

A STUDY IN PUPIL ACHIEVEMENT

by

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## PREFACE.

The Author's thanks are due to Dr. Jones for his assistance in planning the study and helping to organize the thesis; and for permission to use Parts III and IV of, "Plans for a Study of Student Achievements in the Content of Normal School Courses."

Thanks are also due to Dr. Shriner for many valuable suggestions, and to the teachers who made and scored the tests and helped explain their results.

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## I. INTRODUCTION AND STATEMENT OF PROBLEM

Teachers everywhere are now much interested in the use of new type tests as a means of solving educational problems of all sorts. This paper deals with the use of inventory tests as applied to solution of a few classroom problems.

### A. Inventory Tests

Inventory tests in particular are very useful in the investigation of student achievement and were used exclusively in this study; hence it is necessary to discuss inventory tests, their purpose and construction, and find some convenient method of interpreting their results.

1. Purpose. An inventory test is one which is designed to find out at the beginning of a period of instruction how much a child knows about a given subject. It is possible that the child knows enough about the subject covered by the test to pass the test before he has taken the course. Buckingham<sup>1</sup> says, "In a certain city school system the sixth-grade at the beginning of the year were given ten questions on the course of study in geography which they were about to study. The following were some of the results: (1) In each class some of the questions were answered to the entire satisfaction of all the teachers.

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<sup>1</sup>Burdette Ross Buckingham, Research For Teachers, (Chicago: Silver, Burdette and Company, 1926), p.336.

(2) Each question was answered satisfactorily by at least some of the pupils. (3) More than half of the pupils answered at least some of the questions satisfactorily."

2. Construction of Inventory Tests. In the construction of inventory tests the following steps should be observed.

a. Make a list of the important items which are to be covered in the course.

b. Convert these items into test questions of the new type.

c. Give the test on mimeographed sheets being careful to leave plenty of space for the answers.

3. Interpretation of Results. The results of the inventory test can best be interpreted by means of the diagnostic chart which will be explained later.

#### B. The Problems of the Present Study

The problems of this study are some that arose in the writer's school and are here stated together with some expected results of their study.

##### 1. Statement of the Problem.

a. Do teachers give semester marks on basis of improvement?

b. Do teachers give semester marks on basis of intelligence?

c. Do teachers give semester marks on basis of the grade on final test?

d. What is the relation between improvement in

knowledge and intelligence? Or in other words, do pupils improve in knowledge of a given course in proportion to their intelligence?

2. Results Expected From This Study. First this study was expected to result in

a. An improvement in teaching

(I) Since the teachers should get a clearer idea of the content of the course to be given if a careful outline and list of questions are made. These questions become a definite objective for the work of the semester.

(II) If only a few pupils are able to answer the questions satisfactorily after studying them for an entire semester it would be safe to assume that the work planned was too difficult. On the other hand, if nearly all pupils answered all the questions it would be evidence that the work was too easy.

(III) Improvement in test construction should be a result of this study. Questions answered by all pupils when the test is given at the beginning of the semester should be omitted when the test is reconstructed for use at the beginning of another semester.

(IV) The work of different teachers can be compared by comparing the relations existing between the semester marks given and the improvement in knowledge made by the pupils. A high correlation between teachers marks and improvement would indicate good teaching and grading, while a low positive, or a negative correlation would indicate poor teaching.

(V) By using the diagnostic chart the teacher can see at a glance what parts of the work need more emphasis.

Another thing expected as a result of this study is

b. A better basis for awarding semester marks.

Some teachers use semester marks to reward industry; others grade on basis of intelligence; others issue marks on the basis of grade on the final test; while still others grade on improvement. Each of these methods has its advocates. Which is the best?

## II. THE METHOD OF THE STUDY

### A. Procedure<sup>1</sup>

The procedure consisted of three parts; first, constructing, giving and scoring an inventory test; second, giving and scoring a final test; third, giving and scoring an intelligence test. Let us consider first

1. The Inventory Test. During the first month of school each teacher assisting in the study was required to prepare an inventory test covering the proposed work of the last three months of the semester. The test was to be a new-type test with no true-false items, and was to contain from fifty to two hundred items. The test was to be constructed as if it were the final test at the end of the semester. It was given to the pupils on the first day of the second month of school, scored immediately, and a diagnostic chart prepared according to instructions.<sup>2</sup>

The next part of the procedure was

2. The Final Test. On the last day of the semester the same test was given as a final test. The papers were scored and the results recorded on the chart with the scores made on the inventory test.

Finally, each pupil was given

3. An Intelligence Test. For this purpose the Otis Group Intelligence Scale, Form A was used.

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<sup>1</sup>For complete instructions given to the teachers see Appendix A.

<sup>2</sup>Ibid.

## B. Analysis of Test Results

The individual teachers made a careful analysis of the diagnostic charts which they had prepared and collected all the data in tables.<sup>1</sup> The writer analysed the data in the tables in an effort to obtain answers to the questions stated in the Introduction.

1. Analysis Made By the Teacher. The diagnostic chart prepared using the scores of the inventory test revealed the parts of the course which needed the most attention. With this in mind each teacher planned the remainder of the course. After the final test was given and the scores posted each teacher could see just where their work had been successful and where it had been a failure by noting which items had been answered by the pupils and which ones had been missed. For instance, if any items were missed by all or nearly all pupils on the final test it would be safe to assume that either they were too difficult or the teaching had been poor.

2. Analysis Made By The Writer. The writer figured the correlation between: a. gains in scores and semester marks, b. scores on final test and semester marks, c. intelligence test percentiles and semester marks, and d. gains in scores and intelligence test percentiles. The correlations for each of the twelve courses covered by the study were arranged in Table III and conclusions drawn from a study of the table.

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<sup>1</sup>For tables of original data see Appendix B.

### C. Subjects of The Study

The pupils tested were all in the Bowling Green, Indiana School. The classes were the first, second, third, fourth, seventh and eighth year arithmetic classes; the ninth and tenth year Latin classes; the tenth year English class; the ninth year algebra class; the tenth year history class, and the twelfth year economics class.



### III. THE INVENTORY TESTS AND THE DIAGNOSTIC CHARTS

#### A. A Discussion of The Results of The Inventory Tests

Course Number I was twelfth year economics. A graph of the inventory test showed the following distribution of scores.

Pupils

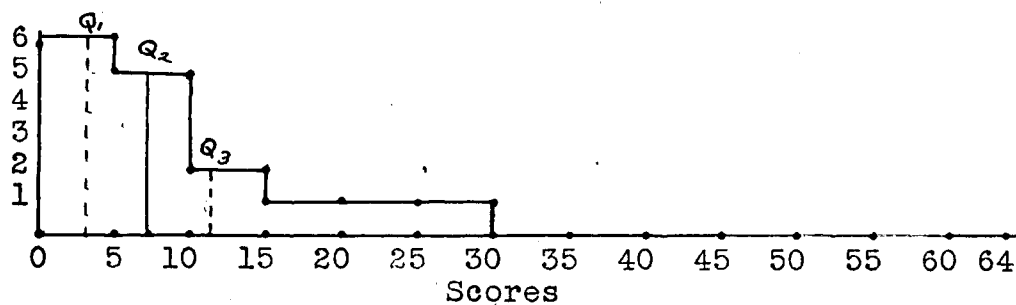


Figure 1. Distribution of scores on the inventory test for Course I<sup>1</sup>.

For this distribution  $Q_1$  is  $3\frac{1}{4}$ ,  $Q_2$  is  $7\frac{1}{4}$ , and  $Q_3$  is  $11\frac{1}{4}$ . No pupils answered as many as half of the items correctly and the median is about one ninth of the total score.

The pupil who made the high score was the honor pupil of the school. This distribution with the scores grouped at the lower end is just what should be expected in the distribution of scores on an inventory test.

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<sup>1</sup>Original data for this and all following figures will be found in Appendix B.

Course Number II was a course in general history. This course was given to all the pupils in the tenth and eleventh years. A graph of the inventory test showed the following distribution of scores.

Pupils

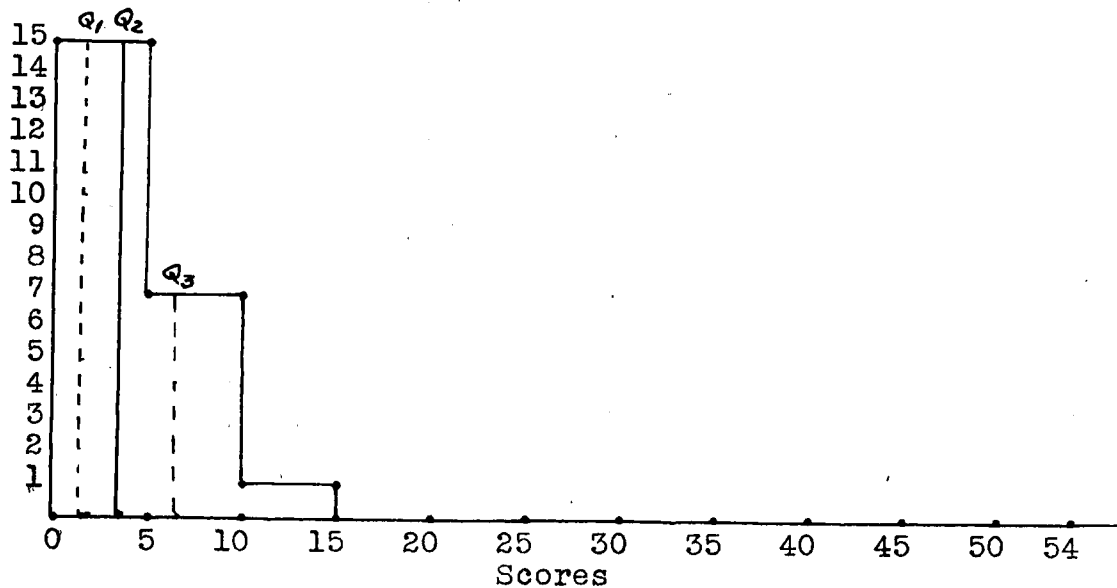


Figure 2. Distribution of scores on the inventory test for Course II.

For this distribution  $Q_1$  is  $1\frac{3}{4}$ ,  $Q_2$  is  $3\frac{3}{4}$ , and  $Q_3$  is  $6\frac{1}{2}$ . Since the highest score was 12 no one answered correctly as many as one fourth of the items and the median is about one fifteenth of the total. Evidently these pupils knew little about the course they were to study.

