparison, with a little wider scattering of I. Q.'s about their measures of central tendency as indicated by the larger S. D.'s and A. D.'s.

The small differences in the I. Q.'s of some of the pairs balance themselves when the entire group is considered and the two groups are equal in the matter of intelligence, in-so-far as it can be measured by standard intelligence tests.

Table 9. COMPARISON OF THE INTELLIGENCE QUOTIENTS

	No.	Mean	S. D.	Median	A. D.
All Urban Pupils	116	107.49	12.23	105.40	8.39
All Rural Pupils	116	107.49	12.35	105.12	8.96
<u>Difference</u>		0		.28	
Urban Boys	49	103.62	10.30	103.27	7.75
Rural Boys	46	103.67	10.97	103.54	8.14
<u>Difference</u>		.05		.27	
Urban Girls	67	107.95	13.90	107.32	9.65
Rural Girls	70	107.57	13.68	106.82	9.79
<u>Difference</u>		.38		.50	

The Age Factor: Table No. 10 shows a comparison of the mean and median ages of the pupils used in the study. The average age of the urban pupils is 14 years,  $6\frac{1}{2}$  months. The average age of the rural pupils is 14 years,  $8\frac{1}{2}$  months. The average rural pupil is  $1\frac{3}{4}$  months older than the average urban pupil. The urban median is  $14\frac{1}{2}$  months while the rural median is 14 years,  $6\frac{1}{2}$  months, indicating that the median rural pupil is two months older than the median urban pupil.

A distribution of the differences in chronological ages between the members of each pair indicates that there is a mean difference for the entire group of  $6.35 \pm 6.75$  months. The median difference for the group is 6.00 months. On the average, therefore, no pupil differed from the pupil paired with him by more than 6.35 months. The mean of the differences favoring the rural pupils is 6.9 months and the mean of the differences favoring the urban pupils is 5.6 months.

Table 10. COMPARISON OF THE AGES OF THE PAIRED PUPILS

No.	Mean	Median
Urban 116	14 years, $6\frac{1}{2}$ months	14 years, $4\frac{1}{2}$ months
Rural 116	14 years, $8\frac{1}{2}$ months	14 years, $6\frac{1}{2}$ months
<u>Difference</u>	Rural, $1\frac{3}{4}$ mo.	Rural, 2 months

## CHAPTER V. PRESENTATION OF THE DATA AND ITS INTERPRETATION

The English Correctness Comparison: English was the only subject consistently taught to all ninth grade pupils of the seven schools. This is a condition which is generally true of the schools of the state. Table No. 11 shows the measure of central tendency and variability of the English test scores for all of the urban and rural pupils compared in the study.

Diagram I shows, in percentile graph form, the distributions of the two groups of scores. The broken line represents the rural scores. The continuous line indicates the urban scores. The graph shows that the lower urban scores were higher than the lower rural scores and that the higher urban scores were higher than the higher rural scores, in spite of the fact that the urban median was less than that of the rural pupils. This diagram shows quite well that there was no great difference in these two groups of pupils. The greatest difference appears to have been in the higher group of scores, where the urban pupils scored better than the better rural pupils.

Of the pupils who were paired for the study, 112 of the urban and 115 of the rural pupils made scores on this test. The average of the urban scores was 132.59; that for the rural pupils was 129.52. There was a difference in averages in favor of the urban pupils of 3.07 points. Comparison of the medians shows a smaller difference of .62 points, and this in favor of the rural pupils. The rural scores ranged from 93 to 197, the urban from 82. to 200.

A comparison of the Standard Deviations and the Q's indicates little difference in the scatter of the scores. Approximately  $\frac{2}{3}$  of the urban scores lie within the limits of 104 to 161, while about  $\frac{2}{3}$  of the rural

DIAGRAM I.

PERCENTILE GRAPH

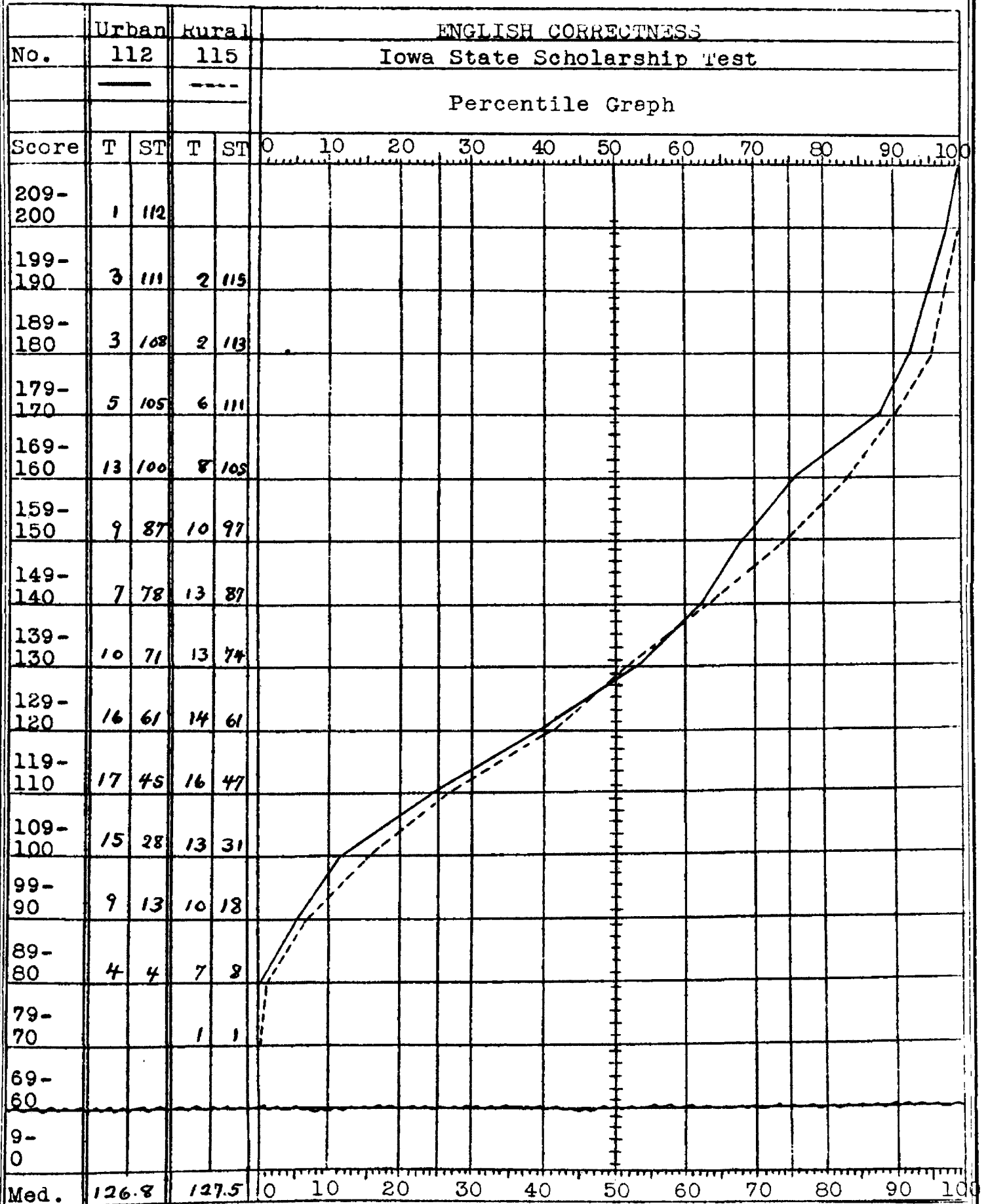


Table No. 11. COMPARISON OF THE SCORES  
OF URBAN AND RURAL PUPILS

	No.	Mean	S. D.	$\sigma$ (av.)	$\sigma$ (diff)	Mdn.	$\sigma$	P.E. (mdn)	P.E. (diff)
<b>ENGLISH CORRECTNESS</b>									
Urban	112	132.59	28.79	2.67	3.70	126.88	23.33	2.76	
Rural	115	<u>129.52</u>	27.57	2.57	(C.R. = .829)	<u>127.50</u>	20.57	2.40	3.66 (C.R. = .169)
<u>Difference</u>		3.07 favor of Urban				.62 favor of Rural			
<b>ALGEBRA</b>									
Urban	74	16.22	7.54	.88	1.21	15.5	5.85	.85	1.05
Rural	66	<u>15.73</u>	6.82	.84	(C.R. = .404)	<u>14.06</u>	4.05	.62	(C.R. = .137)
<u>Difference</u>		.49 favor of Urban				1.44 favor of Urban			
<b>GENERAL SCI.</b>									
Urban	22	34.91	9.79	2.09	2.8	36.00	7.57	2.02	2.8
Rural	33	<u>39.41</u>	10.70	1.86	(C.R. = 1.607)	<u>33.63</u>	8.90	1.94	(C.R. = .94)
<u>Difference</u>		4.50 Favor of Rural				2.63 favor of Rural			

scores are within the limits 102 to 157. The middle 50% of the urban scores are within the range of 103 to 150 and the rural scores within the limits 107 to 148. Using Pearson's Coefficient of Variation formula,  $V = \frac{100\sigma}{\text{Ave.}}$ , we find that the rural group is 98% as variable as the urban.

The Standard Errors of the means, 2.67 and 2.57, indicate that the difference of 3.07 is not a significant difference, since the changes are 68 in 100 that the true average of the urban group is  $132.59 \pm 2.67$ , indicating a one to one chance that the true mean would lie between 135.26 and 129.92; and the true mean of the rural group is  $129.52 \pm 2.57$ , indicating the probability that the true mean would lie between 140.6 and 124.58.

Similarly, a check on the medians reveals a low reliability. The urban median of 126.88 has a Probable Error of 2.76 and the rural median of 127.5 has a P. E. of 2.4. The small difference of .62 shown in favor of the rural group thus assumes no great significance.

Estimating the reliability of the obtained differences, we find further evidence that these differences are insignificant. The large  $\sigma$  (diff.) of the average, 3.7, indicates that in 99 out of 100 times, the true difference would be between  $3.7 \pm 3\sigma$  (diff.) or between -8.03 and 14.17. The critical ratio,  $\frac{D}{\sigma(\text{diff})}$ , equals .829, whereas, to indicate complete reliability, this should equal 3.

The P. E. of the difference between the medians is 3.66. This is too large to admit reliability. The critical ratio equals .169, which shows very low reliability as far as the difference in medians is concerned. When we consider the number of points which were possible in this test, the difference in the averages <sup>of 3.7</sup> is not large. This difference has taken into account the extreme scores, and the fact that the median favors the rural group, slightly, would somewhat lessen the value of the mean. Statistical treatment indicates that the difference is not a reliable difference. Thus, it must be concluded that no appreciable differences are found between the work of the urban pupils and the rural pupils in high school English as measured by this test.

Tables No. 12 and No. 13 show the measures of central tendency and variability of the rural and urban boys and of the rural and urban girls. The greatest difference exists in the comparison of the boys, where the difference in means is 6.24 and the difference in medians is 4.82 in favor of the urban boys. There is less difference in the comparison of the girls, where there is a difference in means of 1.32 in favor of the urban



and a difference in medians of 3.88 in favor of the rural girls. However, a glance at the large S. D.'s and the measures of reliability indicates that about the same situation exists here as in the comparison of the entire group. Using the critical ratios as a final criterion, we find that this yields 1.15 in the instance of the boys scores and .277 for the girls, indicating no reliability. In regard to the medians, the critical ratios are 1.01 and .843, respectively, also indicating a lack of reliability. In all four instances, the results of the critical ratio are too low to indicate reliability. The differences may have a significance for the immediate group studied and indicate that the rural boys were poorer than the urban boys, with a lesser degree of difference among the girls.

The larger difference in favor of the urban boys, together with the fact, shown by Diagram II, that this difference is consistent throughout the range of scores and is not influenced by extremes, may indicate that this difference is of more significance. The critical ratio, when applied to the boys scores, indicates some tendency toward greater reliability. If further studies were made, the chances are greater that there would always be a difference in favor of the urban boys. Apparently, much of the difference found in comparing the entire rural and urban groups may be attributed to differences in the boys' scores. This may be due to inferior training, but the fact that there was little difference in the girls scores might raise a question as to whether there might not have been other forces at work to influence these scores.

Diagrams II and III show the differences in the distributions and their spread for the boys' and girls' groups, graphically. A comparison of the two indicates the greater superiority of urban boys over the rural boys than is the case with the girls.

Table No. 12. COMPARISON OF RURAL AND URBAN BOYS PAIRED FOR THE STUDY

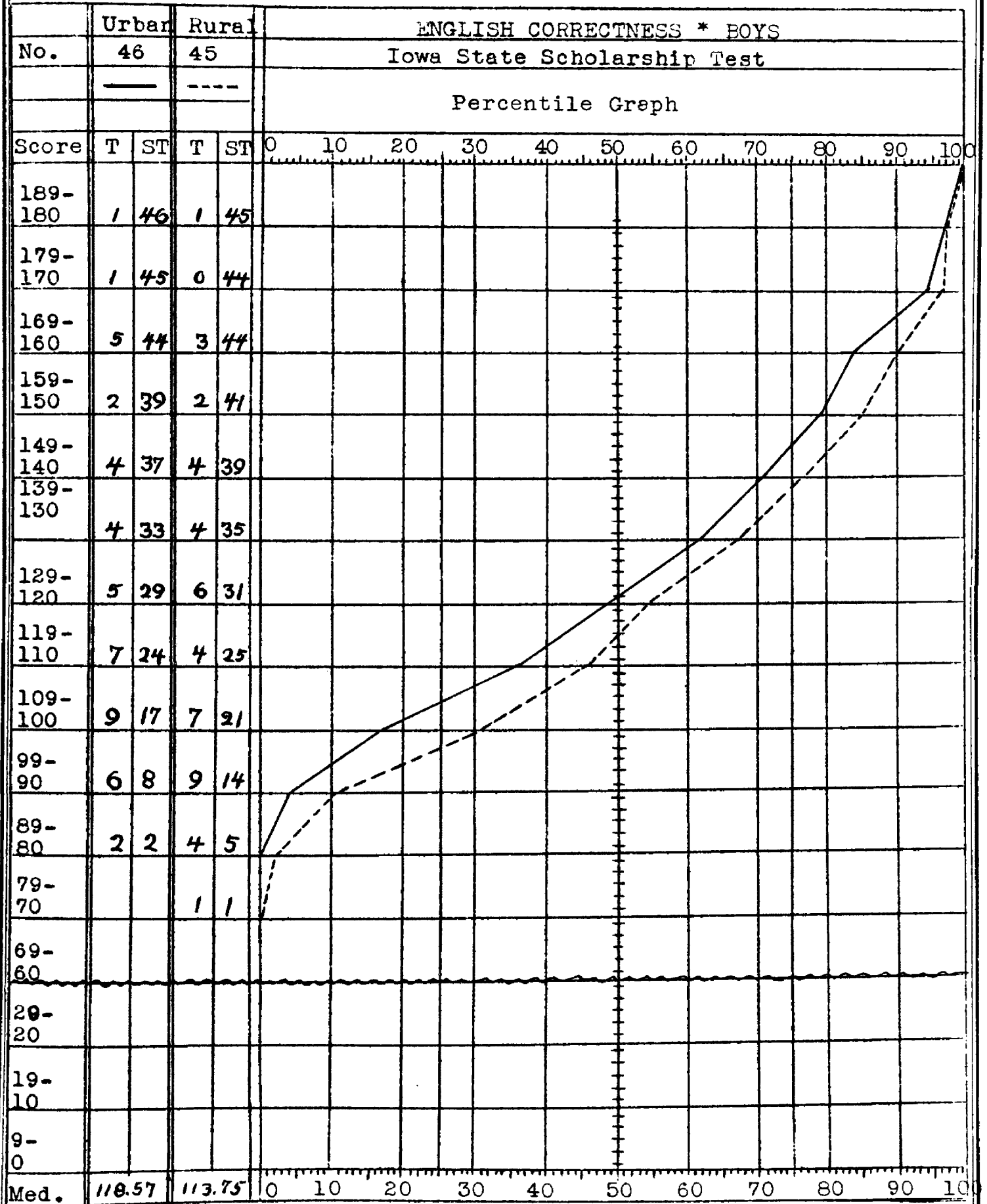
	No.	Mean	S. D.	$\sigma$ (av)	$\sigma$ (diff)	Mdn.	Q	P. E. (mdy)	P. E. (diff)
ENGLISH CORRECTNESS									
Urban	46	124.57	25.87	3.81	3.44	118.57	20.12	3.71	4.76
Rural	45	<u>118.33</u>	25.99	3.87	(C.R.= 1.15)	<u>113.75</u>	19.96	2.98	(C.R.= 1.01)
<u>Difference</u>		6.24 favor of Urban				4.82 favor of Urban			
ALGEBRA									
Urban	30	16.00	8.02	1.46	1.90	15.20	5.62	1.03	3.35
Rural	27	<u>14.50</u>	6.32	1.21	(C.R.= .789)	<u>13.36</u>	4.09	.786	(C.R.= .549)
<u>Difference</u>		1.5 favor of Urban				1.84 favor of Urban			
GENERAL SCI.									
Urban	14	36.5	9.56	2.56	3.42	39.00	6.38	1.71	2.40
Rural	16	<u>44.2</u>	10.17	2.54	(C.R.= 2.25)	<u>41.75</u>	6.75	1.69	(C.R.= 1.15)
<u>Difference</u>		7.7 favor of Rural				2.75 favor of Rural			

Table No. 15. COMPARISON OF RURAL AND URBAN GIRLS PAIRED FOR THE STUDY

	No.	Mean	S. D.	$\sigma$ (av)	$\sigma$ (diff)	Man.	Q	P.E.(min)	P.E.(diff)
ENGLISH CORRECTNESS									
Urban	66	138.18	29.34	3.61		131.67	23.18	3.56	
Rural	70	<u>136.86</u>	26.04	3.10	4.76 (C.R.= .845)	<u>135.55</u>	19.40	2.90	4.59 (C.R.= .845)
<u>Difference</u>		1.32 favor of Urban				5.88 favor of Rural			
ALGEBRA									
Urban	44	16.39	7.77	1.17		16.00	5.89	1.11	
Rural	39	<u>16.50</u>	7.08	1.11	1.61 (C.R.= .79)	<u>14.94</u>	4.79	.959	4.59 (C.R.= .23)
<u>Difference</u>		.11 favor of Rural				1.06 favor of Urban			
GENERAL SCI.									
Urban	8	32.00	10.28	3.62		29.00	10.50	4.64	
Rural	14	<u>36.75</u>	10.11	2.7	4.52 (C.R.= 1.05)	<u>36.00</u>	9.00	3.00	5.52 (C.R.= 1.27)
<u>Difference</u>		4.75 favor of Rural				7.00 favor of Rural			

DIAGRAM II.

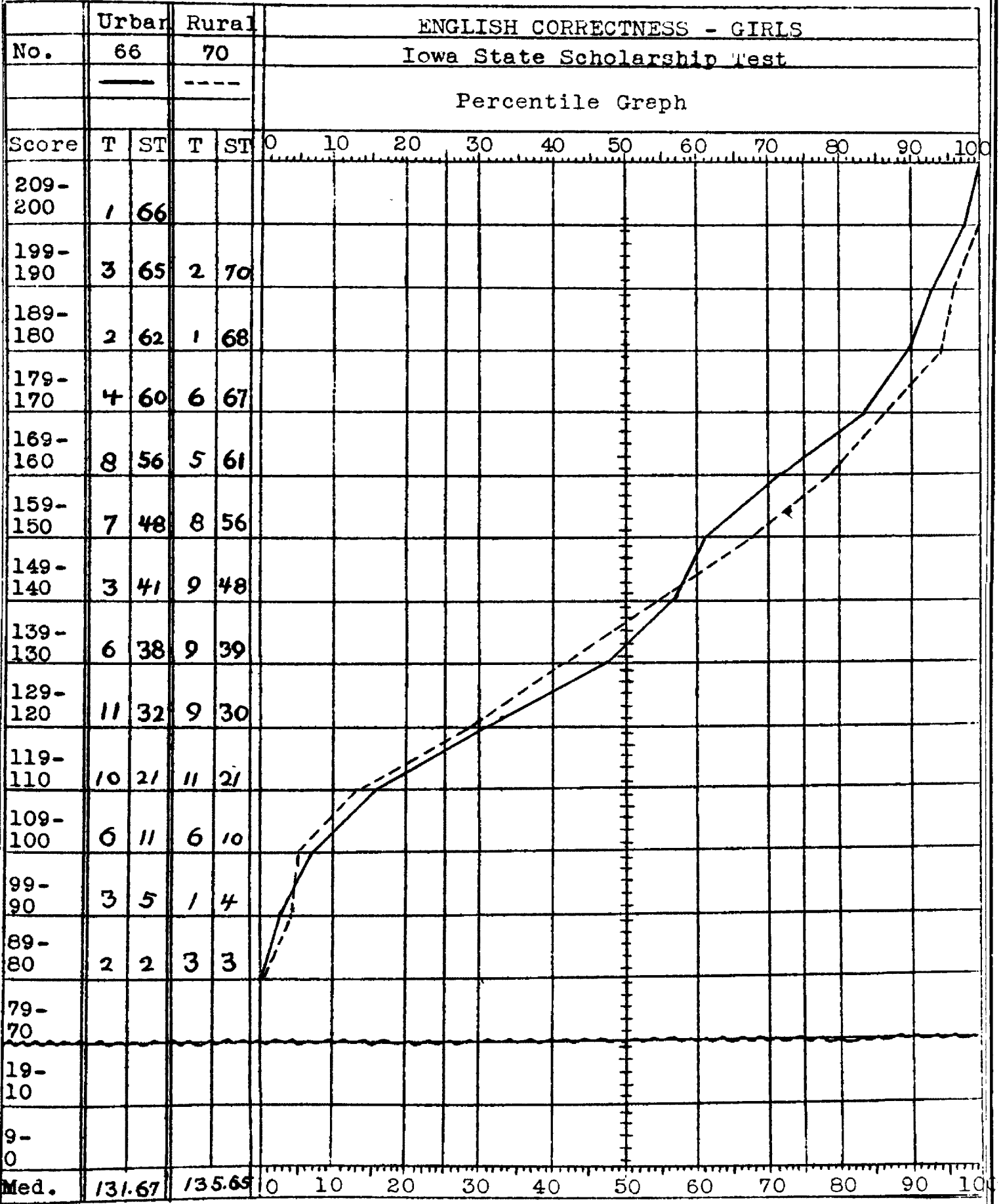
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DIAGRAM III.

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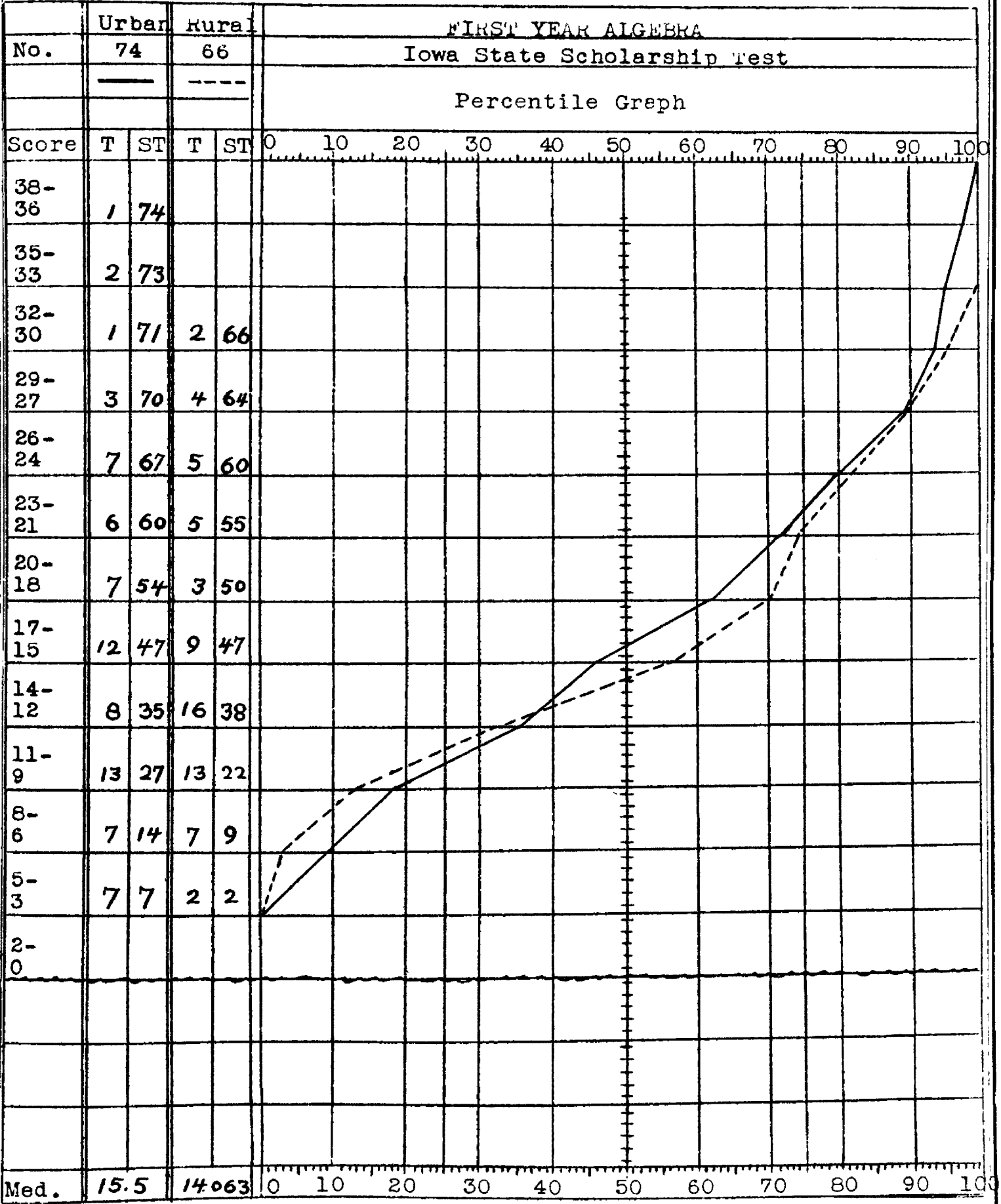
The Ninth Grade Algebra Comparison: In the two larger schools, algebra was elective. With a considerable number of subjects to choose from, a comparative few elected to take algebra, and these, as a general rule, were the better students. The course in Gallatin County High School was taught as General Mathematics and, as a result, the pupils could not be expected to be as thoroughly grounded in Algebra as those in the schools teaching the latter course. However, due probably to the selected nature of the pupils, their scores compared favorably with the scores of pupils from the smaller schools. The course was elective in Broadwater County High School, but the number of alternative subjects was not so great and, as a result, a large percent of the ninth grade pupils had entered the course. For these reasons, the greater number of algebra scores used in the study are scores made by pupils from the smaller schools.

The algebra scores are grouped rather heavily toward the lower ends of the distributions. The highest possible score that could be made on the test was 53. The range for the urban pupils was 3 to 37 and for the rural pupils, 3 to 32. A glance at the distribution shown in Diagram IV indicates that the pupils did not, as a rule, score very high on the test and indicates the differences in medians and percentiles.

The measures of central tendency and variability of the algebra test scores may be found in Table 11. Of the 232 individuals in the study, only 74 urban and 66 rural pupils made scores on the subject. The mean of the urban scores was 16.22 and of the rural scores was 15.73. The difference in the averages was .49 points in favor of the urban group. The medians were 15.5 and 14.06, respectively. The median of the urban group was 1.44 points higher than that of the rural group.

DIAGRAM IV.

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These small differences assume further insignificance when the S. D.'s and Q's are compared. The Standard Deviations are 7.54 for the urban and 6.82 for the rural. This indicates very little difference in the scatter of the scores. The Q's show about the same degree of scatter of the scores about the medians. Approximately 68% of the urban scores are scattered around the mean within the limits of  $16.22 \pm 7.54$  or between 8.68 and 23.76. The middle 50% of the same scores lies within the limits of  $15.5 \pm 5.85$  or between 21.35 and 9.65. In like manner, 68% or about 2/3 of the rural scores lies within the limits 22.55 and 8.91, and 50% of the scores between 18.11 and 10.01. By Pearson's Coefficient of Variation formula, the rural pupils are 94% as variable as the urban, indicating a close resemblance in the scatter of the two groups.

There are 68 chances in 100 that the true mean of the urban scores is  $16.22 \pm .88$ , indicating a one to one chance that the true mean would lie between 17.10 and 15.34 and that the true rural mean is  $15.73 \pm .84$ , indicating the probability that the true mean would lie between 16.57 and 14.89. Thus the difference of .49 is not only small, but is unreliable as well.

A check on the medians shows much the same picture. The urban median of 15.5 has a Probable Error of .85 and the rural median of 14.06 has a P. E. of .62, which indicates no reliability.

The relatively large  $\sigma$  (diff) of 1.21 indicates that in 99 out of 100 times, the true difference would be  $.49 \pm 3 \sigma$  (diff) or that it would be between -3.149 and 4.129. Thus, the chances are almost as good that the true difference would be in favor of the rural pupils as in favor of the urban. The critical ratio for the mean yields .404, and 1.37 for the median, neither of which indicates reliability.



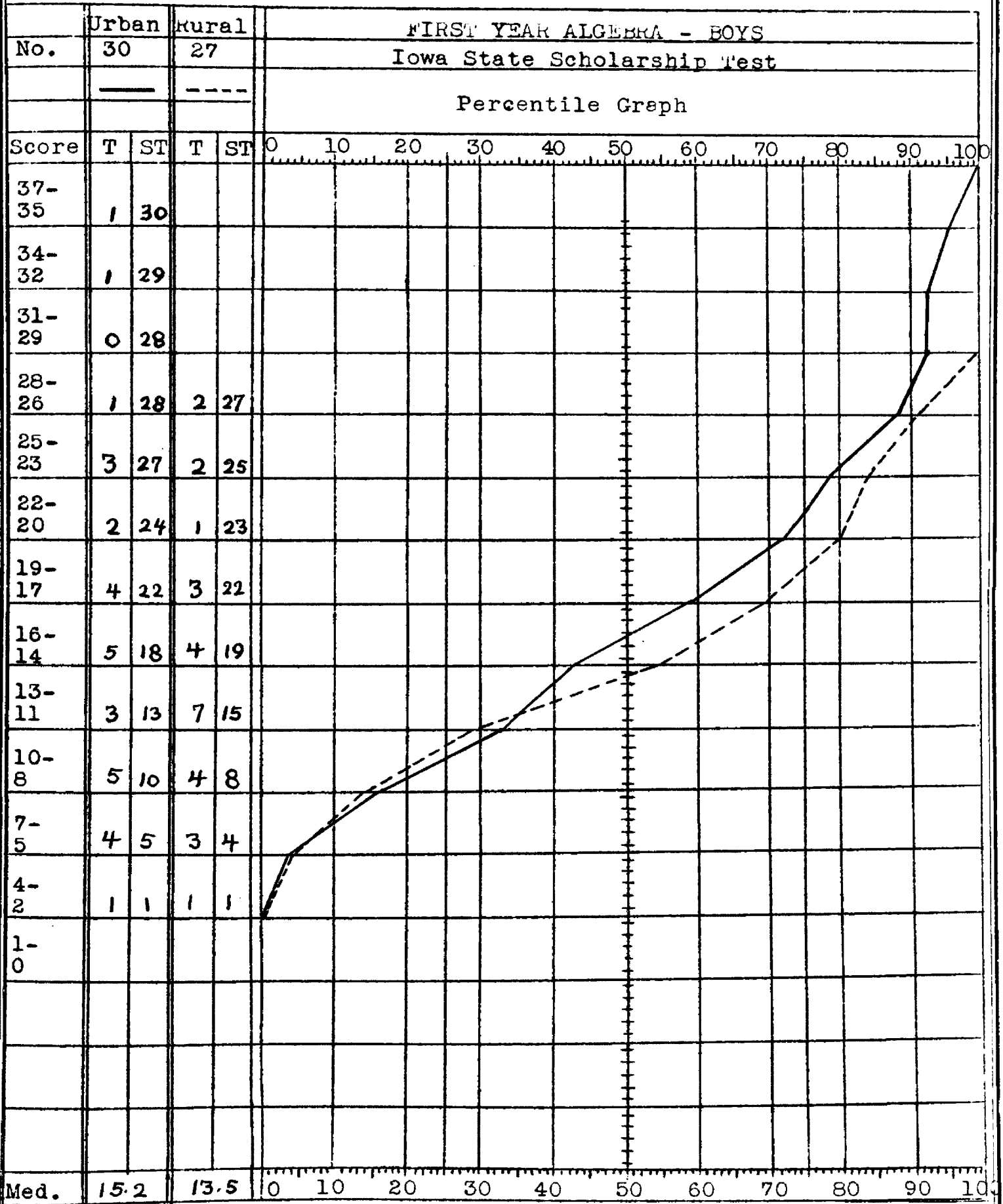
Tables No. 12 and 13 show about the same differences in medians and means of the scores and their grouping about the measures of central tendency for comparisons of the boys' groups and the girls' groups. The boys show a slightly greater difference and the girls a lesser difference, as is shown in Diagrams V and VI. As in the English comparison, the urban boys show more superiority over the rural boys, and the girls from the two groups are more nearly equal. The critical ratio applied to the boys' scores yields .79, indicating, however, that this difference has no significance.

Summarizing, there is not a great deal of difference between the urban and rural groups in their algebra achievement. When statistical procedure is used, this difference becomes so insignificant that there is justification for concluding that urban and rural training have made little difference in algebra achievement in high school for the group studies, and probably would have little bearing on the results of other groups of Montana pupils were tested.

The General Science Comparison. As in the case of algebra, general science was not generally taught in the larger schools where it was elective. The classes were extremely small, and it was generally the rural pupil, who entered the course. The course was required in Manhattan, Three Forks and Willow Creek. It was not taught in Belgrade. About one half of the ninth grade pupils in Breadwater County High School were enrolled in the subject. The number of scores available for the study is not large enough to make the measures of central tendency of much significance or to warrant the computation of measures of reliability. However, this data is included in Table No. 11 for comparative purposes and indicates a trend. Diagram VII shows the difference graphically. The fact that the differences are larger than in any of the other comparisons and are in favor of the rural

DIAGRAM V.