Course Number III was ninth year algebra. Some of the pupils taking this course were tenth year pupils; some had come from country schools; and some were from the local eighth grade where some algebra was taught. A graph of the inventory test showed the following distribution of scores.

Pupils

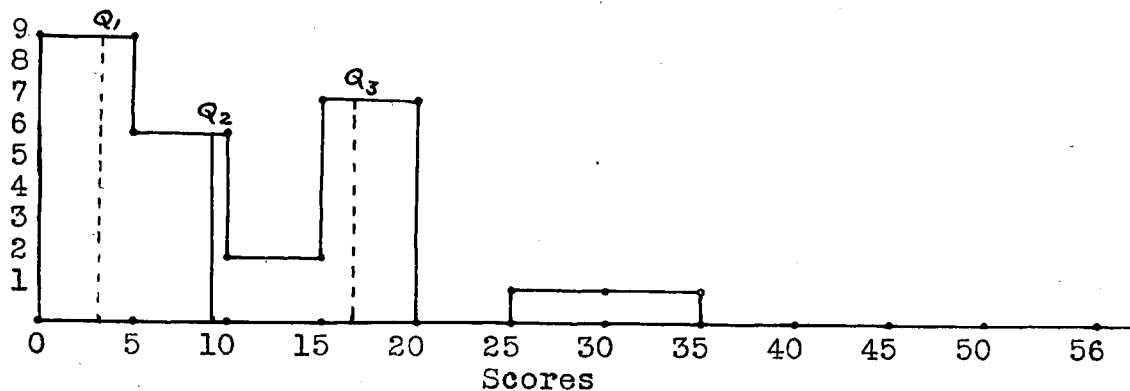


Figure 3. Distribution of scores on the inventory test for Course III.

For this distribution  $Q_1$  is  $3\frac{1}{2}$ ,  $Q_2$  is  $9\frac{1}{4}$ , and  $Q_3$  is  $16\frac{3}{4}$ . This distribution is not as good as the distribution shown in either Figure 1 or Figure 2, since one pupil answered half of the questions correctly. The median is about one sixth of the total score.

Course Number IV was tenth year English. A graph of the inventory test showed the following distribution of scores.

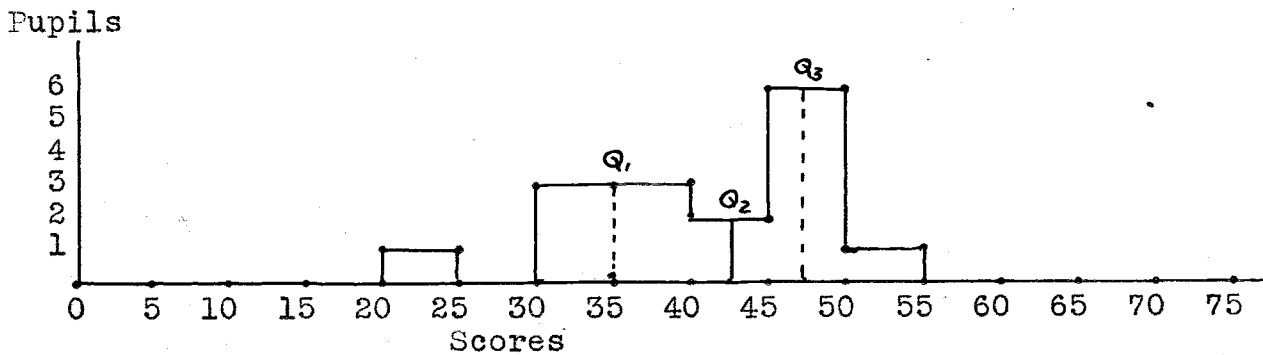


Figure 4. Distribution of scores on the inventory test for Course IV.

This distribution is not such as one would expect from the scores on an inventory test.  $Q_1$  is 35 which means that three fourths of the pupils answered nearly half of the items correctly.  $Q_2$  is  $42\frac{1}{4}$ , much more than half of the total number of items.  $Q_3$  is  $47\frac{1}{4}$ . Apparently this test was too easy, or it contained too many review items. However it would be rather difficult to make an English test that did not contain many review items.

Course Number V was ninth year Latin. This is a subject about which the pupils had no previous knowledge. A graph of the inventory test showed the following distribution of scores.

Pupils

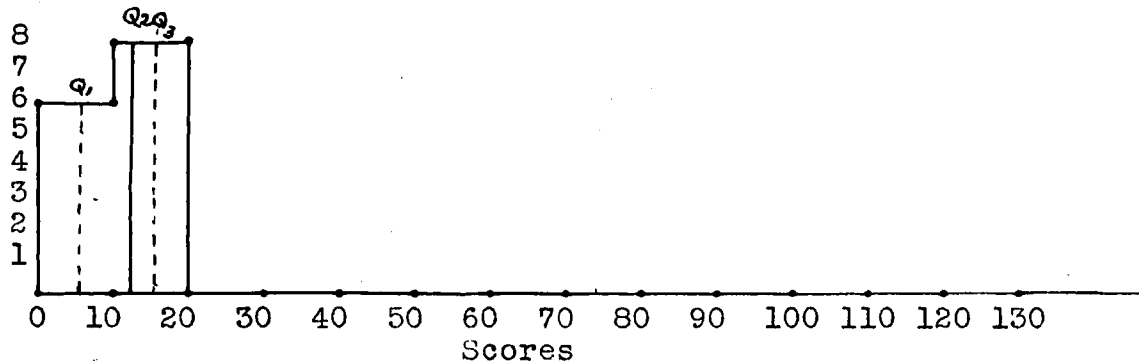


Figure 5. Distribution of scores on the inventory test for Course V.

For this distribution  $Q_1$  is  $5\frac{3}{4}$ ,  $Q_2$  is  $12\frac{1}{4}$ , and  $Q_3$  is  $15\frac{1}{2}$ . The median is less than one tenth of the total, while the highest score is less than one sixth of the total.

Course Number VI was tenth year Latin. The graph of the inventory test showed the following distribution of scores.

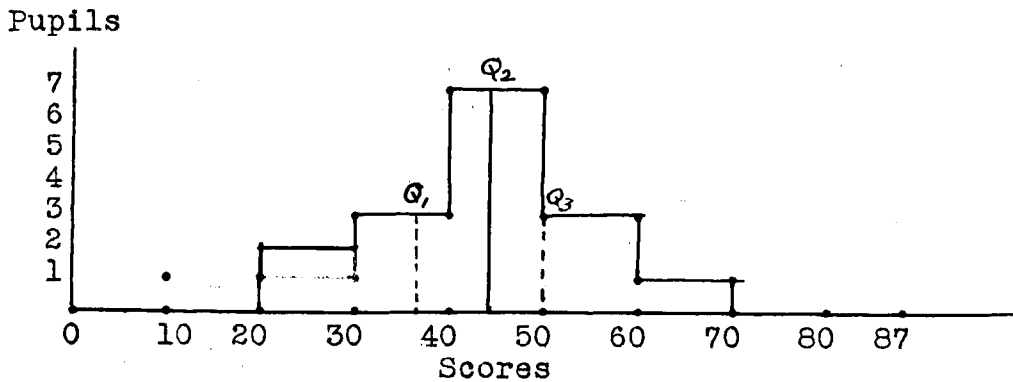


Figure 6. Distribution of scores on the inventory test for Course VI.

For this distribution  $Q_1$  is 37, nearly half the total score.  $Q_2$  is  $44\frac{1}{4}$ , over half the total.  $Q_3$  is 50. This is almost a normal distribution. Had this test been given as a final examination for ninth year students this distribution would have been good. However the test is too easy for an inventory test for tenth year Latin.

Course Number VII was seventh grade arithmetic. The intelligence test percentiles of this class range from seven percent to eighty nine percent. A graph of the inventory test showed the following distribution of scores.

Pupils

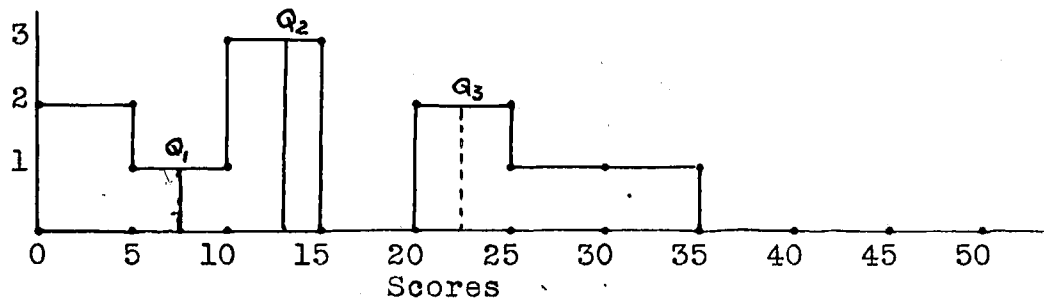


Figure 7. Distribution of scores on the inventory test for Course VII.

For this distribution  $Q_1$  is  $7\frac{1}{2}$ ,  $Q_2$  is  $13\frac{1}{4}$  and  $Q_3$  is  $22\frac{1}{2}$ . The scores are widely scattered, the highest being over half the total. The median is over one fourth of the total. This is the poorest distribution considered so far in this study.

Course Number VIII was eighth grade arithmetic.

A graph of the inventory test showed the following distribution of scores.

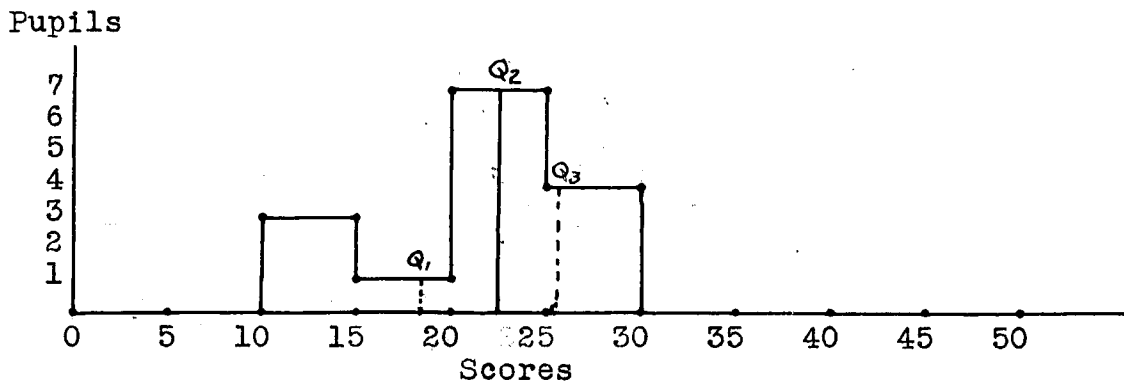


Figure 8. Distribution of scores on the inventory test for Course VIII.

For this distribution  $Q_1$  is  $18\frac{3}{4}$ ,  $Q_2$  is  $22\frac{1}{2}$  and  $Q_3$  is  $25\frac{1}{4}$ . The test must have been too easy for a final test since more than one fourth of the class made more than half the total score. The distribution of scores on this test is nearer normal than the distribution shown in Figure 7.



Course Number IX was fourth grade arithmetic. A graph of the inventory test showed the following distribution of scores.

Pupils

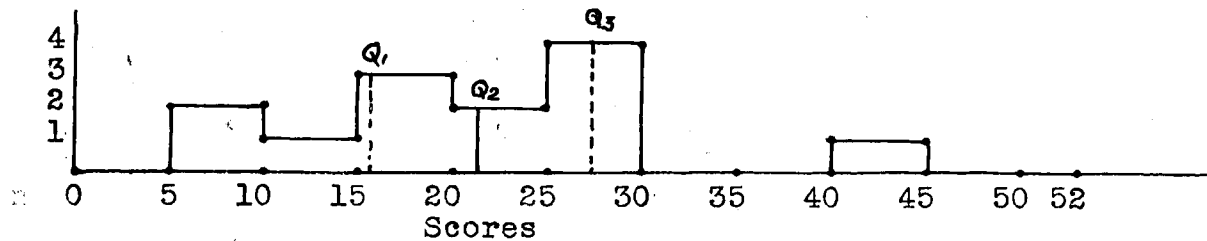


Figure 9. Distribution of scores on the inventory test for Course IX.

This distribution is very poor. The scatter is too wide, being eighty percent of the total score. More than one third of the class answered half or more of the questions correctly.  $Q_1$  is  $15\frac{3}{4}$ ,  $Q_2$  is  $21\frac{1}{4}$ , and  $Q_3$  is  $27\frac{1}{4}$ .

Course Number X was third grade arithmetic. This class was above the average in intelligence, only one pupil ranking below fifty percent. A graph of the inventory test showed the following distribution of scores.

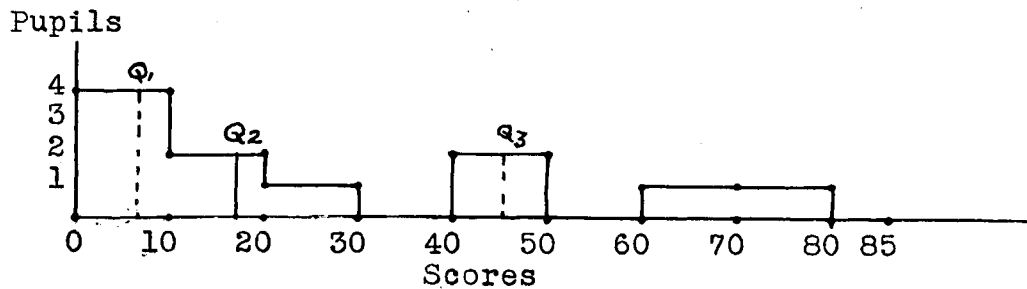


Figure 10. Distribution of scores on the inventory test for Course X.

For this distribution  $Q_1$  is 7,  $Q_2$  is  $17\frac{1}{2}$ , and  $Q_3$  is  $46\frac{1}{2}$ . This is a very wide scatter, including nearly ninety percent of the total range possible. If the test is a valid one, surely the two pupils at the top wasted their time by taking the course. It is more than likely that the test was much too easy.

Course Number XI was second grade arithmetic. A graph of the inventory test showed the following distribution of scores.

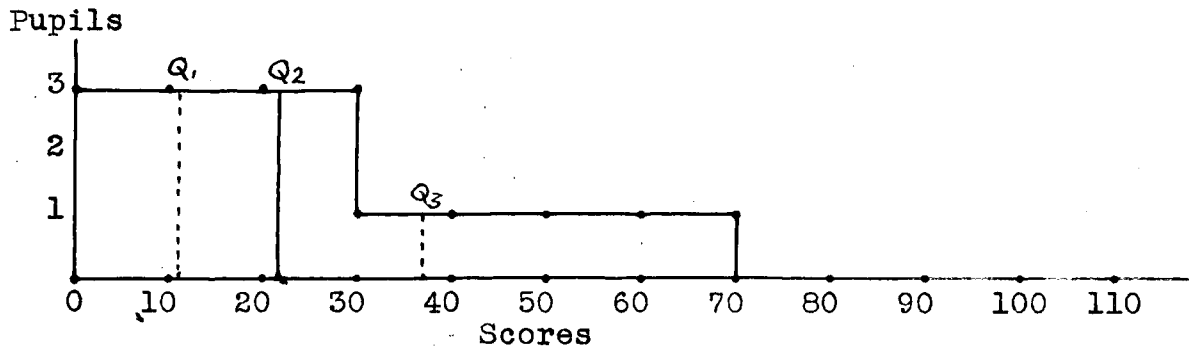


Figure 11. Distribution of scores on the inventory test for Course XI.

This distribution is fair for the distribution of scores on an inventory test. The grades are bunched at the bottom of the score which is what we should expect in this kind of test.  $Q_1$  is  $10\frac{3}{4}$ ,  $Q_2$  is  $21\frac{1}{2}$ , and  $Q_3$  is  $37\frac{1}{2}$ . Though the scatter is too wide, yet the median is less than twenty percent of the total.

Course Number XII was first grade arithmetic. The class taking this course contained only seven pupils; therefore any conclusions drawn from this graph are of questionable value. A graph of the inventory test showed the following distribution of scores.

Pupils

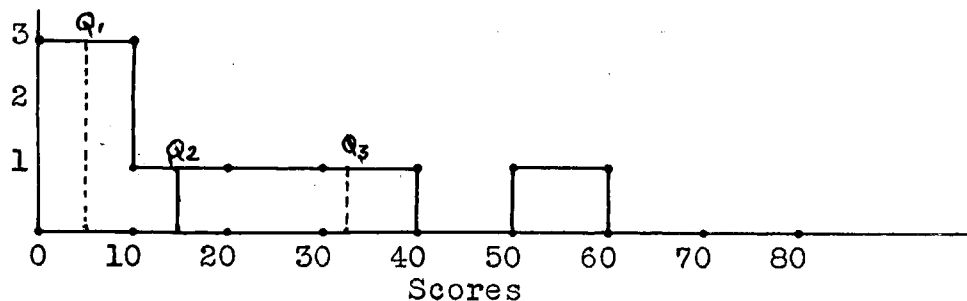


Figure 12. Distribution of scores on the inventory test for Course XII.

For this distribution  $Q_1$  is  $5\frac{1}{2}$ ,  $Q_2$  is 15, and  $Q_3$  is  $32\frac{1}{2}$ . The scatter is very wide, but the most scores are at the bottom.

Table I on the next page gives a summary of these twelve figures. An examination of this table will reveal the fact that the tests for Courses IV, VI, VIII and IX have medians near the center of the total score. The median should be located near the center of the score on the final test to enable the upper half of the class to scatter as much as the lower half. For this reason these four medians are too high for an inventory test.

TABLE I

THE LOCATION OF THE QUARTILE POINTS AND THE  
 QUARTILE DEVIATION FOR THE INVENTORY TEST  
 ALL EXPRESSED IN PERCENTAGES OF THE  
 HIGHEST POSSIBLE SCORE

Course No.	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	Q
I	5	11	18	6½
II	3	7	12	4½
III	6	12	30	12
IV	47	57	64	8½
V	4	10	12	4
VI	43	52	58	7½
VII	15	27	45	15
VIII	37	45	50	6½
IX	30	41	52	11
X	8	21	54	23
XI	10	19	37	13½
XII	10	19	41	17

B. A discussion of the Inventory Test Results Shown by  
the Diagnostic Chart

The diagnostic charts were so large that only one is included in this paper. Appendix C contains the chart and the list of questions used in Course I. They were to be used by the teacher in planning the semester's work and did not directly concern the major questions of this study. The results shown by these charts are discussed under two headings.

1. Items Answered Correctly By Few or No Pupils.

As was expected there were many items in the various tests which were answered by few or no students. It is evident that these are the items in which the class needs instruction provided they represent valid objects.

2. Items Answered Correctly By All or Nearly All Pupils.

Many items were answered correctly by all or nearly all the pupils. Just one case will be discussed. In the algebra test one question was, "State the formula for finding the interest when the rate, time and principal are given." Out of twenty two students sixteen answered correctly. Five of the six who failed were from one room country schools and all stated they had never heard the word formula and did not know what it meant. A word of explanation on the part of the teacher removed this difficulty. This is evidence that even questions that were answered by almost all pupils have some value.

C. Conclusions

1. Concerning the position of the median. A high median might indicate that the proposed course contained

too much material included in a previous course, in other words it was too much of a review. It might also indicate that the items of the test were too easy. In the test on English X, Course IV, the median was more than half of the total score. An examination of the items in the test revealed the fact that many of them were covered in the previous year's work. Since this was for the most part a course in English composition which of necessity contains many items of review this is about what should be expected.

A low median might indicate that the proposed course was not a review of a prerequisite course. It might also indicate that the test was too difficult. In the test on Course V the median was ten percent of the total score. This course was Latin I. In the test on Course II the median was only seven percent of the total score. This course was algebra I.

2. Concerning Changes in the Test. Items answered by all the students should be omitted before the test is used again as an inventory test, unless they concerned some very important point in the course.

IV. THE FINAL TEST

The final test will now be considered by discussing its results, comparing its results with those of the inventory test, and last drawing some conclusions.

A. A Discussion of the Results of the Final Test.

With very few exceptions the pupils made a much better score on the final test than on the inventory test. It must be kept in mind that this was exactly the same test that was given in the beginning. We will consider first

1. The Gain Made in the Median and Quartile Points With Some Probable Reasons for the Various Degrees of Advancement. This advancement is shown in the following diagrams which show both tests at once. The final test is in red.

Course Number I was twelfth year economics. The following figure shows the distributions for both tests.