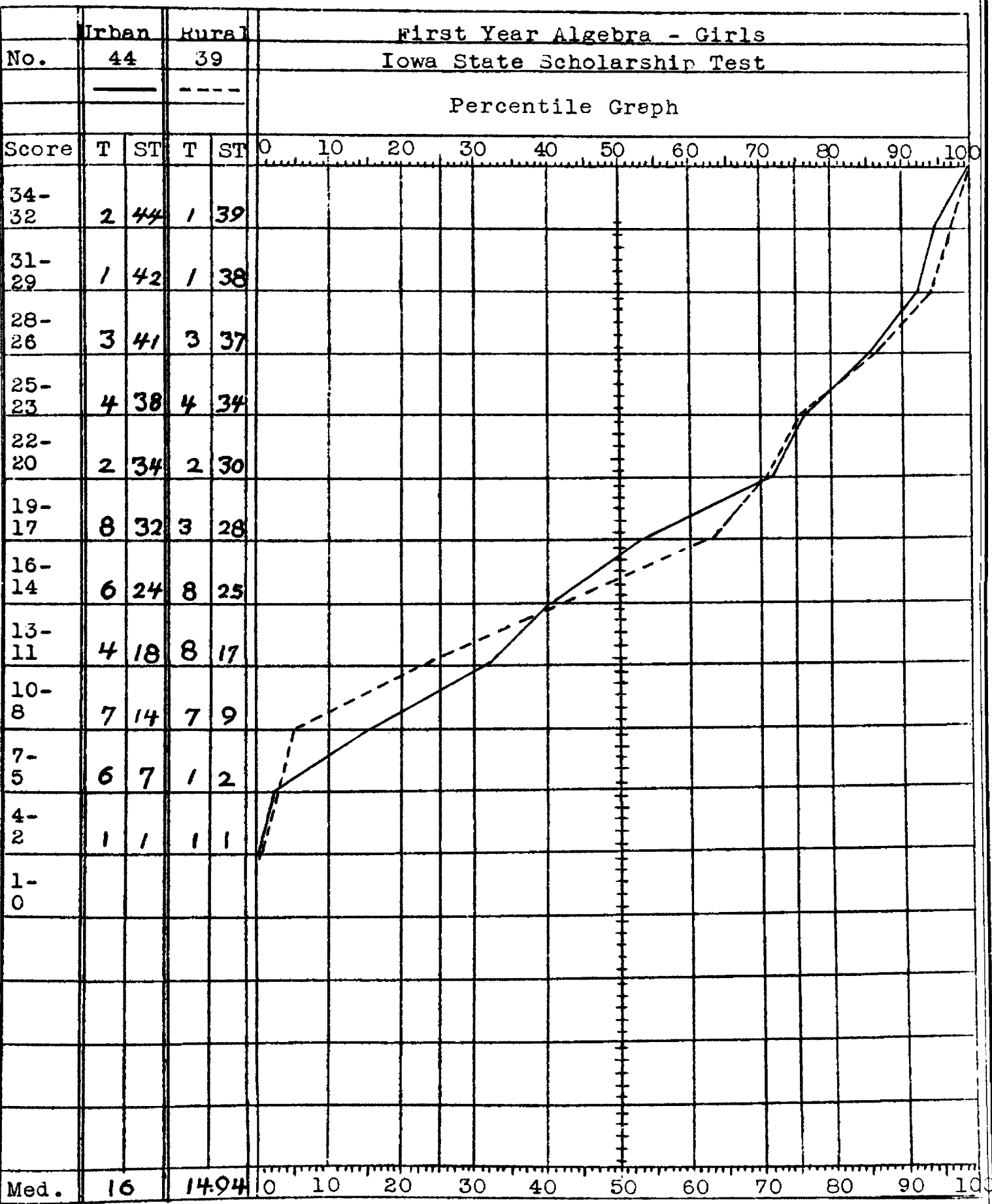
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DIAGRAM VI.

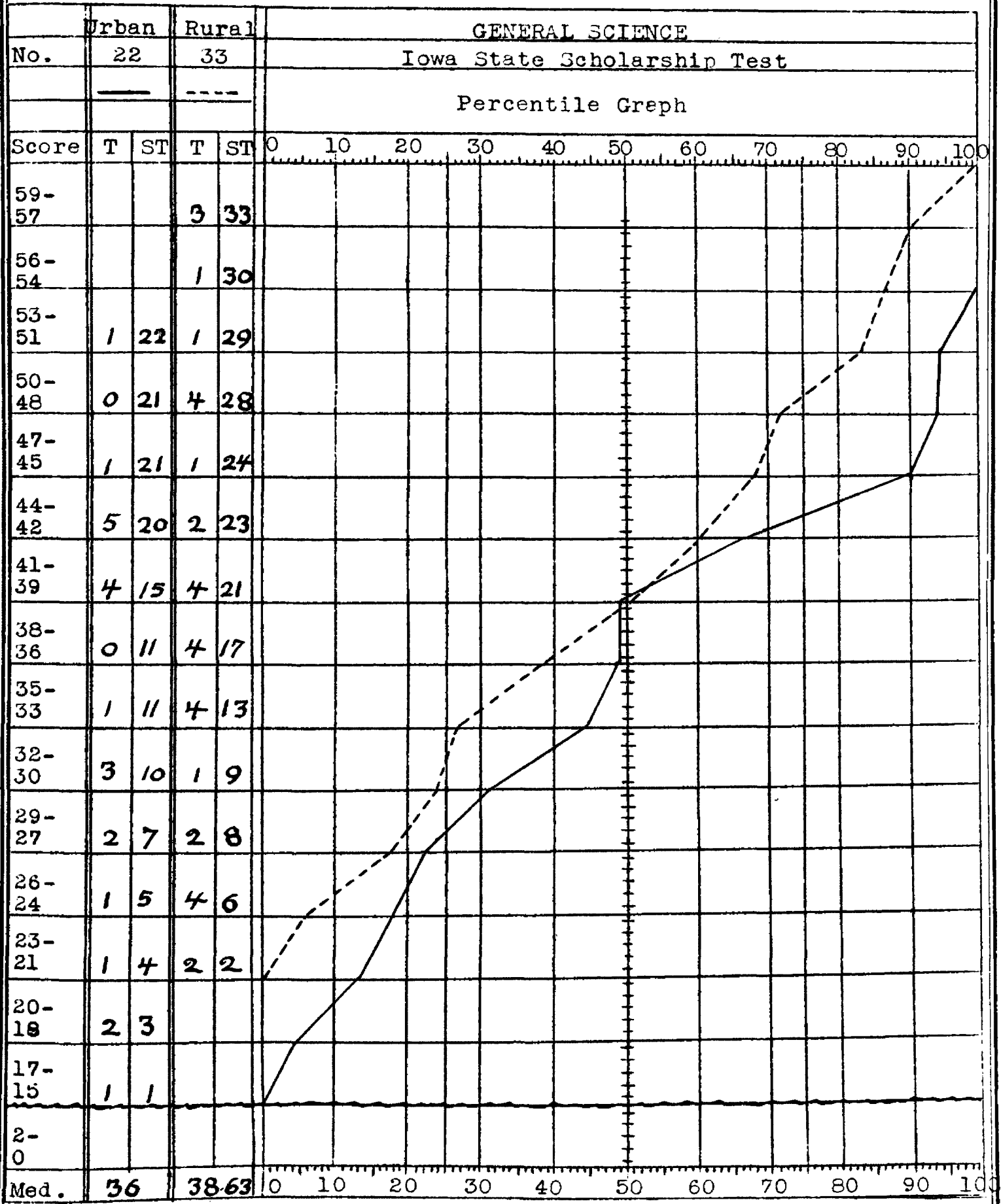
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DIAGRAM VII.

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DIAGRAM VIII.

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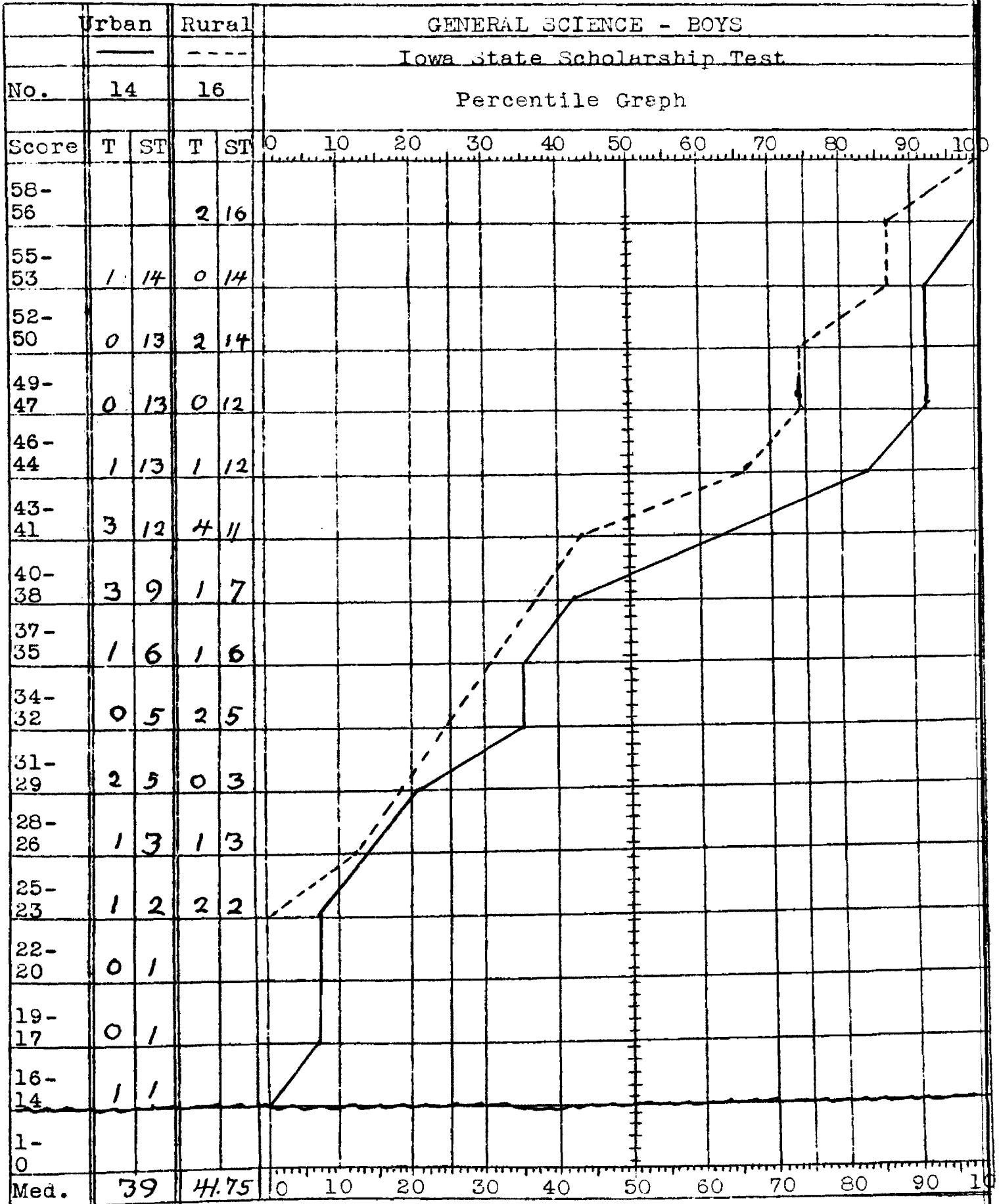
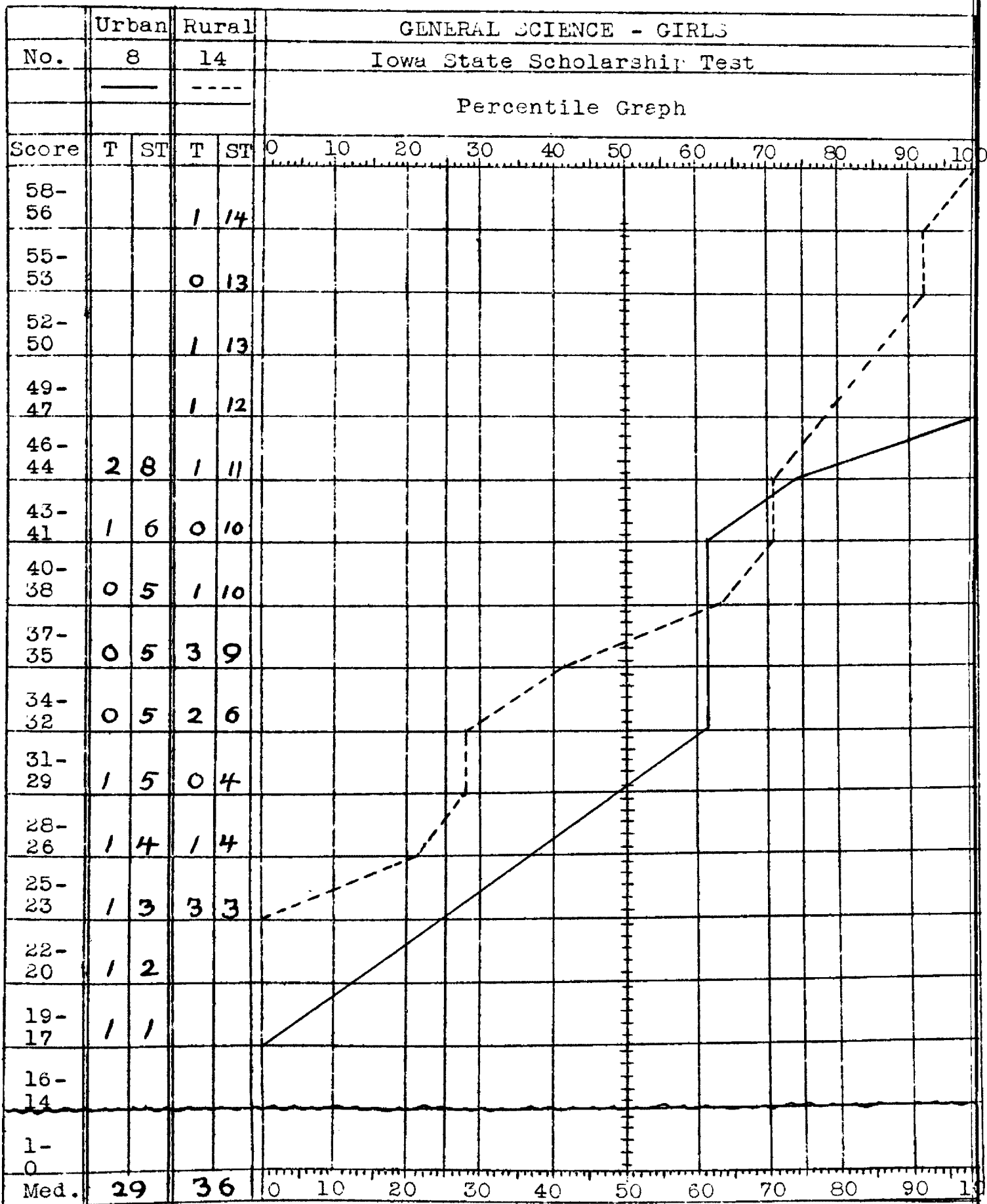


DIAGRAM IX.

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pupils adds some interest.

The highest possible score on the test is 96. The range of urban scores is 53 to 15, that of the rural, 58 to 23. The difference between the means is 4.5 and the difference between the medians is 2.63 in favor of the rural group. The  $\sigma$ 's are 9.79 and 10.7, respectively. The rural group is 97% as variable as the urban, showing that they are about equally grouped about their central measures. The critical ratio yields 1.607, which is too low to admit reliability.

The differences shown between the urban and rural boys and the urban and rural girls, in Tables 12 and 13, indicate a considerable difference in favor of the urban boys but a larger difference in favor of the rural girls. These differences are based on too few cases, however, to have any particular value.

Comparison of the Test Scores of the Boys with Those of the Girls. A comparison of the measures of central tendency and reliability of the scores made by the boys and girls on these tests serves to emphasize the insignificance of the differences found between the urban and rural groups. Table No. 7 contains the data for this comparison. The greatest difference occurs on the English Correctness scores, where there is a difference between the means of 16 and a difference between the medians of 17.24 points in favor of the girls. There is little difference in the scatter of the scores as indicated by the S. D.'s and Q's. By Pearson's formula, the girls are found to be 93% as variable as the boys. The large scattering of the scores, indicated by S. D.'s of the size found, would imply that further testing might place the means considerably above or below the ones obtained. However, the Standard Errors of the average 2.35 and 2.73 place a limit on this divergence from the means found in the study. There are 68 chances in 100

that the true means are  $137.48 \pm 2.33$  and  $121.48 \pm 2.73$  or would lie between 139.81 and 135.15 for the girls and 124.21 and 118.75 for the boys. It is almost certain that the true mean would lie within the limits of the means of the two groups 3 times the  $\sigma$ 's (av.) or between 144.47 and 130.49 for the girls and 129.67 and 113.29 for the boys. The mean of the boys in no case would equal the mean of the girls.