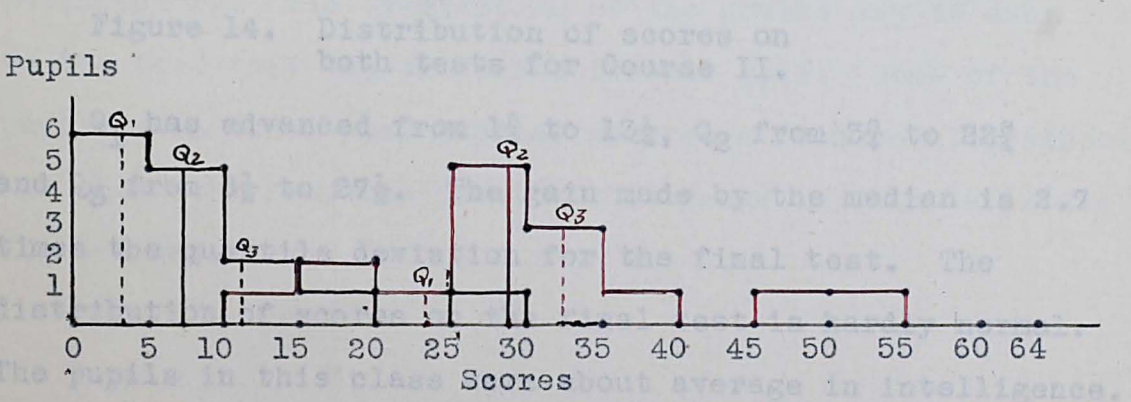


Figure 13. Distribution of scores on both tests for Course I.

Q1 has advanced from 3 1/4 to 23 3/4, Q2 from 7 1/4 to 29 and Q3 from 11 1/4 to 32 1/4. The gain made by the median is 5.1 times the quartile deviation for the final test. The red graph shows almost a normal distribution. Since these were



older pupils many of them had some knowledge of the subject matter of this course before taking the course. This fact would explain the overlapping.

Course Number II was a course in general history. The following figure shows the distributions for both tests.

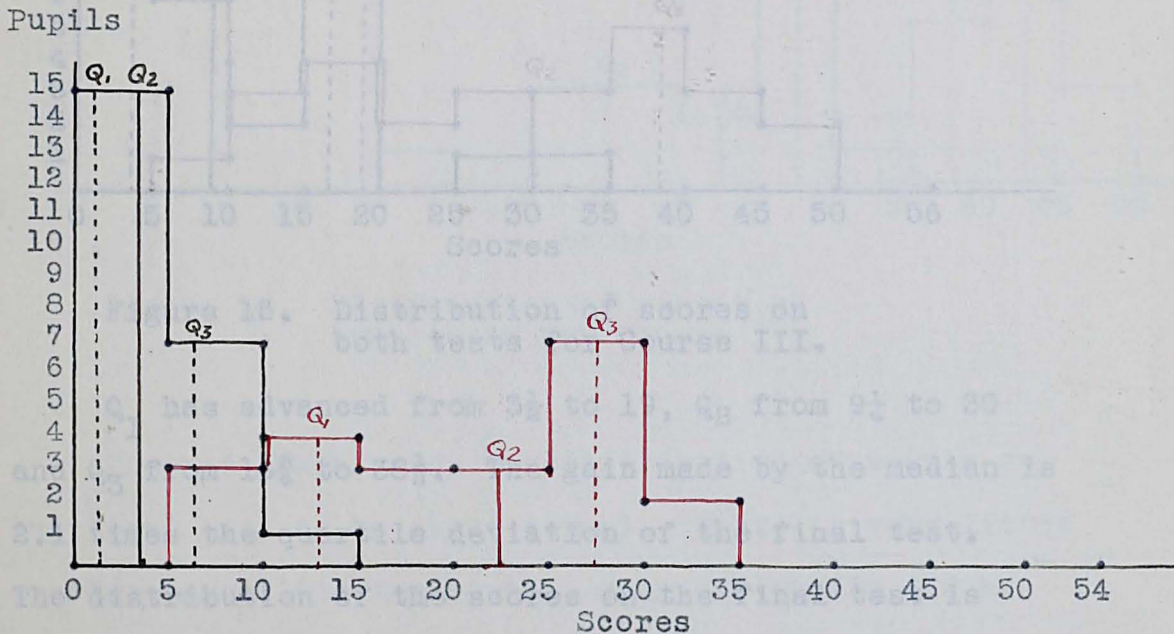


Figure 14. Distribution of scores on both tests for Course II.

$Q_1$  has advanced from  $1\frac{3}{4}$  to  $13\frac{1}{4}$ ,  $Q_2$  from  $3\frac{3}{4}$  to  $22\frac{3}{4}$  and  $Q_3$  from  $6\frac{1}{2}$  to  $27\frac{1}{2}$ . The gain made by the median is 2.7 times the quartile deviation for the final test. The distribution of scores on the final test is hardly normal. The pupils in this class were about average in intelligence. Seven pupils did no better on the final test than one did on the first test. This overlapping might be explained by the fact that the Junior pupils in this class had already studied U. S. History in the high school while the tenth year pupils had not.

Course Number III was ninth year algebra. The following figure shows the distributions for both tests.

Pupils

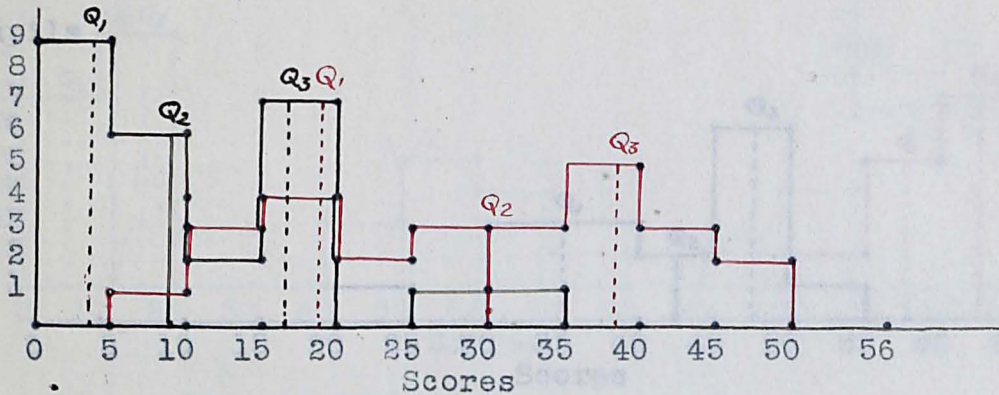


Figure 15. Distribution of scores on both tests for Course III.

$Q_1$  has advanced from  $3\frac{1}{2}$  to 19,  $Q_2$  from  $9\frac{1}{4}$  to 30 and  $Q_3$  from  $16\frac{3}{4}$  to  $38\frac{1}{2}$ . The gain made by the median is 2.1 times the quartile deviation of the final test. The distribution of the scores on the final test is satisfactory. The overlapping of the graphs may be due to the fact that the classification was poor. Some of the pupils were tenth year pupils, some were from country schools and some were from the local eighth grade in which a little algebra was taught. That the median on the first test was more than half the total score. This left less room for improvement.  $Q_1$  has gained 22 $\frac{1}{2}$  scores, which is 50 percent of the total score. Many of the easier items should have been left out of this test.

Course Number IV was tenth year English. Both Writing Composition and literature were studied during this semester. The following figure shows the distributions for both tests.

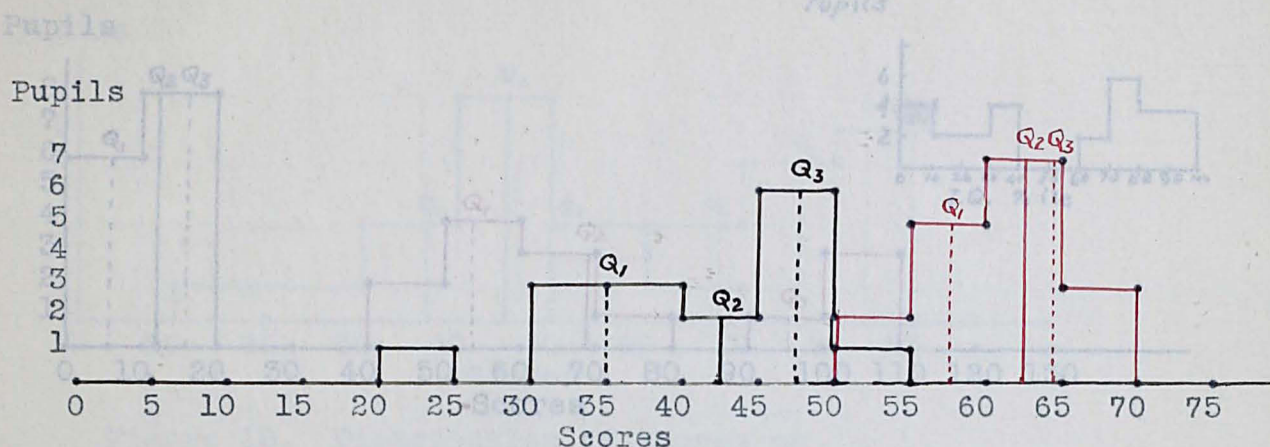


Figure 16. Distribution of scores on both tests for Course IV.

The red graph in this figure is a bi-modal curve.

A graph of the intelligence test percentiles as shown in inset shows this same kind of curve. Four pupils in the final test to be about normal. There is very little overlapping of the two tests. Only two pupils did as well on the final test as the best pupil did on the first test.  $Q_1$  has advanced from 35 to  $57\frac{1}{2}$ ,  $Q_2$  from  $42\frac{1}{2}$  to  $62\frac{1}{2}$ , and  $Q_3$  from  $47\frac{1}{2}$  to  $64\frac{1}{2}$ . The gain made by the median is 5.7 times the quartile deviation for the final test. There is no overlapping of the two graphs, the highest score on the first test being less than half the lowest score on the final test. The high for improvement.  $Q_1$  has gained  $22\frac{1}{2}$  scores, which is 30 percent of gain is largely due to low scores on the initial test. Many of the easier items should have been left out of this test.

Course Number V was ninth year Latin. The following figure shows the distributions for both tests.