The  $\sigma$  (diff) 3.73 gives further proof that there would always be a true difference between the groups. The true difference in favor of the girls of  $16 \pm 3$  (diff) shows that the true difference would, 99 in 100 times, lie between 27.19 and 4.81. It is thus practically certain that there would always be a considerable difference in favor of the girls. The critical ratio gives the results, 4.29 for the mean and 5.67 for the median, which is great enough in each case to guarantee reliability.

A study of the reliability of the difference between the medians gives even stronger evidence of a significant difference than in the case of the means. Thus it is more evident that the girls exceed the boys in English ability than that there is a significant difference between urban and rural-trained pupils.

The algebra score differences between boys and girls are not so large nor so reliable as was true of English. Table No. 7 shows a difference in means of 1.77 and a difference in medians of 2.05 and a large but similar scatter of scores. Statistical use of the Standard Errors of the means, .846 and 1.00, indicates that it is practically certain that the true mean of the girls would lie between 19.75 and 14.67, and of the boys between 18.44 and 12.44. The critical ratio yields 1.35 for the means and 2.15 for the medians, showing no reliability.



The statistical results of the general science tests, shown in Table 7, indicate a tendency for boys to excel girls in this subject. This bears out the general opinion that boys are more interested in General Science and consequently make better progress in it.

## CHAPTER VI. SUMMARY AND CONCLUSIONS

Summary: This study has been an effort to determine the relative achievement in Freshman High School English, Algebra, and General Science of pupils who have graduated from rural, one-room schools and those from urban graded schools. The testing program was carried out in seven schools, in three counties of Montana. Of the 555 ninth grade pupils in these schools, 232 were paired on a basis of intelligence quotients, chronological age, sex, and urban and rural grade training, and comparison<sup>was</sup> made of their scores on tests in the three subjects. The average intelligence of the urban and that of the rural group was exactly the same; there was a difference in medians of .28. The rural group was an average of 1.3/4 months older, with a difference in medians of 2 months.

Both the difference in means and the difference in medians of the three subjects were compared. The mean takes more cognizance of the extreme scores, but, since the pupils of the two groups were paired into relatively equal groups, these extremes may have some significance.

A difference between the means of 3.7 in favor of the urban pupils was found in the English Correctness test scores, but the median showed .62 points in favor of the rural group. The total possible score was 232. The urban pupils excelled in algebra by a difference in means of .49 and a difference in medians of 1.49, and the total possible score was 53. In General Science, where the total possible score was 96, the rural pupils excelled by a difference in averages of 4.5 and a difference in medians of 2.63. None of these differences was very large and measures of reliability indicated that they had little significance. A comparison of the scores of the boys with those made by the girls indicated a larger and much more significant difference, especially in English, where the difference in means was 16.

Use was made of the critical ratios,  $\frac{D}{\sigma(\text{diff})}$  and  $\frac{D}{\text{P.E.}(\text{diff})}$ . The

results indicated that, if other groups of equated pupils were examined, in about 8 out of 10 times, any difference in averages found in the English scores of the two groups would be in favor of the urban pupils.

If further groups of algebra pupils were examined, the chances are about even that the rural group would excel as often as the urban.

The number of General Science scores that were compared was not large but the results indicated that further testing would find the rural pupils superior in 8 or 9 times out of 10.

There was no evidence found to indicate that any differences which might be obtained by further testing would be large differences.

Conclusions for the Groups Studied: There were 232 pupils of the three counties paired and studied. It may be concluded that, so far as ninth grade English is concerned, in these counties, more of the extremely high scores were made by the rural pupils and more of the extremely low scores were made by the rural pupils. This was particularly true of the boys. However, generally speaking, and ignoring the extreme scores, the two groups were about equal, with the same number of good, average, and poor pupils in each. If any difference existed, when the extreme scores were ignored, there were more good and average pupils in the rural group than in the urban. When the boys, alone, were compared, the urban boys not only made the highest scores, but there were more good and average pupils among them than in the rural group. The extent to which environment and lack of interest may have entered into this inferiority of the rural boys is problematical.

There were extremely good scores made in algebra by either group, and about an equal number of extremely poor scores. There were a few more good and average pupils in the urban classification than in the rural.

In General Science, the rural pupils showed more definite superiority than existed in either of the other two subjects. They not only made the highest extreme scores but quite generally excelled the urban pupils. There is

little question that their farm experience and interests had considerable bearing on these results.

As far as preparation for functions tested in this study is concerned, the rural schools of Fergus, Gallatin, and Broadwater Counties are apparently on a par with the urban schools. There is certainly no justification for schoolmen to feel that either one group or the other is superior.

The Broader Implications of the Study: The seven schools included in this study are fairly representative of the schools of the state. The extremely small school, the average size, and the larger school are represented. The schools are more representative of the agricultural regions, where the pupils are drawn from the farms, the small industries, and commercial groups, than of industrial and mining centers. There are comparatively few schools in Montana, however, that truly belong to the latter group. This study should be a limited but fair sampling of Montana's schools.

Keeping in mind the limitations of the study, general conclusions for the state might be made. Pupils with equal intellectual ability will not differ greatly in high-school achievement whether they have graduated from urban, one-room schools, or from the larger village or city grade schools. The urban pupils might show a small superiority in some fields, but not consistently enough to indicate undisputed excellence. There is an indication that rural pupils make a superior showing in General Science, but more extensive testing would be needed to prove this.

Reinoehl's study,<sup>62</sup> made in 1921, in the grade schools, was more representative. He concluded that the urban pupils were definitely superior. However, his assumption of equal intelligence on the part of the urban and

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62. Reinoehl, op. cit., p. 826.

rural pupils was without factual basis, and the difference in the medians, in many cases, were extremely small. Furthermore, requirements for qualifications of grade teachers have been raised since that time, and present day rural teachers are better qualified.

Would it not be well to keep an open mind as to the relative superiority of the urban-trained and rural-trained pupils of the country until continued study, which gives due consideration to all factors, gives us conclusive evidence?

Significant Questions: A study of this nature gives rise to questions which may have a considerable significance. In the first place, there might be questions raised from the standpoint of research in the field of measurement of the achievement of rural and consolidated school pupils. A review of this field has indicated that a majority of the studies have concluded that the urban or consolidated school pupils are definitely superior in scholastic achievement, and have attached considerable significance to these findings. The results of this study are at variance with this majority. The chief differences in the procedure of this study from that of many of the others, seems to have been the use of groups equated on the bases of intelligence, chronological age, and sex, and the evaluation of the results by statistical procedure. Many of the studies have been of the survey type and have dealt with large numbers of pupils.

The questions then arise: Are the differences in results due to the difference in procedure? Would the equating of the groups tested in these other studies and statistical evaluation of the results have changed the data derived from them? Or would the application of these methods to a larger field than that of the present study reverse the findings, and show different results from those obtained in this study? Is the situation in

Montana rural and urban schools different than in other sections of the country?

If the schools that took part in this study are typical of Montana schools, in general, there would be a number of questions arise that would have state-wide significance.

1. Should we expect superiority of achievement from the pupils who have been trained in the larger urban schools?

2. This study has indicated that there is little or no difference in achievement in the fields of English Correctness, Algebra, and General Science, as measured by certain objective tests. Would testing in other school subjects return similar results?

These questions have some similarity to several of the questions raised by John M. Foote and his N.E.A. committee at the conclusion of a study of the same problem on a nationwide basis,<sup>63</sup> and should warrant serious consideration.

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63. See Appendix, p. XL.

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## APPENDIX

May 4, 1936.

To the person administering the Achievement Tests:

Please arrange to give these tests this week. All of the schools involved in the study are to give the tests this week.

Kindly follow the directions for giving the tests, exactly and do not change the minutest detail of the procedure. This is important, in order to eliminate as much possible error, as can be done, in the statistical work for which these test results will be used.

There are keys included in each package of tests. You may score these tests if you wish to learn the test results, immediately. Or you may return the completed tests and the keys to me. In either case, all tests should be returned to me as soon as possible. Kindly send them by express, collect.

Results of the tests and data from Iowa State University, containing norms will be sent you at an early date.

PLEASE ARRANGE TO GIVE ALL THE TESTS IN EACH SUBJECT TO ALL PUPILS TAKING IT, DURING THE SAME PERIOD. If it is impossible to do this, be sure to indicate on the first page of the test, all of the tests given at a later period.

Thanking you for your cooperation, I am

Very truly yours,

## THE 1936 IOWA EVERY-PUPIL TEST IN ENGLISH CORRECTNESS

*MANUAL OF DIRECTIONS*

A sixty-five minute period should be provided for this test. Five minutes at least will be required for distributing and collecting the test booklets and for filling in the blanks on the first page of the test, and another five minutes for working out the sample exercise on the back page, and fifty minutes must be allowed for actual working time.

The pupils should be told in advance to bring to class two sharpened pencils. The examiner should also have a few on hand.

Arrange the pupils in alternate seats if possible. In any event, careful surveillance is necessary throughout the examination. There should always be one proctor for every thirty pupils, and these proctors should circulate freely about the room throughout the examination.

## ADMINISTERING THE TEST:

- 1) To administer the test, begin by saying,

*"We shall now pass out the test booklets. As soon as you receive one you may begin filling the blanks at the upper part of the first page, giving your name, grade, etc."*

- 2) When the test booklets have been distributed and the pupils have been allowed a minute or two for filling the blanks, say,

*"Now open the test and lay it before you so that both the title page and the back page are up." (Show the pupils how to do this.) "The directions on the title page must be read in connection with the sample exercise on the back page. Read these directions very carefully, then study the lines in the sample exercise that have been properly corrected, and then correct the remaining lines in the sample exercise according to the directions. When you have corrected the sample exercise, I will check it with you to make sure that you all understand exactly what to do. Now go ahead and read the directions and complete the sample exercise. Do not turn to any of the inside pages of the test."*

- 3) When the majority of the pupils have finished the sample exercise (do not wait for the slowest pupils to finish), say,

*"Now stop working on the sample exercise, and we will check over what you have done."*

*"In line 5, the adjective 'sure' is incorrectly used as an adverb. You should have corrected this error by writing the word 'surely' in the rectangle. Remember that in errors of this kind you are to give the proper form of the same word that is given in the sentence. Do not change it to an entirely different word."*

*"No comma is needed after the word 'home,' so you should have drawn a straight line through that comma."*

*"The interrogative sentence, 'Why should we tell our mothers,' requires a question mark instead of a period. You should have drawn a line through the period and written a question mark beside it."*

*"In line 6, the use of 'ain't' is incorrect. You should have written the word 'isn't' in the rectangle. Remember that you are not to correct errors in contractions by writing two words in the rectangle. In this case, for instance, you would not receive credit for writing 'is not' in the rectangle."*

*"The word 'people,' in the last line, is misspelled, so you should have written the correct spelling--'p-e-o-p-l-e'--in the rectangle."*

*"The word 'plan' should not be capitalized here, so you should have drawn a straight line through the letter 'P.'"*

*"The word 'secret' is correctly spelled already. You should, therefore, have written a zero in the rectangle above it."*

*"Now does everyone understand just how to correct the errors in this test?"*

- 4) Pause to answer any reasonable questions. Then say,


*"You will be allowed fifty minutes in which to complete the whole test. You may go on from page to page whenever you are ready without waiting for any signal. Work as rapidly as you can, but do not become careless. Now open the test to page 2 and begin work."*

Note the exact time carefully and write it down. Answer no questions and permit no interruptions after work is begun.

- (5) At the end of exactly fifty minutes from the time the pupils were told to begin work, say, "Stop!" and have the papers collected at once. Make sure that all test booklets are accounted for.

#### SCORING THE TESTS:

A stencil key for scoring this test has been provided. To use this key most effectively, follow the directions below very carefully.

- (1) Work on a large table or desk surface.
- (2) Place all of the tests that you are to score in a pile at your right.
- (3) Take the top paper from the pile, open it to pages 2 and 3, and lay it on the table in front of you.
- (4) Pick up the key for pages 2 and 3, and adjust it on the paper so that the guide marks  on page 2 of the paper appear exactly centered through the guide holes in the left half of the key. (In scoring page 3, the key may require a slight readjustment in order to center the guide holes of the key exactly over the guide marks on that page of the paper.)
- (5) Through each opening in the key, compare the pupil's correction with the correction that is printed above the rectangle or beside the hole in the key. If the pupil's correction corresponds with that on the key, place a small heavy check mark on the pupil's paper through the opening. A soft colored pencil should preferably be used for this purpose, so that the check marks may be readily counted.

If a zero has been printed above a rectangle, this means that the word under the rectangle of the test was correct as given. The pupil should receive credit in such cases only if he has placed a zero in the rectangle.

If a zero has been printed beside a hole in the scoring key, this means that there is no error in the test at this point, and that the pupil should have made no correction. (The purpose of providing holes in the key at these correct points is to check against superfluous punctuation and other superfluous corrections on the part of the pupil.) Through each such hole, place a check mark on the paper only if the pupil has made no correction; if any marks at all appear through the hole do not give credit.

Follow the arrows on the key in checking, to make sure that you do not overlook any holes or rectangles.

- (6) When all error situations on pages 2 and 3 have been checked, before lifting the key count the check marks appearing through the holes and rectangles. Again follow the arrow, to make sure all check marks are counted. The total number of check marks will be the score on pages 2 and 3. Enter this score on the pupil's paper through the window in the lower right-hand corner of the key. (The possible score on pages 2 and 3 is 79.)

Note: After you have scored a few papers, you may find it possible to count the check marks as you make them instead of making the check marks first and then going back over the paper to count them. There is, of course, greater danger of error if you follow this procedure, and the scoring should not be done this way unless you are sure that you can do it accurately.

- (7) When pages 2 and 3 of the first paper have been scored, lay the paper to your left, leaving it open at pages 2 and 3. Score pages 2 and 3 of the remaining papers in the same fashion, laying them on the pile at your left as you finish them and leaving them open at pages 2 and 3.
- (8) Lay aside the key for pages 2 and 3, and take up the key for pages 4 and 5. Score pages 4 and 5 on all papers in the same fashion that you scored pages 2 and 3. Before lifting the key from each paper, count the number of check marks on pages 4 and 5, and enter the score on these two pages through the window in the lower right-hand corner of the key. (Notice that you are to enter only the score of these two pages. You are not to enter the cumulative score, including that on the preceding pages as is done in scoring most of the Every-Pupil tests.)
- (9) As each paper is scored, lay it aside on a pile at your right, leaving it open at pages 4 and 5.
- (10) When pages 4 and 5 have been scored on all papers, lay aside the key for those pages, pick up the key for pages 6 and 7, and score these pages on all papers in the same manner as before.
- (11) Transpose the scores on pages 2 and 3, 4 and 5, 6 and 7 to the appropriate blanks on the title page of each paper. Add these scores to secure the total score. Check the addition very carefully of each paper. Experience in previous testing programs has shown that a very large proportion of the more serious errors in scoring consists of errors made in addition at this point.

## THE 1936 IOWA EVERY-PUPIL TEST

IN

## ENGLISH CORRECTNESS

Score

Score on Pages 2 and 3	
Score on Pages 4 and 5	
Score on Pages 6 and 7	
Total	

By:

M. F. CARPENTER

Associate Professor of English, State University of Iowa  
and Head of English, University High School

Do not open this booklet, or turn it over, until you are told to do so. First fill these blanks, then read carefully the directions below. Write plainly.

NAME: \_\_\_\_\_ Age last birthday: \_\_\_\_\_ years  
(Last name first name initial)

Grade: \_\_\_\_\_ School: \_\_\_\_\_ City: \_\_\_\_\_

Name of your teacher in this subject: \_\_\_\_\_

DIRECTIONS: This test consists of three short themes, such as might have been written by a high school pupil, in which are included a large number of errors in spelling, capitalization, punctuation and usage. You are to find these errors and correct them as follows:

- (1) Wherever you find an error in *punctuation*, correct it in the sentence itself. If a punctuation mark has been omitted, *but it in where it belongs*. If a *wrong* punctuation mark has been used, *cross it out by drawing a vertical line through it* and put the *correct* punctuation mark *beside* it. Study the sample exercise on the back page to see how this is done. Always *cross out* a wrong punctuation mark, do not try to make the correct mark out of it. For example, if you find a period where there should be a comma, *do not* make a comma out of the period, but *cross out* the period and place a comma beside it. (Errors in the use of the apostrophe are to be corrected in the same way as errors in punctuation.)
- (2) Wherever you find a mistake in *capitalization*, (if you find a capital letter which does not belong, or if you find a letter that *should* be a capital but is not), *draw a heavy vertical line through the letter* in which the error occurs. Study the sample exercise for illustrations of such corrections.
- (3) Errors in spelling and grammatical usage will be found only in *underlined* words. If there is an *s* under an underlined word it means that you are to decide whether or not the word is correctly spelled. If there is a *u* under a word it means that you are to decide whether or not the word represents correct usage. *Not all* underlined words are incorrect. If you think the underlined part of a sentence is *not correct*, write the correct word or words in the rectangle *above* it. If you think the underlined part of the sentence is *already correct*, write a *zero* (0) in the rectangle above it.

Do *not* write in any rectangle *any more words than are needed* to take the place of the underlined words below it. Do not change contractions to two words.