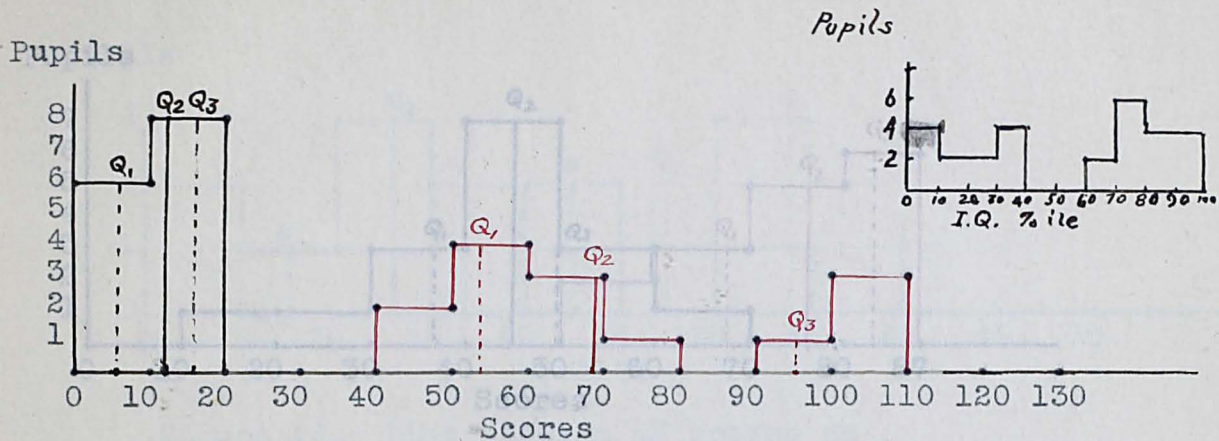


Figure 17. Distribution of scores on both tests for Course V.

The red graph in this figure is a bi-modal curve.

A graph of the intelligence test percentiles as shown in inset shows this same kind of curve. Four pupils in this class had high intelligence scores. These four pupils made the high scores on the final test. In this distribution  $Q_1$  has advanced from  $5\frac{3}{4}$  to  $53\frac{3}{4}$ ,  $Q_2$  from  $12\frac{1}{4}$  to  $69\frac{1}{2}$ , and  $Q_3$  from  $15\frac{1}{2}$  to 95. These are good increases. The gain made by the median is 2.7 times the quartile deviation for the final test. There is no overlapping of the two graphs, the highest score on the first test being less than half the lowest score on the final test. The high percentage of gain is largely due to low scores on the initial test.

Course Number VI was tenth year Latin. The following figure shows the distributions for both tests. both tests.

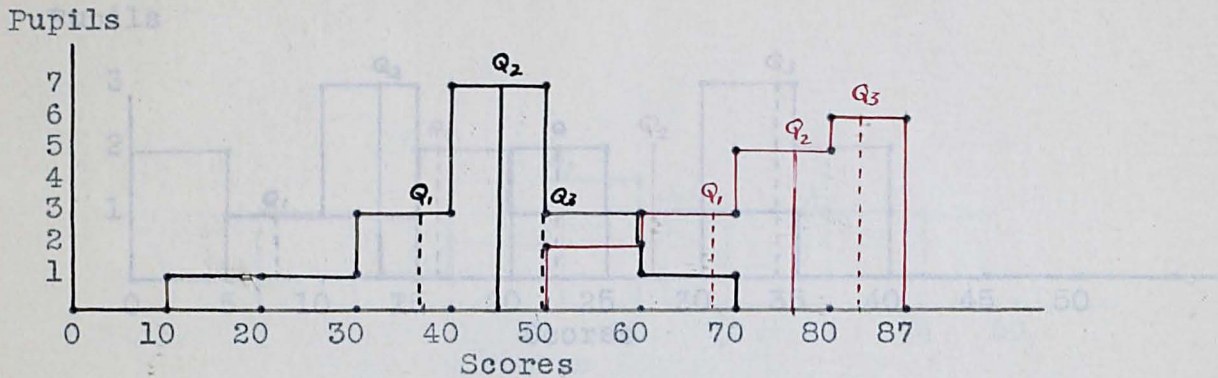


Figure 18. Distribution of scores on both tests for Course VI.

The pupils in this class were rather below the average in intelligence. Only one had an outstanding intelligence score. They had had sixth-grade arithmetic under two different teachers, nearly half of the class coming to this school from a country school which was abandoned. The distribution shown by the red graph is far from normal.  $Q_1$  has advanced from 37 to 67,  $Q_2$  from  $44\frac{1}{2}$  to 76, and  $Q_3$  from 50 to 83. The gain made by the median is 4 times the quartile deviation for the final test, in spite of the fact that the median was very high on the first test. There is also very much overlapping of the two tests. The gain made by the median is 1.6 times the quartile deviation for the final test. Only two pupils made a higher score on the final test than the highest score made on the first test. In spite of the poor classification and the low intelligence of the pupils in this class it must be concluded that there is something radically wrong with the test.

Course Number VII was seventh year arithmetic. The following figure shows the distributions for both tests.

Pupils

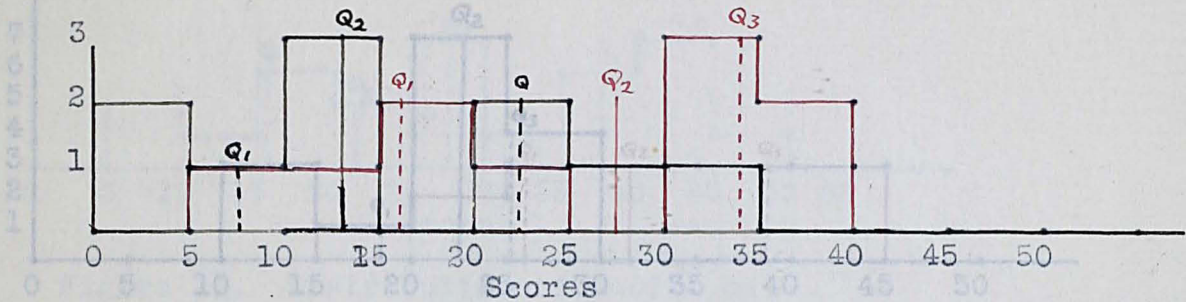


Figure 19. Distribution of scores on both tests for Course VII.

The pupils in this class were rather below the average in intelligence. Only one had an outstanding intelligence score. They had had sixth-grade arithmetic made more advancement than the poorer ones.  $Q_1$  has advanced under two different teachers, nearly half of the class coming to this school from a country school which was abandoned. The distribution shown by the red graph is far from normal.  $Q_1$  has advanced from  $7\frac{1}{2}$  to  $16\frac{1}{4}$ ,  $Q_2$  from  $13\frac{1}{4}$  to  $27\frac{1}{2}$  and  $Q_3$  from  $23\frac{1}{2}$  to 34. The gain made by the median is 1.6 times the quartile deviation for the final test. Only two pupils made a higher score on the final test than the highest score made on the first test. In spite of the poor classification and the low intelligence of the pupils in this class it must be concluded that there is something radically wrong with the test.

Course VIII was eighth grade arithmetic. The following figure shows the distributions for both tests.

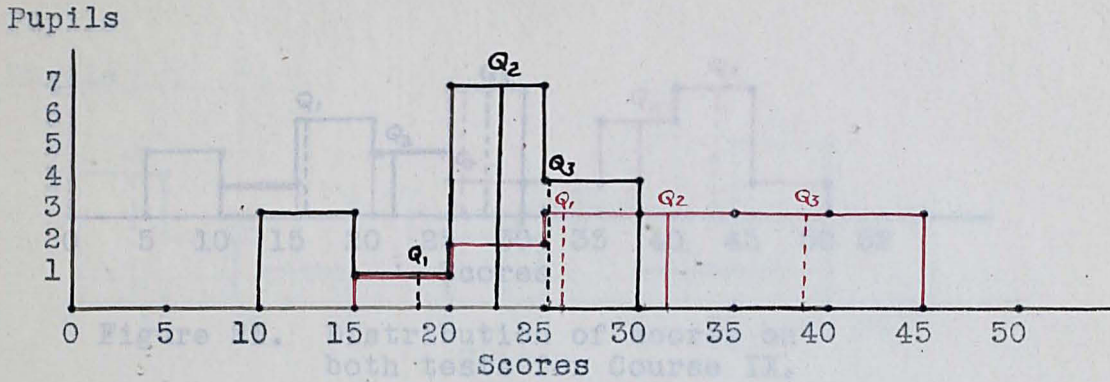


Figure 20. Distribution of scores on both tests for Course VIII.

The red graph in this figure shows a greater deviation than the black graph. This means that the better pupils made more advancement than the poorer ones.  $Q_1$  has advanced from  $18\frac{3}{4}$  to  $26\frac{1}{4}$ ,  $Q_2$  from  $22\frac{1}{2}$  to  $31\frac{3}{4}$  and  $Q_3$  from  $25\frac{1}{4}$  to  $38\frac{3}{4}$ . The gain made by the median is 1.5 times the quartile deviation for the final test. This is very low, however had the ten easiest items been eliminated the gain would have been higher. There is also much overlapping.

Course Number IX was fourth grade arithmetic. The following figure shows the distributions for both tests. following figure shows the distributions for both tests.

Pupils

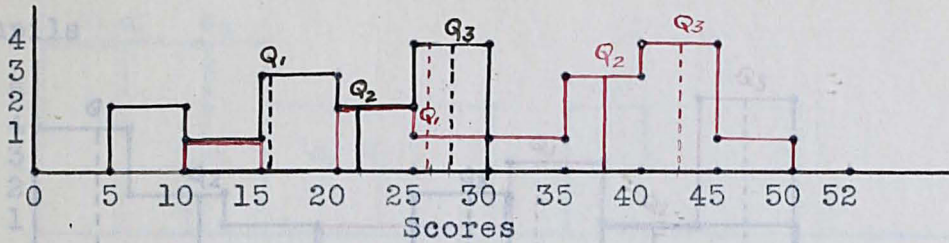


Figure 21. Distribution of scores on both tests for Course IX.

The distribution is poor in both these tests. The scatter is also too great, being eighty percent of the total score in the final distribution. The gain made by the median is 2 times the quartile deviation for the final test.  $Q_1$  has advanced from  $15\frac{3}{4}$  to  $26\frac{1}{4}$ ,  $Q_2$  from  $21\frac{1}{2}$  to  $37\frac{1}{2}$  and  $Q_3$  from  $27\frac{1}{4}$  to  $42\frac{1}{4}$ . The better pupils gained more than the poorer ones. This class was above the average in intelligence with the exception of one pupil who was subnormal. The one low grade on the final test was made by a pupil who was angry at the teacher and did not try.



Course Number X was third grade arithmetic. This class was much above the average in intelligence. The following figure shows the distributions for both tests.