In cases where the wrong form of a word has been used, write in the rectangle the proper form of the *same* word; do not change it to an entirely different word.

(Do not turn this page until you are told to do so.)

My Friend is a Missionary to the Indians



In the Seventeenth Century, in a sleepy quiet villag

in Normandy, lived a young priest in charge of the parris

Church. Meek humilaty and gentle kindness were his chei

characeristics. He had longed, however when in attendenc

at university to be one of those, sent to foreign lands

Because of his frail health, his superiors wouldn't leave hi

go. That age like our's, had it's share of dissappointments

The young Norman clergyman's thoughts run often on a frien

a dear comrad of the days' spent in colledge. This frien

a jesuit father was doing the work the man in Normandy ha

wished for himself. The later never

ight without praying for the absent one. Often the people

of the little country place, heard their pastor refer to

his friend. "Think of my friend in the American wilderness,"

as a frequent exclamation in the young Father's sermons to

his flock, "What if he burst suddenly in on me uninspired

Christians here. He would be like a spirit sent from above.

As the winter sun was setting one bitterly, cold evening;

man come to the pastor's door a man whose face was scared

by the fiery torments of the savages. One don't need to no

much of indian torture to imagin his really awful face.

After an instants time had passed the pastor reconized him.

"In god's eyes its the face of an angel," he said piously.

on to the next page.) Score on pages 2 and 3



[redacted]  
The Conclusion of many Days' Labor

I have just finished reading about a lengthy sceintif [redacted]

[redacted] research in which niether time nor effort were spared.

[redacted] a sence, it begun back in new testament times. Something

[redacted] said there about us having the hairs of our head's numbered

[redacted] I can clearly recollect reading the passage for it puzzled

[redacted] quiet a little as a child to descide why anybody should wa

[redacted] to have their hairs numbered. Evidentially some people wa

[redacted] it now and some one has took the time to gratify the wis

[redacted] Furthermore he must have found a lot of money just lying



[redacted] bout waiting quietly, for some one, who was anxious to t

queer wild foolish unusual ways, to spee [redacted] of the real



[redacted] o's money it was is a mystery to me; there was nothing in

[redacted] e artical about its owner or source. Nevertheless, enough

ney was found to hire people, to count every, single hair,

a number of person's heads. It was demanstrated that a

onde is different from a Brunette in both quantity and qual-

y of hair, I own that it don't in any way supprize me to

arn this, I suspected it. The idea had laid around in my

nd so to speak. These kind of bright ideas must be always

side my mind, used as you know it is, for stern hard vigor-

s thinking. I'll bet that I shine in subjects like Physics,

d Chemistry. I'll admit that I don't see any way of using

e knowledge, but isn't Nature and Science wonderful.

(Go right on to the next page.)

Score on  
pages 4 and 5



## And what Would You Have Said

Napoleon and Czar Alexander of Russia, who the great  
 emperor hoped would turn from an enemy to a friend, was en-  
 gaged in a mutuel admiration society. Officially, it wa-  
 called a peace conference but it had soon begun to develop  
 into the instution just mentioned. There's little doubt, the  
 Alexander a very unstable fickle Monarch had a most since  
regard for Napoleon, whom he thought was marvelous as  
 soldier, and a statesman. Peoples' minds are easily swayed  
 by success. Few men reallize that todays triumph may mea-  
 tomorrows fearful disaster. Napoleon always a shrewd manag-



of men used every device trick and sch

to

Alexander. Backed by Russia, Napoleon might revenge himself,

or the battle of Trafalgar where lord Nelson had broke the

power of the French fleet. Part of Napoleons plan, was to

have varous regiments shown to Alexander. Complements and

the speeches was to be exchanged in the coarse of the show-

ing. The Russians, they had beat in battle would receive all

the praise that was due them. Occassionally the Frenchmens'

own lips, would praise their foes'. Now and then, however a

soldier could not of been properly coached, I know of one,

who growled in responce to some enthusastic remark of Napo-

sons about Russian soldiers, "There all dead now you know.

I wonder what either of the emperors was able to say?

ght on to the next page.) Score on pages 6 and 7

**DIRECTIONS:** Lines 1-4 of the sample exercise have been properly corrected. Study them carefully to make sure you understand what to do; then make necessary corrections in the remaining lines in the sample. When you have finished the sample, your teacher will check with you to see if you have followed the directions properly.

### SAMPLE EXERCISE

- (1) The day seemed fine for skateing. It was
- (2) clear and cold. Jack and I both had bright new
- (3) ice skates, and we were anxious to try them. The
- (4) river wasn't far from school. If we went early, we
- (5) could sure reach home, before dinner. Why should
- (6) we tell our mothers. It ain't right to make
- (7) people worry. So we kept our Plan a secret.

(Do not open this booklet until told to do so.)

## THE 1936 IOWA EVERY-PUPIL TEST IN NINTH YEAR ALGEBRA

**MANUAL OF DIRECTIONS**

A sixty-five minute period should be provided for each test. Five minutes at least will be required for distributing and collecting test booklets and for filling in blanks on the first page of the test, and sixty minutes must be allowed for actual working time.

The pupils should be told in advance to bring to class two sharpened pencils and some scratch paper. The examiner should also have a supply of paper and pencils on hand.

Arrange the pupils in alternate seats if possible. In any event, careful surveillance is necessary throughout the examination. There should always be one proctor for every thirty pupils, and these proctors should circulate freely about the room throughout the examination.

**ADMINISTERING THE TEST:**

- (1) To administer the test, begin by saying,

*"I shall now pass out the test booklets. As soon as you receive one you may begin filling the blanks at the upper part of the first page, giving your name, grade, etc. When you have filled in these blanks, read carefully the directions that are given on the first page. Do not open the test booklet until I tell you to do so."*

- (2) When all of the test booklets have been distributed and the pupils have been allowed two or three minutes for filling the blanks and reading the directions, say,

*(Read slowly) "This test consists of three parts, but as soon as you finish Part I you may go right on with Part II. You will be given exactly sixty minutes for the whole test. Not over twenty minutes should be required for Part I. At the end of that time I will tell you to go on to Part II, although you may do so earlier if you finish Part I before the twenty minutes are up. If you finish the test before the sixty minutes are up, look over your whole paper and correct errors or fill in omissions, then remain quietly at your seat until the period is up."*

*"You are not to ask any questions after work has begun. If you have any questions concerning the procedure, ask them now."*

- (3) Pause here to answer any reasonable questions that may be raised by the pupils. Then say,

*"You may now turn the first page and begin work on the test."*

Note the exact time carefully and write it down. Answer no questions and permit no interruptions after work has begun.

- (4) At the end of exactly twenty minutes from the time the pupils were told to begin work, say,

*"Even though you have not finished Part I, stop working on it and go on immediately to Part II."*

- (5) At the end of exactly twenty minutes more (forty minutes from the beginning) say,

*"Even though you have not finished Part II, stop working on it and go on immediately to Part III."*

- (6) At the end of exactly twenty minutes more (sixty minutes from the beginning) say, "Stop!" and have the papers collected at once. Make sure that all test booklets are accounted for.

**SCORING THE TEST:**

A key containing the right answers to the test questions has been provided with the test. The key is arranged so that it may be cut up into strips with the correct answers for one page on each side of a strip. The answers are arranged on the strips so that they may be brought adjacent to the responses on the test.

To score the test, lay the proper edge of the appropriate strip alongside the pupil's responses and, using a colored pencil, draw a horizontal line through the number of each item that has been answered correctly. Draw a cross (X) through the number of each item that has been answered incorrectly, and draw a circle around the number of each item that has been omitted. (It is important that these directions for marking papers be carefully observed in order to facilitate the analysis of the tests that will be made later in Iowa City.)

In scoring the tests, follow the scoring key very rigidly. Even though you may in some cases not agree exactly with the answers provided in the key, follow them nevertheless. If you allow your personal opinion to enter at all into the scoring of the tests, it is not likely that results will be comparable to those secured from other schools. No answer should be marked as correct, therefore, unless it corresponds exactly with that provided in the scoring key. An attempt has been made, in preparing the key, to anticipate all correct forms of each answer. For some items, therefore, several forms of the answer are given, any one of which is correct. In spite of these precautions, however, it may happen in very rare instances that the pupil has hit upon some other form of the answer, exactly equivalent to that given in the key. Such answers must be marked correct. Algebraic equivalence however, should be very rigidly interpreted. In general, an answer that is correct will differ from that given in the key only in the order of the terms.

The score on this test is simply the number of correct answers. Enter the score for each part in the blank space provided on the first page of the test booklet and find the total score.

In order to insure accuracy, each paper should be scored twice, and the copying and adding of the scores should be checked, since it is very difficult to avoid making one or two mistakes in the scoring of a paper. If a large number of papers are to be scored, it may be found convenient to have one scorer score pages two and three, another score pages four and five, a third pages six and seven, and a fourth page eight.

## THE 1936 IOWA EVERY-PUPIL TEST

IN

## NINTH YEAR ALGEBRA

HAROLD LUNDHOLM

Instructor in Mathematics  
The Blake School  
Minneapolis, Minnesota

Score

Part I	
Part II	
Part III	
Total	

Edited and approved by the Department of Mathematics  
of the State University of Iowa

Do not open this booklet, or turn it over, until you are told to do so. First fill these blanks, then read carefully the directions below. Write plainly.

NAME: \_\_\_\_\_ Age last birthday: \_\_\_\_\_ years  
(Last name first name initial)

Grade: \_\_\_\_\_ School: \_\_\_\_\_ City: \_\_\_\_\_

Name of your teacher in this subject: \_\_\_\_\_

**DIRECTIONS:** This test consists of three parts. You will be allowed twenty minutes for each part, making a total of sixty minutes for the whole test. If you finish one part before the time is up for that part, you may go on to the next part without waiting for the signal.

Each part of the test should contain plenty of work to keep you busy during the time allowed, and you may not be able to complete all of the exercises before time is called. You will therefore be most likely to make a high score if you do not linger too long over difficult items, but pass on instead to those that are easier.

The directions for each part will be found at the beginning of the part. Read these directions very carefully before beginning work.

Any figuring that may be required in solving any of the problems should be done on a separate sheet of scratch paper. Only the answers to the exercises should be written on the test paper itself, in the rectangles provided for them.

Your teacher will answer no questions and will permit no interruptions after work has begun. If you have any questions, ask them now.

(Do not turn this page until you are told to do so.)

Fundamental Processes

DIRECTIONS: Write your answers in simplest form in the rectangles.

1. Solve for  $d$ :  $fd = w$ .

2. If  $x = 2$ , what is the value of  $3x^3$ ?

3. Solve for  $x$ :  $2x - 3 = 8$ .

4. If  $x = 3$ , and  $y = -2$ , find the value of  $2x^2 - y^3$ .

5. Solve for  $R$ :  $N = \frac{R}{A}$

6. Subtract  $2b - 4c + 3d$  from the sum of  $3a - 5b - c$  and  $2a + 7b - 3c$ .

7. Find the value of  $x$ :  $8x - 3(2x - 1) + 7 = 20 - 3x$ .

8. Reduce to lowest terms:  $\frac{a^2 - 4}{a^2 - 5a + 6}$

9. Divide  $6x^4y^6$  by  $3x^2x^2$ .

10. What is the lowest common denominator that should be used in adding three fractions whose denominators are  $8ax$ ,  $6a^2$ , and  $12x^3$ ?

11. If  $C = \frac{5}{9}(F - 32)$ , find the value of  $F$  when  $C$  is 10.

(Go right on to the next page.)



2. Simplify the following expression:  $\frac{(x+a)(x-a)-(x-a)^2}{2a}$  (12)

3. Multiply  $x^2 + 2x - 3$  by  $x - 2$ . (13)

4.  $m = ax - b$ . Solve for  $x$  in terms of  $a$ ,  $b$ , and  $m$ .  $x =$  (14)

5. Reduce the following mixed expression to one fraction in its simplest form:  $x + n - \frac{x^2 - 2n^2}{x - n}$  (15)

6. What is the ratio of  $\frac{4x}{5}$  to  $\frac{2x^2}{5}$ ? (16)

7. If  $h = \frac{V^2}{2g}$ , find the positive value of  $V$  when  $h$  is 36 and  $g$  is 32.  $V =$  (17)

8. Simplify:  $\left(\frac{2x}{3} - 1\right) \cdot \frac{6}{4x^2 - 9}$ . (18)

9. Solve for the unknowns:  $2a - 3b = 13$   
 $5a + 2b = 4$   $a =$  ,  $b =$  (19)

10. Using the value  $\sqrt{3} = 1.7$ , find the value of  $\sqrt{12} + \sqrt{27}$ . (20)

11.  $S = \frac{W_2}{W_2 - W_3}$ . Write a formula for  $W_2$  in terms of  $S$  and  $W_3$ .  $W_2 =$  (21)

12. Find the two roots of the equation  $2b^2 - 4b = 16$ .  $b =$  and (22)

13. Solve for  $m$ :  $\frac{4m+1}{4} - \frac{m+1}{m-1} - \frac{2m-1}{2} = 0$ .  $m =$  (23)

(Go right on to the next page.)

Score on Part I \_\_\_\_\_

## Algebraic Relations and Representations

**DIRECTIONS:** Read each problem carefully. Write your answers IN SIMPLEST FORM in the rectangular boxes.

1. Write the sum of the squares of two numbers,  $a$  and  $b$ .

2. The larger of two positive numbers is equal to the square of the smaller diminished by 2. What is the larger number if the smaller is  $k$ ?

3. What is the quotient obtained by dividing the product of  $2a$  and  $3m$  by  $7w$ ?

4. The length of a rectangle is  $m$  feet more than its width. Represent the width by  $w$  and write a formula for the area ( $A$ ) of the rectangle in terms of  $m$  and  $w$ .

5. What must be the value of  $N$  if the two ratios  $\frac{N}{3}$  and  $\frac{2}{5}$  are equal in value?

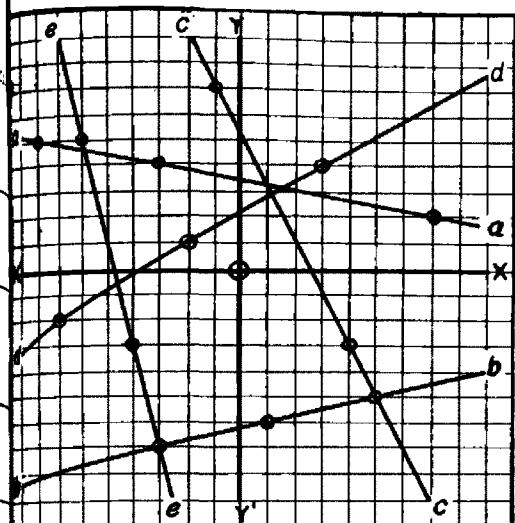
6. What trinomial has  $2x + y$  as one of its two equal factors?

7. Two monomials are in the ratio of 3 to 4 and their sum is  $28ab$ . What is the larger of the two numbers?

8. On January 1, John Doe had  $D$  dollars in his savings account. He decided to deposit  $x$  dollars regularly at the end of each month. Write the formula which should show the total amount ( $A$ ) of his savings after  $m$  months.

(Go right on to the next page.)

Answer questions 9, 10, and 11 by referring to the graph below.



9. Which of the lines ( $a$ ,  $b$ ,  $c$ ,  $d$ , or  $e$ ) passes through the point whose coordinates are  $(4, -3)$ ?

 (9)

10. Which of the lines ( $a$ ,  $b$ ,  $c$ ,  $d$ , or  $e$ ) is the graph of the equation:  
 $x - 4y = 25$ ?

 (10)

11. What is the value of  $k$  if  $y + kx = 5$  is the equation of line  $c$ ?

  $k =$  (11)

12. The expression  $\frac{a}{a-b}$  may be changed into a fraction whose denominator is  $a^2 - b^2$ . What is the numerator of this fraction?

 (12)

13. The sum ( $S$ ) of a number of consecutive odd integers, beginning with 1, is given by the formula  $S = k^2$  where  $k$  is the number of integers added. Using this principle, find how many consecutive odd integers must be added in order to obtain a sum of 400?

 (13)

14.  $A$  varies inversely as  $B$ , and  $A$  is 16 when  $B$  is 3. What is the value of  $A$  when  $B$  is 8?

  $A =$  (14)

15. Suppose that  $x$  is  $r$  per cent of  $P$ . Write a formula for  $P$  in terms of  $r$  and  $x$ .

  $P =$  (15)

(Go right on to the next page.)

16. The volume of a pyramid may be found by taking one-third the product of its base area and its height. What is the volume ( $V$ ) of a pyramid whose height is  $h$  inches and whose base is a rectangle  $3x$  inches long and  $2x$  inches wide?

$V =$  cu. in.

17. By what expression must  $4x + 1$  be divided in order to obtain a quotient of 2 and a remainder of 3?

18. For what value of  $x$  is the expression  $a^2 - \frac{ax}{3}$  equal to zero?

$x =$

19. A train travels at the rate of 30 miles per hour. How many minutes will it take this train to travel  $m$  miles?

min.

20. The areas of two circles have the same ratio as the squares of their diameters. Find the diameter of the smaller of two circles if their areas are in the ratio of 4 to 9 and the diameter of the larger circle is 6 inches?

in.