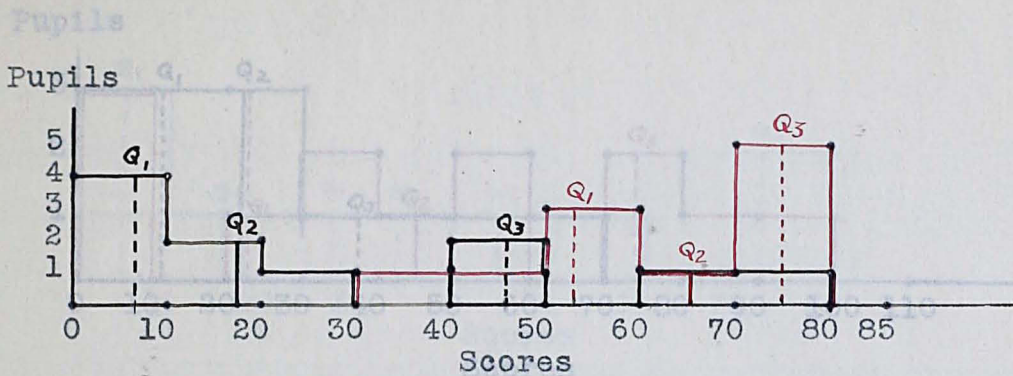


Figure 22. Distribution of scores on both tests for Course X.

This was entirely too easy since a score near the top was made on the first test.  $Q_1$  has advanced from 7 to  $52\frac{1}{2}$ ,  $Q_2$  from  $17\frac{1}{2}$  to 65 and  $Q_3$  from  $46\frac{1}{4}$  to  $74\frac{1}{2}$ . This is a good improvement. The gain made by the median is 4.3 times the quartile deviation for the final test. The two pupils at the top on the first test have made little improvement. If the test is a valid one they might just as well have been promoted at the beginning of the semester. Had this been done the test might not have appeared too easy. The gain made by the median is .9 times the quartile deviation of the final test.

Course XI was second grade arithmetic. The following figure shows the distributions for both tests.

Pupils

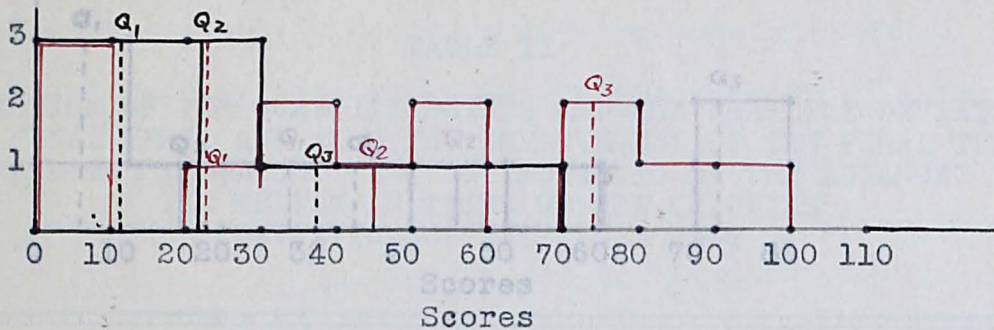


Figure 24. Distribution of scores on  
Figure 23. Distribution of scores on  
both tests for Course XI.

The red graph indicates very poor distribution. The scores for the test are scattered along the entire scale. However the improvement was fair.  $Q_1$  has advanced from 10 $\frac{1}{2}$  to 22 $\frac{1}{2}$ ,  $Q_2$  from 21 $\frac{1}{2}$  to 45 and  $Q_3$  from 37 $\frac{1}{2}$  to 73 $\frac{3}{4}$ . The gain made by the median is 1.3 times the quartile deviation of the final test. They were above average in intelligence but had attended a one room country school the previous year and had had very little arithmetic.

$Q_1$  has advanced from 10 $\frac{1}{2}$  to 22 $\frac{1}{2}$ ,  $Q_2$  from 21 $\frac{1}{2}$  to 45 and  $Q_3$  from 37 $\frac{1}{2}$  to 73 $\frac{3}{4}$ . The gain made by the median is .9 times the quartile deviation of the final test.

Course XII was first grade arithmetic. The following figure shows the distributions for both tests.

Pupils

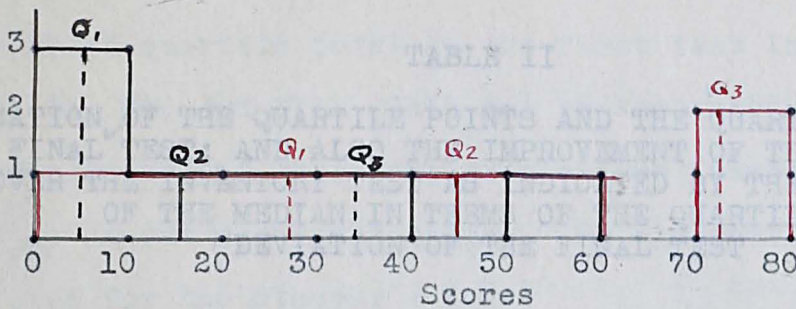


Figure 24. Distribution of scores on both tests for Course XII.

The red graph indicates very poor distribution. The scores for the test are scattered along the entire scale. However the improvement was fair.  $Q_1$  has advanced from  $5\frac{1}{2}$  to  $27\frac{1}{2}$ ,  $Q_2$  from 15 to 45 and  $Q_3$  from  $32\frac{1}{2}$  to  $72\frac{1}{2}$ . The gain made by the median is 1.3 times the quartile deviation for the final test.

	(1)	(2)	(3)	(4)	(5)	(6)
						Imp. in Q's
VII	10	27	54	9		1.6
VIII	20	31	38	8		1.5
IX	26	37	42	6		2
X	33	55	74	11		4.3
XI	23	45	75	25		.9
XII	27	45	72	22		1.3

TABLE II

THE LOCATION OF THE QUARTILE POINTS AND THE QUARTILE DEVIATION FOR THE FINAL TEST; AND ALSO THE IMPROVEMENT OF THE FINAL TEST OVER THE INVENTORY TEST AS INDICATED BY THE ADVANCE OF THE MEDIAN IN TERMS OF THE QUARTILE DEVIATION OF THE FINAL TEST

Course No.	$Q_1$	$Q_2$	$Q_3$	$Q$	Imp. in Q's
(1)	(2)	(3)	(4)	(5)	(6)
I	$23\frac{3}{4}$	29	$32\frac{1}{4}$	$4\frac{1}{4}$	5.1
II	$13\frac{1}{4}$	$22\frac{3}{4}$	$27\frac{1}{2}$	7	2.7
III	19	30	$38\frac{1}{2}$	$9\frac{3}{4}$	2.1
IV	$57\frac{1}{2}$	$62\frac{1}{2}$	$64\frac{1}{2}$	$3\frac{1}{2}$	5.7
V	$53\frac{3}{4}$	$69\frac{1}{4}$	95	$20\frac{3}{4}$	2.7
VI	67	76	83	8	4
VII	$16\frac{1}{4}$	$27\frac{1}{2}$	34	9	1.6
VIII	$26\frac{1}{4}$	$31\frac{3}{4}$	$38\frac{3}{4}$	$6\frac{1}{4}$	1.5
IX	$26\frac{1}{4}$	$37\frac{1}{2}$	$42\frac{1}{4}$	8	2
X	$52\frac{1}{2}$	65	$74\frac{1}{4}$	11	4.3
XI	$22\frac{1}{2}$	45	$73\frac{3}{4}$	$25\frac{1}{2}$	.9
XII	$27\frac{1}{2}$	45	$72\frac{1}{2}$	$22\frac{1}{2}$	1.3

Table II on the preceding page contains a summary of the data of the last twelve figures. A comparison of column (2) of this Table with column (4) of Table I shows that the first quartile point on the last test was below the third quartile point on the first test in Courses VII, IX, XI, and XII. This can be accounted for in Course XI since some of those children had no foundation in arithmetic as was mentioned before. No explanation has been offered for the others.

A discussion of Table II will also show that Courses I, IV, VI, and X are outstanding in improvement while Courses VII, VIII, XI, and XII show the least improvement. Course IV shows three times the improvement of Course XI. The test for Course VIII may have been too easy since the median was near the center of the total score on the first test. The poor improvement for Course XI has been explained before.

Before the teacher of any particular course is blamed for the lack of improvement as shown by the advance of the median the diagnostic chart should be examined to see if many items were answered correctly by all pupils. Better test construction by leaving out these items would have indicated a higher rate of improvement. The higher the median on the first test the less opportunity remains for improvement.

A study of Table II, Column (5) shows that the final test on Course IV has the lowest deviation, four and one half percent of the total score, while the test for Course XII has a deviation of twenty-eight and one half percent.

Course XII was primary arithmetic and there were only seven pupils who took both tests therefore that data from that course would be unreliable at the best. This leaves Course XI with a quartile deviation of twenty-three per cent as really the greatest.

2. The Diagnostic Chart After The Results of The Final Test Had Been Posted. The results of the final test were posted on the same chart with the results of the inventory test, using a different colored pencil. After a study of these charts it was decided that the items answered correctly by few or no pupils on the last test were either too difficult, or poorly stated, or the teaching had been inadequate. The teachers were instructed to correct the wording of the poorly stated items, to leave out most of the items which were too difficult, and to do more careful teaching in order that they might get better results in the next semester's work in these same subjects.

When the original plans were made the directions were that the same plans were to be followed in the second semester without thinking that the same test could not be used until the next year since none of our courses are repeated in consecutive semesters. The writer was not connected with the same school the following year and the study was discontinued. Consequently no data are available showing that the study resulted in improvement in teaching.

#### B. Relationships

As soon as the second test was scored the tables of data in Appendix B were prepared. From these data various simple correlations were computed and are presented

in the following table.

TABLE III

CORRELATION BETWEEN SEMESTER MARKS AND GAINS IN SCORES,  
BETWEEN SEMESTER MARKS AND INTELLIGENCE SCORE PER-  
CENTILES, BETWEEN SEMESTER MARKS AND SCORE ON  
FINAL TEST, AND BETWEEN THE GAINS IN  
SCORES AND INTELLIGENCE  
SCORE PERCENTILES

Course No.	Marks and Gains	Marks and Intel.	Marks and Scores	Gains and Intel.
(1)	(2)	(3)	(4)	(5)
I	.18	.39	.47	.37
II	.79	.69	.88	.33
III	.69	.72	.85	.48
IV	-.49	.80	.60	-.43
V	.59	.98	.74	.64
VI	.22	.43	.67	.04
VII	.02	.49	.81	.43
VIII	.63	.78	.71	.51
IX	.30	.24	.78	.34
X	-.49	.21	.86	-.24
XI	.65	.29	.96	.31
XII	.89	.15	.67	.04

Since Probable Error is so greatly effected by the number of cases it would be a waste of time in this study to compute the P. E. 's for the correlations.