Score on Part II \_\_\_\_\_

(Go right on to the next page.)

## PART III (Time: 20 minutes)

## Verbal Problems

**INSTRUCTIONS:** Your success in Part III will depend somewhat upon the care with which you read these problems. Be sure you answer exactly the question raised in each problem. Write your answers in the rectangles.

1. If 6 is subtracted from one-third of a certain number, the result is 8. What is the number?

(1)

2. Three numbers are so related that the first is equal to twice the second, while the second is equal to three times the third. What is the largest of the three numbers if their sum is 45 ?

(2)

3. The base of an isosceles triangle is 4 inches longer than either of its two equal sides. What is the length of the base if the perimeter of the triangle is 40 inches?

in. (3)

4. A side of one square is 2 inches less than a side of a second square. Their areas differ by 36 square inches. Find the length of one side of the square which has the greater area.

in. (4)

5. A salesman receives a commission of 15% on his sales. How many dollars' worth of goods must he sell in order to get a commission of \$21 ?

(5)

In problems 6 to 10, you are to select the equation which should be used to solve the problem and write the NUMBER of that equation in the rectangle. DO NOT SOLVE THE EQUATION.

6. The length of a certain rectangle is 4 feet more than the width. If each dimension is increased by 2 feet, the area of the rectangle will be greater by 39 square feet. What are the dimensions of the rectangle?

Let  $w$  represent the width of the rectangle. Which of the following equations should be used to solve the problem?

(1)  $(w + 2)(w + 6) = 39$

(3)  $(w + 2)(w + 6) = w^2 + 4w + 39$

(2)  $(w + 2)(w + 6) = w^2 + 4w - 39$

(4)  $2w(2w + 8) = w^2 + 4w + 39$

(6)

(Go right on to the next page.)

7. One automobile runs 8 miles per hour faster than another automobile, and requires one hour less time to travel 240 miles. What is the rate of each automobile?

Let  $x$  represent the rate, in miles per hour, of the slower automobile. Which of the following equations should be used to solve the problem?

$$(1) \quad \frac{240}{x} = \frac{240}{x+8} + 1$$

$$(3) \quad \frac{x}{240} = \frac{x+8}{240} - 1$$

$$(2) \quad \frac{x}{240} = \frac{x+8}{240} + 1$$

$$(4) \quad \frac{240}{x} = \frac{240}{x+8} - 1$$

8. The number of pounds of sugar that can be purchased with a fixed amount of money varies inversely as the price per pound. What must be the price of one pound if a decrease in cost of 3 cents per pound increases by 9 the number of pounds which can be purchased for \$1.20?

Let  $c$  represent the price per pound (in cents); then  $\frac{120}{c}$  represents the number of pounds which can be purchased for \$1.20. Which of the following equations should be used to solve the problem?

$$(1) \quad 9(c-3) = \frac{120}{c}$$

$$(3) \quad (c+3)\left(\frac{120}{c} - 9\right) = 120$$

$$(2) \quad (c-3)\left(\frac{120}{c} + 9\right) = 120$$

$$(4) \quad (c+9)\left(\frac{120}{c} - 3\right) = \frac{120}{c}$$

9. A motorist has 10 quarts of a 35 per cent mixture of alcohol and water. How much of this mixture must be replaced by pure alcohol in order to obtain 10 quarts of a 60 per cent solution of alcohol?

Let  $x$  represent the number of quarts to be replaced by pure alcohol. Which of the following equations should be used to solve the problem?

$$(1) \quad 3.5 + x = 6$$

$$(3) \quad 3.5 + x = 6 + .6x$$

$$(2) \quad 3.5 + .35x = x + 6$$

$$(4) \quad 3.5 - .35x + x = 6$$

10. A dealer bought a number of fountain pens for \$68. He kept two for his own use and sold each of the remaining pens for \$1.75 more than it cost him, thus making a total profit of \$16. How many fountain pens did he buy?

Let  $x$  represent the number of pens bought by the dealer; then  $\frac{68}{x}$  represents the cost of one pen (in dollars). Which of the following equations should be used to solve the problem?

$$(1) \quad (x-2)\left(\frac{68}{x} + 1.75\right) = 68$$

$$(3) \quad (x-2)\left(\frac{68}{x} + 1.75\right) = 84$$

$$(2) \quad \frac{68}{x-2} + 1.75 = 16$$

$$(4) \quad \frac{68}{x} + 1.75 = \frac{16}{x-2}$$

## 1935 - THE SEVENTH IOWA EVERY-PUPIL TESTING PROGRAM - 1935

EVERY-PUPIL TESTS IN  
GENERAL SCIENCE AND BIOLOGY

## MANUAL OF DIRECTIONS

Since the tests in general science and biology are similar in form, only one manual of directions has been prepared for both subjects. The directions given herein are to be followed in administering each of these tests.

One of the principal values of the Every-Pupil tests is that they enable each participating school to compare the achievement of its own pupils with that of pupils in other schools. Strict comparability for this purpose can be secured only if each participating school adheres very closely to the standard procedure for administering each test. Any variation from this procedure may not only destroy this value of the tests for the school that introduces the variation, but it may also detract from the value of the project for all participating schools. The following directions, therefore, should be *rigidly* observed in the order given.

A sixty-five minute period should be provided for each test. Five minutes at least will be required for distributing and collecting test booklets and for filling in blanks on the first page of the test, and sixty minutes must be allowed for actual working time.

All pupils taking the same examination (within a single school) must be tested during the same period, although in different rooms if necessary. To administer the test in different periods would almost certainly result in exchange of information between pupils and thus invalidate the results for the pupils tested last.

Every attempt should be made to secure full attendance on the day the tests are given. It is only with full attendance that the average score earned is a valid measure of school or of class achievement. While any school may, to complete its own record, administer tests later to pupils who were absent, the scores of these pupils should not be reported to the director of the program.

## DIRECTIONS FOR ADMINISTERING:

- (1) The pupils should be told in advance to bring to class two sharpened pencils. The examiner should also have a few on hand.
- (2) Arrange the pupils in alternate seats if possible. In any event, careful surveillance is necessary throughout the examination. Where the examination is given to large groups, there should always be one proctor for every thirty pupils, and these proctors should circulate freely about the room throughout the examination.
- (3) To administer the test, begin by saying,

*"We shall now pass out the test booklets. As soon as you receive one you may begin filling the blanks at the upper part of the first page, giving your name, grade, etc. When you have filled in these blanks, read carefully the directions that are given on the first page. Do not open the test booklet until I tell you to do so."*

- (4) When all of the test booklets have been distributed and the pupils have been allowed two or three minutes for filling the blanks and reading the directions, say,

*(Read slowly) "You will be given exactly sixty minutes to complete the test. If you finish before the sixty minutes are up, look over your whole paper and correct errors or fill in omissions, then remain quietly at your seat until the period is up."*

*"Let me remind you that many of the questions in this test are intended to be thought questions. Read each response to an item carefully before making your choice. If you are not sure of the correct response, try to get it by eliminating the responses which you believe are definitely wrong."*

*"You are not to ask any questions after work has begun. If you have any questions concerning the procedure, ask them now."*

Pause here to answer any reasonable questions that may be raised by the pupils.

(5) Then say,

*"You may now turn the first page and begin work on the test."*

Note the exact time carefully and *write it down*. Answer no questions and permit no interruptions after work has begun.

(6) At the end of exactly sixty minutes say, *"Stop!"* and have the papers collected at once. Be sure that all test booklets are accounted for.

#### DIRECTIONS FOR SCORING:

A key containing the right answers to the test questions has been provided with the test. The key is arranged so that it may be cut up into strips with the correct answers for one page on each side of a strip. In case of the double column pages the responses for one column are arranged along one edge of the strip and the responses for the second column along the other edge. The answers are arranged on the strips so that they may be brought adjacent to the responses on the test.

To score the test, lay the proper edge of the appropriate strip alongside the pupil's responses and, using a colored pencil, draw a horizontal line through the number of each item that has been answered correctly. Draw a cross (x) through the number of each item that has been answered incorrectly, and draw a circle around the number of each item that has been omitted. (It is important that these directions for marking papers be carefully observed in order to facilitate the analysis of the tests that will be made later in Iowa City.)

In scoring the tests, follow the scoring key very rigidly. Even though you may in some cases not agree exactly with the answers provided in the key, *follow them nevertheless*. If you allow your personal opinion to enter at all into the scoring of the tests, it is not likely that result will be comparable to those secured from other schools. No answer should be marked as correct therefore, unless it corresponds exactly with that provided in the scoring key.

The score on this test is simply the total number of correct answers. Enter the total score in the blank space provided on the first page of the test booklet.

In order to insure accuracy, each paper should be scored twice, and the copying and adding of the scores should be checked, since it is very difficult to avoid making one or two mistakes in the scoring of a paper. If a large number of papers are to be scored, it may be found convenient to have one scorer score pages two and three, another score pages four and five, a third pages six and seven, and a fourth page eight.

#### DIRECTIONS FOR RECORDING:

Report forms are provided, on which the scores of all pupils in each subject are to be reported to the director of the program at the University of Iowa. The directions for filling in these forms are printed on the forms themselves.



EVERY-PUPIL TEST IN GENERAL SCIENCE

\*\*\*\*\*

ALVIN W. SCHINDLER  
Adams State Teachers College  
Alamosa, Colorado

Edited by:

C. J. LAPP  
Associate Professor of Physics  
State University of Iowa

Score \_\_\_\_\_

Do not open this booklet, or turn it over, until you are told to do so. First fill these blanks, then read carefully the directions below. Write plainly.

NAME: \_\_\_\_\_ Age last birthday: \_\_\_\_\_ years  
(First name, initial, last name)

Grade: \_\_\_\_\_ School: \_\_\_\_\_ City: \_\_\_\_\_

Name of your teacher in this subject: \_\_\_\_\_

DIRECTIONS: Each item in this test consists of a direct question followed by four responses, only one of which is correct. Read each question carefully, decide which response makes the best answer, and write the number corresponding to that response in the square preceding the question.

You will be given exactly 60 minutes to complete the whole test. The test is long, and you may not be able to answer all questions in the time allowed. You will therefore be most likely to make a high score if you do not linger too long over difficult items, but go on instead to those that are easier. You may return to the difficult items later if time permits.

Many of the questions are intended to be thought questions, and should not be answered hastily. Read every one of the answers carefully before making your choice. If you are not able to recognize the correct answer directly, you may in some cases be able to eliminate the wrong responses and so arrive at the correct answer. Your score may be much improved if you remember this suggestion and apply it wherever possible.

Your teacher will answer no questions and will permit no interruptions after work has begun. If you have any questions, ask them now.

(Do not turn this page until you are told to do so.)

2

1. In what structural unit of man's body does oxidation release heat energy?

- 1) In the air sacs of the lungs
- 2) In the small intestines
- 3) In the cells composing the body tissues
- 4) In the red corpuscles of the blood

2. Which of the following diseases is commonly caused by drinking impure water?

- 1) Typhoid fever
- 2) Tuberculosis
- 3) Smallpox
- 4) Diphtheria

3. Which statement best describes the principle that is applied in the fireless cooker?

- 1) A wall containing air spaces prevents rapid loss of heat
- 2) Slow oxidation produces heat without producing a visible flame
- 3) Electricity produces heat without fire
- 4) Certain chemical actions produce heat without fire or flame

4. Which of the following is commonly utilized by aviators to determine their altitude?

- 1) Changes in air pressure
- 2) Changes in temperature
- 3) The number of beacon lights which may be observed at one time
- 4) A small thermostat

5. Which of the following is an important function of the red corpuscles?

- 1) To destroy disease germs
- 2) To distribute oxygen to the cells of the body
- 3) To carry waste products from the cells to the kidneys
- 4) To absorb digested food and distribute it to the cells of the body

6. Which of the following foods contains the most carbohydrates per pound?

- 1) Green beans
- 2) Beefsteak
- 3) Eggs
- 4) Potatoes

7. A liquid one-third as heavy as mercury is used to make a barometer. How high will it stand in the tube when the air pressure is normal?

- 1) About 10 inches
- 2) About 90 inches
- 3) About 45 inches
- 4) About 34 inches

8. In which of the following processes is oxygen combined with some other substance?

- 1) Electrolysis of water
- 2) Rusting of iron
- 3) Capillary action
- 4) Evaporation of liquid oxygen

9. Which of the following makes use of the fact that every electric current is surrounded by magnetic lines of force?

- 1) An electric motor
- 2) A compass
- 3) Neon signs used for advertising purposes
- 4) Electroplating

10. Which of the following is not a purpose of heating coal to high temperatures in great airtight ovens?

- 1) To produce gas for heating purposes
- 2) To obtain the coke that is mixed with iron ore in blast furnaces
- 3) To obtain tar and dyes
- 4) To remove the mineral content from the coal

11. If an object which is ten feet below street light receives heat from the light, how is the heat transferred to the object?

- 1) By conduction and radiation
- 2) By radiation
- 3) By conduction
- 4) By convection

12. Which statement applies to most adult insects?

- 1) They are harmful
- 2) They have three pairs of wings
- 3) They feed on the nectar which flowers produce
- 4) They have six legs

13. What is the chief reason that green plants grow better if they receive sunlight?

- 1) The sunlight contains organic materials which the plants use
- 2) The energy in the sun's rays helps to produce chemical changes in the plant cells
- 3) The sunlight kills bacteria and harmful fungi
- 4) The sunlight contains chlorophyll

14. Where do green plants get the nitrogen which they use in manufacturing proteins?

- 1) From carbon dioxide
- 2) From the air through the leaves
- 3) From the energy of sunlight
- 4) From the soil

15. What part of a flower produces the pollen grains?

- 1) Pistil
- 2) Stamens
- 3) Ovary
- 4) Ovules

16. What part of the eye corresponds to the shutter of a camera?

- 1) Lens
- 2) Iris
- 3) Pupil
- 4) Optic nerve

17. Which of the following plants do not manufacture their own food supply?

- 1) Any plants that grow on very fertile soil
- 2) Any plants that are known as weeds
- 3) Clovers or any other of the legume plants
- 4) Molds or other fungus plants

18. What effect of an electric current is utilized in a telephone receiver to produce sound waves?

- 1) The chemical effect
- 2) The heating effect in a coil of wire
- 3) The magnetic effect
- 4) The buzzing sound produced when a current alternates in a wire

(Go right on to the next page.)

19. By which of the following can non-living material be transformed into living material?

- 1) Protoplasm
- 2) Inorganic matter
- 3) Osmosis
- 4) Digestion

20. Which of the following is an alloy?

- 1) Copper
- 2) Bronze
- 3) Iron rust
- 4) Aluminum

21. To which class of rocks does limestone belong?

- 1) Sedimentary
- 2) Igneous
- 3) Metamorphic
- 4) Glacial

22. Which of the following foods will supply the body with the most proteins?

- 1) Milk, butter, and nuts
- 2) Beans, peas, and lean meat
- 3) Fruits, potatoes, and rice
- 4) Mineral foods such as salt

23. When the atmospheric pressure is 15 pounds per square inch, what is the weight of the air in a vertical column that is one square inch in area and extends from the surface of the earth to a point beyond the atmosphere?

- 1) 30 pounds
- 2) 15 pounds
- 3) Several hundred pounds
- 4) 15 pounds times the length of the column

24. Of what are diamonds made?

- 1) A rare element called diamond
- 2) A rare kind of glass formed in nature
- 3) A transparent kind of quartz
- 4) Highly crystallized carbon

25. Which of the following is used in making all kinds of glass?

- 1) Sand
- 2) Crystallized igneous rock
- 3) Clay and limestone
- 4) A transparent variety of slate

26. Which of the following serves as the negative post in a dry cell?

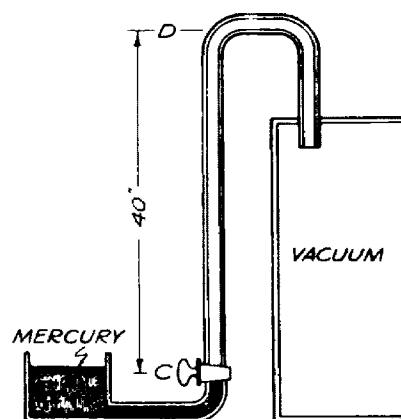
- 1) A tin can
- 2) A strip of copper
- 3) A carbon rod
- 4) A zinc can

27. What is formed whenever a combustible substance containing atoms of hydrogen is oxidized?

- 1) Molecules of water
- 2) Carbon dioxide
- 3) A carbohydrate compound
- 4) Molecules of poisonous carbon monoxide

28. Why is water a good substance to use in extinguishing most fires?

- 1) It cools the burning object and keeps oxygen away from it
- 2) It has a low kindling temperature
- 3) It is a very good conductor of heat
- 4) It always retards chemical changes



**FIG. 1**

29. Figure 1. What will happen if the valve at C is opened?

- 1) Air pressure will force air and mercury into the vacuum chamber
- 2) Air pressure will force mercury about three-fourths of the way from C to D
- 3) Air will bubble through the mercury into the vacuum
- 4) No noticeable change will take place

30. During the compression stroke of a four-cycle gasoline engine, both valves are closed. What is the position of the valves during the stroke that follows the compression stroke?