### 1. Relationships Between Marks and Gains in Scores.

From Table III on the previous page this coefficient of correlations is found to vary from  $-.49$  to  $.89$ . Courses IV and X, tenth year English and third year arithmetic, show a negative correlation. Table II shows that Course X made high improvement yet the teacher gave marks almost, one might say, on basis of lack of improvement. However six of the twelve courses show a correlation above  $.50$ . Course XII, first grade arithmetic, shows a correlation of  $+.89$  and this is the only course in which this column shows the highest result. Therefore this teacher is the only one who has given grades on basis of improvement rather than intelligence scores or scores on the final test.

### 2. Relationship Between Semester Marks and Intelligence.

From Table III this coefficient of correlation is found to vary from  $.14$  to  $.87$ . Five courses in all had correlations higher than  $.50$ . In Course IV, tenth year English, there is a peculiar condition. The correlation between semester marks and intelligence scores is a  $.80$  while that between gains in scores and intelligence scores is  $-.43$ , and that between gains in scores and semester marks is  $-.49$ .

Undoubtedly this teacher did not give marks on basis of improvement. Courses IV, V and VIII, tenth year English, ninth year Latin and eighth year arithmetic respectively, show a higher correlation in column (3) than either of the other columns. This would indicate that these teachers issued marks on basis of intelligence rather than gains in scores or scores on final test.



3. Relationship Between Semester Marks and Scores on Final Test. The coefficients of correlation in column (4) were higher as a rule than those in either of the other columns. .47 was the lowest; all the rest were .60 or above, the highest being .96. Course I, senior economics; Course II, general history; Course III, ninth year algebra; Course VI, tenth year Latin; Course VII, seventh grade arithmetic; Course IX, fourth grade arithmetic; Course X, third grade arithmetic and Course XI, second grade arithmetic show higher correlations in this column than either of the others. This would seem to indicate that the teacher of these Courses issued semester marks on basis of scores on final test rather than gains in scores or intelligence scores.

4. Relationship Between Gains in Scores and Intelligence Scores. Table III shows that the most intelligent pupils do not always make the greatest improvement in their work. Course IV, tenth year English and Course X, third grade arithmetic show a negative correlation between gains in scores and intelligence scores; and Course VI, tenth year Latin and Course XII, first grade arithmetic have correlations so near zero that they can be considered zero. Only two courses have correlations above .50, the highest being only .64. Course X, third grade arithmetic with a correlation of  $-.24$  shows an improvement of 4.3 Q's in Table II, Page 35. This must mean that the less intelligent pupils in this class did good work. Since correlation between teacher's marks and gains in scores for this course was a  $-.49$  it seems that their good work was

not rewarded by high marks.

5. Relationship Between General Scholarship Ratings of All High School Pupils and Intelligence Scores. In an effort to get more evidence on the relationship between teacher's marks and intelligence scores the general scholarship ratings of all the pupils in the high school was correlated with their intelligence percentiles and the result was found to be .47. Compared with the results in Table II this is rather high, only three of the twelve courses showing a higher correlation than column (3). This might mean that the more intelligent pupils received high marks just because they were intelligent, or it might mean that because they were more intelligent they made the most improvement, or that because they were more intelligent they made better grades on the final test and therefore received higher marks. Since Table III disclosed that most of our teachers issue marks according to the score on final test the latter supposition seems more likely.

### C. Conclusions

1. A study of the diagnostic chart enabled the teacher to see where he had failed.
2. If the median score of the final test is only a little higher than the median score on the inventory test the test should be reconstructed before using again, and the teacher should be more careful in his teaching!
3. Teachers consider the grade on the final test as more important in determining semester marks than either intelligence or improvement.

4. There is a fairly high correlation between general scholarship and intelligence of the high school pupils tested.

## V. SUMMARY

This section contains a statement of the problems of this study with probable answers together with some results of the study and some suggestions for further study.

### A. Answers To The Original Questions

1. Do teachers give semester marks on basis of improvement? The evidence of this study is that they do so in only one case out of twelve. (See Page 39, 1)

2. Do teachers give semester marks on basis of intelligence? The evidence is not so clear here. In three of the twelve sections of this study the correlation between semester marks and intelligence score percentiles was higher than the correlation of marks with scores on final test. In eight of the sections the correlation of marks with intelligence score percentiles was higher than the correlation of marks with gains in scores. Thus in three cases out of twelve teachers assign marks according to intelligence and in eight cases out of twelve the marks are based on intelligence rather than improvement.

3. Do teachers give semester marks on basis of score on final test? The evidence here is that they do so in eight cases out of twelve.

4. What is the relation between improvement in knowledge and intelligence? In this study it was found to be negative in two cases out of twelve, near zero in two cases out of twelve and varying from .31 to .64 in eight cases out of twelve.

B. Were the Original Objectives Realized?

1. An Improvement in Teaching. There was no statistical evidence to answer this question but the teachers taking part in this study agreed that:

a. They had a clearer idea of the content of the courses.

b. They gained some knowledge about test construction.

c. The tables and diagrams were valuable in comparing each other's work.

d. That a diagnostic chart was a valuable device to detect poor test construction and poor teaching.

2. A Better Basis For Awarding Semester Marks.

It was agreed that although achievement scores were valuable in making semester marks yet too much consideration had been given scores on the final test by the teachers taking part in this study.

C. Suggestions For Future Study

If similar studies could be carried on in a few large schools using classes of twenty or more pupils the results would be much more reliable. More valid conclusions could be drawn if well selected standardized tests had been used in addition to the tests prepared by the teachers. This would enable one to judge the value of the teacher's test, the gain in achievement, and the efficiency of the pupils.

IV. APPENDIX

A. Instructions to Teachers

PLANS FOR A STUDY OF PUPIL ACHIEVEMENT  
IN THE CONTENT OF COURSES  
OFFERED IN THE SCHOOLS OF  
WASHINGTON TOWNSHIP CLAY COUNTY INDIANA

CONTENTS

PART I	PURPOSE AND PLAN
PART II	SUGGESTIONS
PART III	SAMPLE OBJECTIVE TESTS
PART IV	DIAGNOSTIC CHART

STUDY CONDUCTED BY CHARLES WOOLLARD

UNDER THE DIRECTION OF

J. W. JONES DIRECTOR

DIVISION OF RESEARCH

INDIANA STATE NORMAL SCHOOL

## Part I. PURPOSE AND PLAN

It is our hope and intention that this study will have the following results:

1. An improvement in teaching
2. A clearer idea on the part of the teacher of the content of the various courses.
3. A better adaptation of the courses to the student's capacity.
4. An improvement in test construction.
5. A comparison may be made of the work of different teachers.
6. An accurate check on his own work may be made by each teacher by means of the diagnostic chart.

### Plan

1. Sometime in the first month of school each grade teacher teaching arithmetic, and each high school teacher teaching English, science, mathematics, history or Latin, is to prepare an inventory test covering the work of the last three months of the semester.
2. This test is to be given to the students on the first day of the second school month. Each teacher shall immediately score his papers and prepare a diagnostic chart as illustrated in Part IV.
3. The instruction during the remainder of the semester shall proceed in the light of the findings of the diagnostic chart.
4. At the end of the semester the teachers will give the same test.

5. The teacher shall prepare a second diagnostic chart, and prepare a definite report on what he should do to improve his course.

6. Copies of all tests, Keys, charts, and scores are to <sup>be</sup> turned in at the principal's office.

7. The same procedure is to be followed in the second semester except that the first test is to be given on the first day of the semester.



## Part II. SUGGESTIONS

1. Any type or combination of types of test may be used except true-false type.
2. The test should be constructed as if it were the final test at the end of the term.
3. The tests should contain not fewer than fifty, nor more than two hundred questions. More than one period may be used if necessary.
4. Keys should be made as the test is being constructed.
5. Directions to the pupils should be very clear and should precede each section.
6. Questions should be numbered consecutively through the test, and each item should count one point. The total number answered correctly by the student will then represent his raw score.
7. Each test should have the following heading:  
Student \_\_\_\_\_ Date \_\_\_\_\_  
Subject \_\_\_\_\_  
Directions \_\_\_\_\_  
(Test)
8. The office force will cut stencils and assist in duplicating the tests.

Part III. ILLUSTRATIONS OF THE VARIOUS TYPES OF  
OBJECTIVE TESTS

There is given below a brief illustration of each of the various types of objective tests, together with a tentative rate of answering each type, and the advantages of the test illustrated.

SIMPLE RECALL TYPE OF OBJECTIVE TEST

Rate of Answering. About 3 items per minute.

Directions. Write a word or short phrase on each blank line which will make each statement true.

- 
1. Every President of the United States upon coming into office now chooses ten Secretaries to form his \_\_\_\_\_.
  2. The fundamental economic cause of the Civil War was \_\_\_\_\_.
  3. President Wilson said, "The world must be made safe for \_\_\_\_\_."
  4. Large corporations, when consolidated, are popularly called \_\_\_\_\_.

COMPLETION TYPE OF OBJECTIVE TEST

Rate of Answering. About 3 items per minute.

Directions. In each of the paragraphs below write in the words that have been left out. Try to find the word for each blank that makes the best sense.

---

The mouth is concerned with digestion in two ways:

first, the grinding action of the \_\_\_\_\_, and,  
 second, the chemical action of the enzyme \_\_\_\_\_ which  
 acts on \_\_\_\_\_ changing them into \_\_\_\_\_.

In the stomach, the most important enzyme is \_\_\_\_\_  
 which starts the digestions of the \_\_\_\_\_.

The gastric juice also contains an \_\_\_\_\_, which  
 helps to kill bacteria causing fermentation.

#### Advantages

1. Relative freedom from the effects of guessing or chance.
2. Allows some freedom of expression and thought.
3. Better adapted, perhaps, to thought questions than many other forms.

#### MULTIPLE RESPONSE TYPE OF OBJECTIVE TEST

Rate of Answering. About 4 items per minute.

Directions. Underline the word or words making the correct answer.

- 
1. Oliver Twist was written by Scott, Stevenson, Elliot, Dickens, Austen.
  2. The theme of the "Tale of Two Cities" is Defense of poetry, Crimean War, Rights of the American Colonies, French Revolution, Romanticism.
  3. Elaine was a character in "Idylls of the King," "Childe Harold", "Pride and Prejudice", "Dream Children", "Treasure Island".
  4. The earliest of these writers was Stevenson, Kipling, Pope, Keats, Scott.

Directions. Read each question and select the best answer to that question. Record the number of the best answer on the dotted line, as shown in the following samples.