- 1) Both valves are open
- 2) The intake valve is open and the exhaust valve is closed
- 3) The intake valve is closed and the exhaust valve is open
- 4) Both valves are closed

31. Which of the following possesses kinetic energy?

- 1) A bow that is bent into position to shoot an arrow
- 2) A piece of coal on the bed of a river
- 3) The gasoline in the underground tank at a filling station
- 4) A body that is producing sound waves

32. Which of the following is the chief source of commercial dyes at the present time?

- 1) Destructive distillation of coal
- 2) The leaves of certain tropical plants
- 3) The bark of certain trees
- 4) Heating wood in air-tight containers

33. Which of the following involves only a physical change?

- 1) Milk becomes sour
- 2) Cider changes to vinegar
- 3) Butter is obtained when cream is churned
- 4) More perspiration is given off during strenuous exercise

34. How many stars are there in that part of the universe which is commonly spoken of as our solar system?

- 1) One, the sun
- 2) Nine
- 3) About 2000
- 4) Many thousand, the exact number not yet determined

(Go right on to the next page.)

35. Which type of suit would be warmest if worn during a warm summer night? (All suits are wool and equal in weight.)

- 1) A white suit that is very loosely woven
- 2) A black suit that is very tightly woven
- 3) The suit in which the fibers are woven most tightly
- 4) A gray suit that is tightly woven

36. What is one of the changes that take place when a violin string is loosened a little?

- 1) The sound produced by the string has a higher pitch
- 2) The string vibrates more slowly, and the sound has a lower pitch
- 3) The velocity of the sound produced by the string is decreased
- 4) The string vibrates more rapidly and produces a louder tone

37. Why do fruit trees usually yield less fruit if the weather is damp and cloudy at blossoming time?

- 1) Harmful bacteria grow rapidly during damp, cloudy weather
- 2) Plants cannot manufacture food without sunlight
- 3) There is less distribution of pollen during damp weather
- 4) The dampness injures the sepals

38. Of what value to a plant is the food stored in the fruit?

- 1) It is utilized by the seedling
- 2) It results in the seeds being scattered widely
- 3) It is developed to provide food for man
- 4) It plays an important part in the fertilization of the seed

39. Why do some objects have a blue color?

- 1) They absorb all the colors of which white light is composed except blue
- 2) They absorb blue light and reflect all other colors
- 3) They change white light into blue light
- 4) They absorb all the colors of which white light is composed

40. The wastes taken from the blood by the kidneys contain nitrogen compounds. This indicates that what kind of compounds were oxidized in the cells of the body?

- |             |             |
|-------------|-------------|
| 1) Sugars   | 3) Proteins |
| 2) Starches | 4) Fats     |

41. Seedlings growing from planted seeds have a white color and may grow two or three inches before they reach sunlight at the surface of the soil. How can they grow without sunlight and without a green color?

- 1) They manufacture food by utilizing heat
- 2) They manufacture food by utilizing soil moisture
- 3) The seed gives off heat and carbon dioxide during germination and absorbs oxygen
- 4) They grow by using food that has been stored in the seed

42. Why is a sticky substance formed when soap is dissolved in certain kinds of water?

- 1) The soap combines with the calcium and magnesium compounds that make water hard
- 2) The water is unusually soft
- 3) The water contains more soap than it can dissolve
- 4) The water is too cold to dissolve the soap properly

43. Which statement is the best description of the process used in pasteurizing milk?

- 1) The milk is heated as high as possible without allowing it to boil
- 2) The milk is boiled in a partial vacuum for a few minutes
- 3) The milk is heated to 100° C., and then chemicals are added to kill bacteria
- 4) The milk is maintained at a temperature of 145° F. for about 30 minutes

44. If a flame is applied through a small opening to a few of the match heads in a closed match box, the match heads will all burn rapidly but the match sticks will not burn. Which statement best explains this?

- 1) The heat from the burning match head is not sufficient to raise the wood to its kindling point
- 2) The match heads contain much oxygen which is easily liberated, but the sticks do not
- 3) The heads have a lower kindling temperature than the sticks
- 4) The heads are made of a compound containing phosphorus

45. Which of the following determines whether a direct or an alternating current is obtained from a dynamo?

- 1) The speed with which the armature turns
- 2) The number of turns in the armature coils
- 3) The number of poles in the magnetic field of the dynamo
- 4) The nature of the device used to transmit the current from the armature coils to the external circuit

46. Is the partial vacuum that is produced above the wings as a plane moves forward rapidly of any value in lifting the plane?

- 1) Yes, air pressure lifts the plane when the pressure above the wings is decreased
- 2) Yes, the vacuum makes the plane weigh less
- 3) No, the plane is lifted entirely by the pull of the propeller
- 4) No, the air pressure above the vacuum is equal to the air pressure below the wing

47. Which of the following passes over the wire between two phones that are being used in conversation?

- 1) Sound waves
- 2) A direct current of electricity that does not vary in strength
- 3) An alternating current of electricity that does not vary in strength
- 4) A current of electricity that is continually changing in intensity

(Go right on to the next page.)

48. What is a reasonable explanation of the fact that certain animals prepare two exits when they make a nest under the ground?

- 1) Animals that make only one exit are less likely to survive
- 2) Two openings are necessary for proper ventilation
- 3) The nest is usually so small that the animal cannot turn around in it if there is only one exit
- 4) Each generation of animals is taught by the parents to build this kind of nest

49. For which of the following purposes are plant stems of little or no value?

- 1) To carry manufactured foods to the roots  
To hold the leaves so that they may obtain air and sunlight
- 2) To carry to the leaves the carbon dioxide needed for the manufacture of carbohydrates
- 3) To supply the leaves with nitrates and minerals for the manufacture of proteins

50. Which of the following does not help to determine the pressure of the water in a pipe leading directly to an open water faucet?

- 1) The distance of the faucet from the standpipe or pumping station
- 2) The diameter of the standpipe
- 3) The diameters of the pipes leading from the standpipe to the faucet
- 4) The height of the standpipe

51. If a person is nearsighted (has trouble seeing far-away objects), what kind of lenses should he wear?

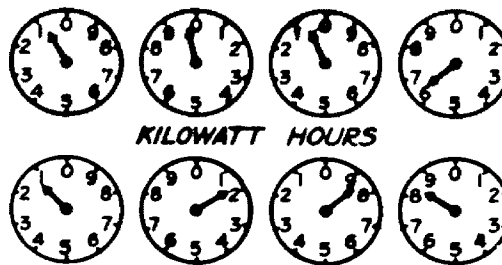
- 1) Lenses that converge (bring together) parallel rays of light
- 2) Convex lenses
- 3) Lenses that are thinner at the center than around the edges
- 4) Lenses that focus light like a burning glass

52. Which of the following is never a step in the process of purifying the water supply for a large city?

- 1) Spraying the water into the air to expose it to sunlight and oxygen
- 2) Passing the water through sand filters to remove solid impurities
- 3) Treating it with chlorine to kill bacteria
- 4) Passing the water through carbon filters to remove bacteria

53. In certain water systems intended for a single home only, no standpipes or elevated tanks are used. In such systems, how is the required pressure usually obtained?

- 1) By compressing air in a tank that is partly filled with water
- 2) By compressing the water in a strong tank that is located in the basement
- 3) By building a cistern in the basement
- 4) By means of a pump that is turned on automatically every time water is drawn from a faucet



**FIG. 2**

54. Figure 2. The upper dials give the reading of an electric meter at the beginning of a month. The lower dials give the reading at the end of the month. If electricity costs ten cents per kilowatt hour, what is the light bill for the month?

- 1) Between \$1 and \$2
- 2) Between \$2 and \$3
- 3) Between \$12 and \$13
- 4) Between \$28 and \$29

55. Why does an echo seem to disappear when one walks toward the wall from which the sound waves producing it are reflected?

- 1) The reflected waves return to the ear before the original sound has faded away
- 2) The waves producing the echo are weaker near the wall
- 3) The reflected sound waves gain in velocity as they move away from the wall
- 4) Sound waves are not reflected after the person has come near the wall

56. Why are persons afflicted with pneumonia sometimes placed in oxygen tents?

- 1) There is more oxidation in the lungs when the patient is in the tent
- 2) Oxygen is poison to pneumonia bacteria
- 3) Oxygen decreases the patient's fever because it is a good conductor of heat
- 4) The patient's blood cannot obtain enough oxygen from ordinary air because the lungs are partially clogged

57. Which of the following is probably the chief cause of the sound called thunder?

- 1) Vibrations caused by the sudden expansion of air that is heated by lightning
- 2) Vibrations caused when lightning strikes a solid object
- 3) Rapid evaporation of water, caused by heat from the lightning
- 4) Sound waves produced by a solid object that is vibrating rapidly

58. How does the most frequently used dry cleaning process differ from the ordinary method of washing clothes?

- 1) No liquid of any kind is used
- 2) The process is similar to that of cleaning a rug with a vacuum cleaner
- 3) The cleaning solution is applied to soiled spots without wetting the whole cloth
- 4) A liquid obtained from petroleum is used instead of water

(Go right on to the next page.)

59. Which of the following processes makes use of the fact that all dissolved solids are left in the container when a liquid evaporates?

- 1) The method frequently used in making river water fit for human consumption
- 2) The preparation of the water to be used in lead storage cells
- 3) The softening of hard water in water softeners
- 4) The transmission of heat in a hot water heating system

60. Which statement does not present the basis of some common method of preserving food?

- 1) Bacteria cannot grow without moisture
- 2) Bacteria grow slowly or not at all in a cold place
- 3) Bacteria cannot grow if osmosis takes water from them
- 4) Bacteria cannot grow without sunlight

61. Which of the following is not an agency that tends to smooth the surface of the earth?

- 1) Sudden temperature changes if the earth's surface is dry
- 2) Gravity
- 3) The carbon dioxide and the oxygen in the air
- 4) The flow of molten material and hot gases from the interior of the earth

62. What advantage is gained by using a single fixed pulley to lift a weight?

- 1) One pound of force can lift a two-pound weight, neglecting friction
- 2) The weight moves twice as fast as the force
- 3) The force moves twice as far as the weight and may therefore be less than the weight
- 4) The force may be applied from a convenient position

63. For which of the purposes mentioned below are machines of no value to man?

- 1) To overcome a large resistance with a small force
- 2) To move a resistance a long distance as the force moves a short distance
- 3) To move a resistance in one direction as the force moves in another direction
- 4) To get more work out of a machine than is put into it

64. It is about 3000 miles across the United States from east to west. How fast would a person have to travel across this distance to keep the sun directly south of him all the time?

- 1) About 250 miles per hour
- 2) About 400 miles per hour
- 3) About 25,000 miles per hour
- 4) About 1100 miles per hour

65. Why should the fire tubes in the boiler of a locomotive be cleaned frequently?

- 1) To remove substances that are poor conductors of heat
- 2) To prevent a boiler explosion
- 3) To decrease friction by keeping the tubes clean and smooth
- 4) To allow more water to pass through the fire tubes

66. Why is either carbon tetrachloride or gasoline better than water for removing grease spots from clothing?

- 1) They surround the grease particles so that the latter will dissolve readily
- 2) They oxidize the grease
- 3) They produce chemical changes that destroy the grease particles
- 4) They restore the natural color of the cloth after removing the grease

67. Does the Big Dipper always appear to be on the same side of the North Star?

- 1) Yes
- 2) No, it is east of the North Star during the summer and west of it during the winter
- 3) No, its apparent position depends on the date and the hour at which the observation is made
- 4) No, it is always to the west and slightly higher than the North Star

68. Why would there be no pronounced seasons if the earth's axis were vertical to the plane of its orbit?

- 1) Days and nights would be of equal length at all places at all times
- 2) The temperatures at all latitudes would be the same
- 3) At any given latitude, the distance to the sun would be the same throughout the year
- 4) The sun's rays would be vertical at all places on the earth's surface

69. Corn growing on beds of gravel or sand that are covered with only two or three feet of soil will suffer from dry weather more quickly than corn growing on deep soil. Select a reason.

- 1) The gravel allows more capillary action
- 2) The soil is harder if it contains sand or gravel
- 3) The corn roots cannot grow deep enough if the soil is only two or three feet deep
- 4) The crevices in the gravel are so wide that water cannot rise through them readily

70. It is definitely known that the moon affects the earth in what way?

- 1) It temporarily raises the level of the water in certain regions of the ocean
- 2) It exerts much control over weather conditions
- 3) It furnishes the signs used by the Weather Bureau in forecasting weather changes
- 4) It causes the great ocean currents

71. Some people believe that it will rain before Monday evening if the sun goes down clear Friday evening. Would you accept the belief if you watched the weather for two months and found that the statement held true every time?

- 1) Yes, a thing that happens so frequently is almost certain to continue to happen regularly
- 2) Yes, if an hypothesis holds true during several observations, it is a scientific fact
- 3) No, the statement could not be accepted without more extensive observations and records
- 4) No, two or three days of clear weather are never followed by cloudy weather in regions over which cyclones and anticyclones move

(Go right on to the next page.)

72. Why must a hot water heating system be equipped with an open tank that is higher than any of the radiators?

- 1) To provide the pressure that forces the water through the heating system
- 2) To keep the water at the proper level in the boiler
- 3) To provide for the extra volume which the water occupies when it is heated
- 4) To store heat that may be utilized when the furnace fire is low

73. The type of fire extinguisher which operates when turned upside down is dangerous to use in extinguishing fires caused by defective electric wiring. Why?

- 1) Carbon dioxide gas is a good conductor of electricity
- 2) Carbon tetrachloride is a good conductor of electricity
- 3) Water solutions of bases or acids conduct electricity readily
- 4) The container is usually made of copper

74. Fence posts are sometimes raised a few inches during the winter. What is the usual cause?

- 1) The action of freezing water
- 2) The irregular expansion of water as it cools to 0° C.
- 3) The fact that ground does not expand until it is frozen hard
- 4) The fact that the post expands more than the ground during cold weather

75. Which of the following might result in the blowing out of the fuse in a house-lighting circuit?

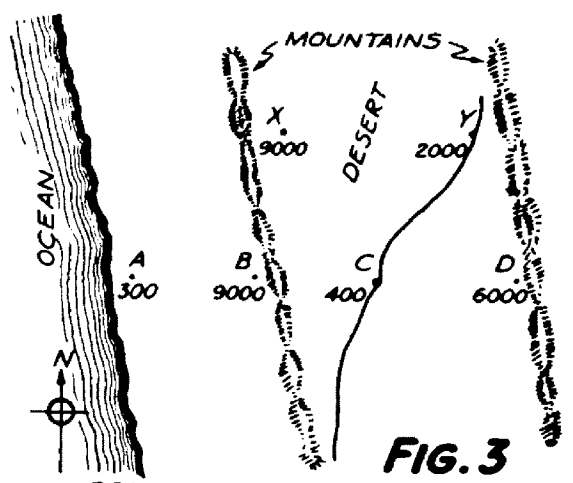
- 1) An increase in the resistance of the circuit
- 2) Several lights in the circuit are changed from parallel to series connection
- 3) A decrease in the resistance of the circuit
- 4) A decrease in the e.m.f. in the circuit from 110 volts to 100 volts

76. There is sometimes no dew on a concrete walk when the grass near the walk is covered with a heavy dew. What is one reason for this?

- 1) The walk causes more condensation of water vapor than the grass
- 2) There are not enough dew points on the walk
- 3) The walk absorbs heat during the day, and the air that comes near it during the night is warmed
- 4) The dew point of concrete is higher than the dew point of grass

77. During a cold winter day, why is there usually more frost on kitchen windows than on parlor windows even when the temperature in the parlor is lower than that in the kitchen?

- 1) The high temperature in the kitchen hastens condensation of water vapor
- 2) The dew point of the air in the kitchen is lower than that of the air in the parlor
- 3) The parlor windows are usually larger
- 4) The air in the kitchen usually has a higher relative humidity than the air in the parlor



**FIG. 3**

SCALE: 1 INCH = 150 MILES

78. Figure 3. The numbers given at A, B, C, and D indicate distances above sea level. The latitude of the places represented at A, B, C, and D is similar to that of Los Angeles. Which of the following locations would have the highest average day-time temperature during July?

- 1) A
- 2) B
- 3) C
- 4) D

79. Figure 3. At which location would you expect the highest average night-time temperature during the winter?

- 1) A
- 2) B
- 3) C
- 4) D

80. Figure 3. At which of the following locations would you expect the least rainfall?

- 1) A
- 2) B
- 3) C
- 4) D

81. Figure 3. The relative humidity of the air carried by the west winds decreases as the air moves from X to Y. Why?

- 1) The winds lose all their water vapor while crossing the high mountains
- 2) The winds become warmer as they move toward the lower altitudes along the river
- 3) The air pressure is greater at the lower altitudes
- 4) There is less cloudy weather at Y than at X

82. Which of the following makes it possible to obtain gasoline from crude oil (petroleum)?

- 1) Gasoline has a lower boiling point than other substances of which crude oil is composed
- 2) The boiling point of gasoline is higher than that of water
- 3) Gasoline rises to the surface if a tank of crude oil is not disturbed
- 4) The kindling temperature of gasoline is lower than that of other substances in crude oil

83. When the Weather Bureau issues a statement predicting cooler weather, which of the following is a reason commonly given for the prediction?

- 1) The approach of high atmospheric pressure
- 2) The approach of a cyclone or "low"
- 3) The formation of fogs
- 4) High relative humidity

(Go right on to the next page.)

84. Which statement best describes the reason that man is now able to use energy which came from the sun many years ago?

- 1) Energy cannot be destroyed or dissipated
- 2) The atmosphere retards radiation of heat from the earth's surface
- 3) Most of the materials in the earth's crust are poor conductors of heat
- 4) The energy in light can be used to produce chemical changes

85. There is an enormous force of attraction between the earth and the sun. Why is the earth not drawn into the sun?

- 1) The sun's attraction is counteracted by an equal attraction of the stars and planets
- 2) The sun's attraction is counteracted by a centrifugal force of equal value
- 3) The earth's gravity is too great
- 4) Beyond the atmosphere there is an immense vacuum on all sides of the earth

86. What is the function of the silks on a growing ear of corn?

- 1) They provide the substance of which the cob is formed
- 2) They manufacture the food that is stored in the kernels
- 3) They produce pollen
- 4) They serve as pathways through which the cells in pollen grains may enter the ovaries in which the kernels start to grow

87. When corn is planted on hilly land, the yield on the level at the top of the hill is usually greater than the yield on the hillside. What is a reason for this?

- 1) The corn at the top of the hill receives more sunlight for photosynthesis
- 2) Water takes more soil from the hillside than from the hilltop
- 3) There is more wind to pollinate the corn on the hilltop
- 4) There is more organic matter and loam on the hillside

88. Is the valve at the bottom of the cylinder of a lift pump opened or closed during the upstroke of the piston if the cylinder is ten feet above the water? Why?

- 1) Closed, because the piston is lifting water out of the cylinder
- 2) Open, because air pressure is forcing water into the cylinder
- 3) Open, because the valve in the piston is also open
- 4) Open, because the piston is forcing water through the valve

89. What is one reason that it is dangerous to fill a balloon completely full of hydrogen before it takes off?

- 1) The balloon would be too heavy if completely filled with hydrogen
- 2) The pressure inside the bag would be too great as the air pressure around the balloon decreased
- 3) The balloon would no longer be full after it reached higher altitudes
- 4) The balloon would move too slowly at first after being released

90. Fire may be kept during the night by putting coal into the furnace and then covering the coal with ashes. Why are the ashes used?

- 1) They help to prevent flow of oxygen around the coal
- 2) They are good conductors of heat
- 3) They prevent the formation of explosive coal gases in the furnace
- 4) They cause the coal to burn more thoroughly

91. Which of the following indicates that air is a poor conductor of heat?

- 1) Ice melts slowly when it is wrapped in sacks or loosely woven blankets
- 2) The air must be taken out of electric light bulbs
- 3) Warm air is pushed upward by colder air
- 4) Air seems warmer when its relative humidity is low

92. What is one of the reasons that the Great Lakes help to moderate the weather of nearby regions during the winter?

- 1) Water is a good conductor of heat
- 2) The warmest water in all parts of the lakes is always at the surface
- 3) Water has a higher specific heat than most other substances
- 4) Water gives off heat to the air as it evaporates

93. Why are compass cases made of brass instead of iron?

- 1) Brass is a more magnetic substance than iron
- 2) Brass does not interfere with the lines of force in the earth's magnetic field
- 3) Brass is a better conductor of electricity than iron
- 4) Brass helps to attract lines of force to the magnetic needle

94. Which of the following always produces an alternating current?

- 1) Chemical action
- 2) The rotation of a coil of wire in a magnetic field
- 3) A lead storage cell
- 4) A dry cell

95. It has been estimated that the roots of a large oak tree may take up 50 gallons of water during one summer day. What becomes of most of this water?

- 1) It is used to make carbohydrates by photosynthesis
- 2) It is consumed in the life processes of the tree
- 3) It is lost to the air through special openings in the leaves
- 4) It passes through the bark by osmosis and then evaporates

96. Which of the following is not a reason that steam engines have a low efficiency?

- 1) The steam still contains much heat energy when it leaves the cylinders
- 2) The gases from the fire box are still very hot when they leave the fire tubes of the boiler
- 3) Energy is lost because of incomplete combustion
- 4) Steam engines are very heavy

Score \_\_\_\_\_



## INTELLIGENCE AND ACHIEVEMENT TEST DATA

## GIRLS

	RURAL						URBAN					
	Pupil	I. C.	C. Age	Gen. Sci.	Algebra	English	English	Algebra	Gen. Sci.	C. Age	I. C.	Pupil
LEWIS-TOWN												
1.	C.A.	101	13-10	35		147	116			14-0	101	S.C.
2.	V.B.	93	16-0			130	158			15-3	99.4	A.B.
3.	J.B.	110	14-2			129	110			14-8	111	F.M.
4.	R.M.	120	13-11			149	167			14-4	121	C.B.
5.	E.B.	116	13-10		26	150	109	21		13-5	115.5	H.F.
6.	A.B.	82	17-0			131	121			15-9	83	N.C.
7.	J.B.	113	13-10	55		95	164	8		13-9	113	J.M.
8.	M.M.	104	14-4			118	110			13-0	104	B.B.
9.	B.B.	101	15-0	24		151	157			15-2	102	B.F.
10.	F.H.	90	14-6			110	118			15-0	92	B.B.
11.	D.B.	97	13-6			136	107			14-10	97	F.S.
12.	D.R.	130	14-1		22	166	185			13-7	130	J.C.
13.	S.W.	136	12-9		28	157	190	17		13-0	137	J.C.
14.	C.B.	88.6	14-0			88	95			15-1	86	J.H.
15.	T.G.	130	12-2			132	199	18		13-0	134	J.C.
16.	T.C.	105	14-6	49		109	125			14-1	105	G.M.
17.	D.T.	120	13-0			171	129	4		12-8	123	T.C.
18.	B.F.	119	13-11		23	119	133	23		13-10	118	G.D.
19.	K.M.	119	13-9		24	140	145			13-11	118	E.S.
20.	M.H.	119	13-8		21	159	156	34		13-4	117	B.E.
21.	P.D.	96	14-3			130	118			14-10	96	N.T.



## INTELLIGENCE AND ACHIEVEMENT TEST DATA

## GIRLS

	MURRL							UREAN				
	Pupil	I. V.	C. Age	Gen. Sci.	Algebra	English	English	Algebra	Gen. Sci.	C. Age	I. V.	Pupil
22.	G.H.110	13-4				149	135	11		13-8	108.5	M.F.
23.	M.J.	101	13-0			119	133			14-2	100	M.F.
24.	H.S.	112	13-8			114	115			12-8	111	H.G.
25.	M.M.	116	14-4			142	151			13-11	113.2	A.R.
26.	M.W.	116	14-11	50	30	172	107	28		13-11	115	V.J.
27.	V.S.	105	14-8			151	131	17		14-3	105	L.G.
28.	E.M.	134	13-7			162	160	26		13-2	129	L.H.
29.	E.S.	117	14-11			174	172	25		14-1	120.1	B.H.
30.	M.J.	101	13-0			119	128			13-9	101	M.T.
31.	L.S.	103.8	15-5			117	89			13-8	106	J.L.
GALLA-												
TIN	32.	E.B.	105	14-6		10	120	127	9	14-2	105	A.C.
	33.	L.C.	133	14-4		14	195	165	29	14-2	132	J.D.
	34.	V.C.	82	17-8			87	100	26	16-2	88	E.H.
	35.	J.D.	104	14-3		15	172	160	9	14-3	104	B.B.
	36.	L.G.	85	15-0			85	123	5	15-7	87	F.N.
	37.	M.J.	89	16-8	38	3	113	117	9	17-0	90	R.D.
	38.	E.L.	105	14-9		14	143	152		14-4	105	D.C.
	39.	V.L.	102	14-6		12	118	126	12	14-1	103	C.J.
	40.	O.M.	105	14-5	28	14	115	112	17	14-1	105	M.S.
	41.	K.M.	107	15-0		11	125	124	7	14-11	106	F.B.
	42.	D.N.	98	16-2			102	110	14	15-1	98	E.V.

INTELLIGENCE AND ACHIEVEMENT TEST DATA

GIRLS

	Pupil	I. Q.	RURAL				URBAN					
			C. Age	Gen. Sci.	Algebra	English	English	Algebra	Gen. Sci.	C. Age	I. Q.	Pupil
	43. A.N.	99	14-10		10	107	93	5		15-1	99	H.S.
	44. M.S.	89	17-0		16	105	117	9		17-0	90	R.D.
	45. R.S.	99	15-4			124	120	19		15-11	98	R.A.
	46. E.W.	125	14-0		16	197	174	24		14-3	126	J.H.
	47. A.W.	111	14-0		11	127	169	17		14-3	111	M.E.
MANHATTAN												
	48. E.B.	137	14-8	58	15	137	200	32	45	12-11	142	G.A.
	49. C.P.	110.8	14-2	49	14	145	142	19	30	14-1	111	C.V.
	50. M.S.	98	14-0	39	14	132	128	14	28	14-6	99	D.F.
	51. H.T.	93	15-2	45	10	124	139	16	42	15-7	97	L.R.
THREE FORKS												
	52. G.N.	101	15-9	33	32	136	121	15	18	15-9	101	D.W.
BROAD-WATER												
	53. B.K.	116	13-2		12	177	161			14-7	116	D.B.
	54. H.B.	104	15-2		13	162	190	8		15-3	102	F.P.
	55. E.W.	111	14-9		13	154	176	13		14-3	111	J.B.
	56. A.H.	98	15-11		11	166	151	6	23	15-9	99	G.C./
WILLOW GREEN												
	57. H.C.	109	14-8	25	17	148	161	24	20	15-2	108	A.W.
	58. A.G.	104	15-0	36	9	124	177	9		14-3	106	C.M. (B.C.)
	59. F.T.	107	14-5	23	27	159	188	15		14-6	107	M.L. (B.C.)

INTELLIGENCE AND ACHIEVEMENT TEST D. T.

GIRLS

	RURAL						URBAN					
	Pupil	I. Q.	C. Age	Gen. Sol.	Algebra	English	English	Algebra	Gen. Sol.	C. Age	I. Q.	Pupil
<b>BELGRADE</b>												
60.	K.M.	110	13-8		17	177	152			13-6	111	H.L.
61.	M.T.	110	12-9		10	105	145			14-5	109	(F.C.) H.C.
62.	E.C.	105	16-10		13	159	88	17		14-3	106	A.K.
63.	A.G.	104	14-6		9	120		21		14-1	106	J.W. (FC)
64.	M.C.	117	13-5		24	143	135	16		13-7	120	R.T. (FC)
65.	F.H. (WC)	110	15-7	34	6	112	105	13		15-5	113	M.B. (B.C)
	(BC)	- Broadwater County High School										
	(FC)	- Fergus County High School										
	(WC)	- Willow Creek High School										

## BOYS

## INTELLIGENCE AND ACHIEVEMENT TEST DATA

	RURAL						URBAN					
	Pupil	I. Q.	C. Age	Gen. Sci.	Algebra	English	English	Algebra	Gen. Sci.	C. Age	I. Q.	Pupil
LEWIS-TOWN (Fergus County)	1. L. B.	107.3	14-8			108			35	14-0	107	E. A.
	2. E. B.	120	13-9		15	160	144	25		14-0	121	R. B.
	3. S. J.	113	13-11	38	14	130	171	21		13-6	115	R. B.
	4. D. L.	114	14-7			95		24		14-3	109	L. B.
	5. S. C.	105	14-0	37		112	109	37		14-7	105	M. B.
	6. G. D.	102	14-11	27		73	126			13-7	104	J. B.
	7. O. W.	108	14-6			120	112		39	14-5	108	D. B.
	8. R. T.	102.7	14-3	41		128	137			14-2	103	R. C.
	9. J. W.	85.6	15-6			88	85			15-8	87	G. C.
	10. J. D.	98	15-3			95	108			14-5	97	V. C.
	11. W. H.	96	14-0			98	102	15		14-3	91	L. D.
	12. D. Y.	121	14-2			158	140			13-6	124.6	F. E.
	13. K. S.	86	14-9		8	102	96			17-5	87	C. F.
	14. T. F.	100.6	14-1			136	131		31	14-7	100.5	J. S.
	15. J. R.	108	13-1			115	100			13-0	108	E. G.
	16. F. H.	133	14-1			130	151	19	39	13-9	132	R. S.
	17. D. H.	100	15-6			112	133			15-1	100	H. M.
	18. G. K.	96	15-9			93	98			15-3	96	T. . .
	19. B. M.	99	13-6			93	107			14-6	99	R. L.
	20. L. M.	100	13-9		24	140	111			13-5	102	B. S.

## INTELLIGENCE AND ACHIEVEMENT TEST DATA

## BOYS

	RURAL							URBAN				
	Pupil	I. Q.	C. Age	Gen. Sci.	Algebra	English	English	Algebra	Gen. Sci.	C. Age	I. Q.	Pupil
GALLATIN												
21.	C.B.	99	16-9		12	86	120	5		15-5	98	D.E.
22.	H.B.	127	14-5	51	27	147	165	18		14-6	129	R.N.
23.	P.C.	109	14-1	57	17	164	108	22		13-11	109	D.B.
24.	M.D.	103	15-2		9	99	140	14		15-3	102	C.R.
25.	H.F.	107	14-8		6	128	118	10		14-3	106	B.D.
26.	G.G.	90	15-8		13	99	98	5		14-8	89	D.T.
27.	J.H.	88	14-11		3	94	82	16		15-4	87	B.B.
28.	C.K.	93	14-6		16	106	146	11		14-6	95	S.R.
MANHATTAN												
29.	J.O.	100.8	14-10	44	22	129		9		15-1	99-1	R.E.
30.	H.D.	109	13-10	57	28	149	127	23	42	14-6	108.6	D.A.
THREE FORKS												
31.	B.M.	105	14-8	43	18	90	117	34	44	14-8	103	P.L.
BROAD-WATER												
32.	W.C.	107	15-2	50	12	131	180	12	53	15-2	107	K.B.
33.	H.H.	101	15-10		19	152	132	10	31	15-9	103	A.O.
34.	J.H.	111	14-0		12	133	157	10	24	13-10	112	J.H.
35.	S.M.	103	14-4	41			114	19	42	14-4	104	C.M.
36.	J.W.	102	15-1	34	7	164	169	6	40	14-3	103	W.S.
WILLOW CREEK												
37.	A.G.	98	16-11	25	8	106	98	3	23	15-7	96	R.N.

## INTELLIGENCE AND ACHIEVEMENT TEST DATA

BOYS

	BULGAL						DRENN					
	Pupil	I. Q.	C. Age	Gen. Sol.	Algebra	English	English	Algebra	Gen. Sol.	C. Age	I. Q.	Pupil
BELGRADE												
38.	R.T.	78	16-4	25		87	115	10		16-5	82	G.L.
39.	J.C.	102	13-3		6	101	101	5		13-8	101	B.F.
40.	M.H.	110	13-8		13	125	129			13-9	112	D.M. (FC)
41.	B.S.	96	16-1			129	161	11		15-1	95	J.L.
42.	E.W.	116	14-9		23	149	164			14-1	115.3	N.J. (FC)
43.	J.T.	102	14-8		11	102	105	16	15	14-1	104	D.M. (FC)
44.	R.M.	106	14-9		16	105	99	14		13-0	106	R.E. (FC)
45.												



INTELLIGENCE AND ACHIEVEMENT TEST DATA

BOYS AND GIRLS PAIRED TOGETHER

	RURAL						URBAN					
	Pupil	I. Q.	C. Age	Gen. Sci.	Algebra	English	English	Algebra	Gen. Sci.	C. Age	I. Q.	Pupil
LEWIS- TORN	1. M.R.	92	17-8			103	104			16-1	90	W.B.
	2. L.S.	109	14-7			131	114			13-5	108.1	A.G.
	3. R.V.	106	14-11		24	165	94	23		13-8	110	T.K.
GALL- TIN	4. B.M.	87	17-4		10	122	150			17-3	89	D.W.
	5. P.B.	87.5	15-4	32	11	88	98	7	40	16-10	83	R.R.
MANN- TAN	6. D.H.	103	13-10	23		131	128	19	42	14-10	102	W.D.
	7. B.S.	80.5	17-4	41	8	115	103	6		16-1	82	R.H.

Foots, John M. A Comparative Study of Instruction in Consolidated and One-Teacher Schools; National Education Association, Addresses and Proceedings of the Sixty-first Annual Meeting, Washington, D. C., Vol. LXI, 1923, pp. 812 - 827.

The following excerpt contains leading questions asked at the close of the report.

- "1. Why is there such a small difference in the results of instruction between the two types of schools?
2. The most significant administrative difference herein reported is that of teacher qualifications. To what extent does this account for the instructional differences favoring the consolidated school?
3. Is the consolidated school realizing on its opportunities?
4. Have we not erected costly buildings, installed elaborate equipment, and set up extensive organizations, and assumed that they would procure superior classroom results?
5. Does not the study create a higher regard for what the one-teacher school is accomplishing?
6. The movement for consolidation contemplates the abandonment of the one-teacher school and the transportation of all the pupils to the central school. Would it not be wise, in the light of the report, to recommend some modification of the plan?"