- 
1. "Snowbound" was written by \_\_\_\_\_.
- (1) Field                      (2) Markham                      (3) Whittier  
(4) Tennyson                      (5) Kipling
2. A poem with symbolic character is \_\_\_\_\_.
- (1) Limerick                      (2) epic                      (3) lyric  
(4) elegy                      (5) allegory

#### Advantages

1. Purely objective in scoring.
2. Very rapidly scored, especially when responses are numbered and the answering done by number.
3. Easier to prepare than the completion type.
4. Guessing effects can be minimized by using from four to seven responses.

#### TRUE-FALSE TYPE OF OBJECTIVE TEST

Rate of Answering. About 9 items a minute.

Directions. If a statement is true, underline True; if false, underline False. If in doubt, omit the item. Do Not Guess.

- 
1. One centimeter is a little more than 2.54 inches.  
..... True                      False
2. 1000 cc. of water is approximately  
..... one pint.                      True                      False

3. When an ordinary electric-light bulb is broken, the glass flies away from the center of the bulb in all directions. True False

Directions. If a question is correct, underline Yes; if false, underline No. If in doubt, omit the item. Do Not Guess.

- 
1. Did Columbus discover America in the year 1894? Yes No
2. Was the Battle of Bunker Hill fought in 1775? Yes No

#### Advantages

1. Wide applicability.
2. Perfectly objective in scoring.
3. Fairly easy to construct.
4. Great rapidity in which items can be answered.
5. Extensiveness of sampling possible in limited time.

#### MATCHING EXERCISE TYPE OF OBJECTIVE TEST

Rate of Answering. About 5 items per minute.

Directions. In the space in front of the names in the first column place the number which corresponds to it in the second column.

- |                           |                       |
|---------------------------|-----------------------|
| <u>        </u> Tennyson  | 1. Treasure Island    |
| <u>        </u> Stevenson | 2. David Copperfield  |
| <u>        </u> Dickens   | 3. Idylls of the King |

Directions. Read each characterizing extract and then find the term at the left which it fits best. Record the number of the proper term in the parentheses in front of each extract.

- 
1. "Open Door" Policy.                    ( ) The passing of the tariff and other laws favorable to a nation's industrial and commercial development.
2. Protectionism.                        ( ) A proposal of the United States that the citizens of all nations should have equal rights for commercial and industrial advantages in China and that all nations respect China's integrity.

#### Advantages

1. Completely objective.
2. May be used as either judgment or factual tests.

BEST ANSWER TYPE OF OBJECTIVE TEST

Rate of Answering. About 5 items per minute.

Directions. Below are a number of incomplete statements which may be completed by any one of the three possible answers. Only one answer is scientifically correct; the other two are partly or entirely incorrect. Study each statement and then make a cross in front of the best answer.

1. Fungous plants are dependent upon other plants for their food supply because
  - They are so simple in structure.
  - Their digestive processes have never developed.
  - The absence of chlorophyll prevents photosynthesis.
2. The act of fertilization is most accurately defined as the
  - Transfer of pollen from stamen to pistil.
  - Union of an egg and a sperm cell.
  - Maturation of the embryo of an organism.

Directions. Check the statement which expresses what you might have prophesied as to the future of the Roman Republic, if you had lived during the first century before Christ and had known the following facts:

Marius becomes consul for the seventh time;

Sulla is given the title of "Perpetual Dictator;"

Caesar becomes dictator for life.

The Republic was on the verge of developing a greater democracy.

Civil Wars and the military rule of one-man power would in time overthrow the Republic.

The rule of the assembly and its leaders was about to triumph over the rule of the senate.

#### Advantages

1. It has all the general advantages of the multiple response test.

2. The vertical arrangement of the responses permits

the use of long response statements, thus allowing wide use of the method for thought and judgement questions.

#### IDENTIFICATION EXERCISE TYPE OF OBJECTIVE TEST

Rate of Answering. About 5 items per minute.

Directions. Select the best breakfast in the four breakfasts given below for a boy or girl twelve years old. In making your choice use all the facts that you have just learned in your study of balanced meals.

---

Answer. My first choice as the best breakfast is No \_\_\_\_\_

1.

$\frac{3}{4}$  cup of oatmeal, cream and sugar  
 2 eggs and fried potatoes  
 3 slices of bread and butter  
 1 cup of coffee.

2.

1 shredded wheat biscuit  
 2 slices of toasted brown bread with butter  
 1 dish prunes  
 1 glass milk

#### Advantages

1. It allows the testing of ability to apply principle to concrete situations or identify examples of such applications of principles.

#### REARRANGEMENT TYPE OF OBJECTIVE TEST



Rate of Answering. About 5 items per minute.

Directions. Number the following great inventions in the order of their making. Put 1 before the earliest, 2 before the next in order, and continue for the others giving the most recent invention the number 10

\_\_\_\_\_ The printing press                      \_\_\_\_\_ Gunpowder  
 \_\_\_\_\_ Wireless telegraphy                      \_\_\_\_\_ Engraving  
 Etc. to 10

#### Advantages

1. It is chiefly useful in subjects involving chronological relations.

#### MULTIPLE RESPONSE-PLURAL CHOICE TYPE OF OBJECTIVE TEST

Directions. Below are a number of incomplete statements which may be completed by several of the possible answers. Study each statement and then indicate by the numbers 1, 2, 3, and 4 the correct answers.

- 
1. The irregular coast line of the Scandinavian peninsula is due to
    - \_\_\_\_\_ The action of glacial drifts.
    - \_\_\_\_\_ The rotation of the earth.
    - \_\_\_\_\_ The weathering of storms.
    - \_\_\_\_\_ The gravitational influence of the moon.
    - \_\_\_\_\_ The sinking of the coastal plane.
  2. The development of the growing plant is controlled by

- \_\_\_ The amount of atmospheric pressure variations.
- \_\_\_ The quantity of sunlight received.
- \_\_\_ The acidity of the soil in which the seed is planted.
- \_\_\_ The directions of the prevailing winds.
- \_\_\_ The rainfall of the region.

#### Advantages

1. Allows the use of statements for which there are several causal factors.

## Part IV. DIAGNOSTIC CHART

The construction of a diagnostic chart. The numbers of the various items of the test are placed across the top of the chart, the names of the pupils are arranged down the side. It is a simple matter then to check the correct responses of each pupil. The blank spaces of the chart indicate items which will require emphasis in the course. There is a variation of this chart possible if the test has been constructed in sections, each section bound in a teaching unit. The number of the section can be placed across the top of the chart and the total score for each section entered opposite the name of the pupil. This type of chart requires care in the grouping of the items about one particular teaching unit. It brings out the principle that the items of the test should be presented in topical sequence, which principle should be followed whether this particular scheme is used or not.



## B. Tables of Original Data

TABLE IV

ORIGINAL DATA FOR COURSE NUMBER I, TWELFTH YEAR  
ECONOMICS, IN A STUDY IN PUPIL ACHIEVEMENT

Total possible score on this test  
64 raw score points

Student	Score on 1st Test	Score on 2nd Test	Differ- ence in Scores	Intelli- gence Test %ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Esther	10	28	18	45	93
Forest	7	20	13	24	77
Wilma	14	32	18	58	90
Gertrude	7	15	8	26	88
Evelyn	4	26	22	78	83
James	5	16	11	20	89
Ruth	0	23	23	75	89
Yuma	5	27	22	6.5	76
Dorothy	10	28	18	72	81
Martin	15	39	24	95	92
Clark	16	48	32	89	96
Carmelita	6	29	23	28	84
Merle	3	32	29	15	93
Mazo	2	31	29	51	76
Royer	28	52	24	94	94

TABLE V

ORIGINAL DATA FOR COURSE NUMBER II, GENERAL  
HISTORY, IN A STUDY OF PUPIL ACHIEVEMENT

Total possible score on this test  
54 Raw score score points

Student	Score on 1st test	Score on 2nd test	Differ- ence in Scores	Intelli- gence Test %ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Forest Walter	3 5	11 15	8 10	24 51	81 85
Frances Nila	2 2	8 7	6 5	59 23	83 77
Virgil Mildred T.	10 10	28 26	18 16	85 33	95 92
Wayne Marg. Bo.	0 1	10 11	10 10	32 42	76 78
Marg. Br. Charlotte	2 7	17 26	15 19	39 61	88 93
George Audry	5 2	26 16	21 14	25 64	89 86
Marian Mildred H.	7 6	28 33	21 27	75 75	87 95
Ruth Lodema	5 5	22 28	17 23	85 86	90 93
Donovan Nathan	10 4	28 21	18 17	99 63	92 93
Clayton Fern	5 3	19 22	14 19	34 61	82 91
Elizabeth Barbara	0 12	14 33	14 21	37 86	79 97

TABLE VI

ORIGINAL DATA FOR COURSE NUMBER III, NINTH  
YEAR ALGEBRA, IN A STUDY  
OF PUPIL ACHIEVEMENT

Total possible score on this test  
56 raw score points

Student	Score on 1st test	Score on 2nd test	Differ- ence in Scores	Intelli- gence test %ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Wayne	6	30	14	32	65
Margaret Bo.	1	13	12	42	78
Margaret Br.	3	27	24	39	81
Charlotte	16	40	24	61	96
George	12	36	24	25	91
Audrey	9	42	33	64	96
Mildred	7	43	35	74	96
Marian	8	33	25	75	80
Ruth	18	41	23	65	87
Donovan	31	48	17	99	98
Clayton	10	24	14	34	69
Fern	16	38	22	61	94
Elizabeth	5	12	7	37	79
Barabara	19	33	14	86	94
Thompson	5	18	13	39	65
Madge	1	21	20	33	76
Liston	18	36	18	77	81
Forrest	15	30	15	64	80
Paul	4	17	13	7	65
Pauline	3	12	9	5	65
Razel	5	6	1	17	60
Mary	5	18	13	23	74
Marshel	17	37	20	77	88
Max	26	46	20	98	97
Ovid	16	27	11	72	77
Wilma	7	31	24	85	81

TABLE VII

ORIGINAL DATA FOR COURSE NUMBER IV, TENTH YEAR  
ENGLISH, IN A STUDY IN PUPIL ACHIEVEMENT

Total possible score on this test  
75 raw score points

Student	Score on 1st test	Score on 2nd test	Differ- ence in Scores	Intelli- gence test %ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Margaret Bo.	33	59	26	42	75
Margaret Br.	40	58	18	39	87
Charlotte	47	65	18	61	91
George	21	60	39	25	78
Audrey	40	51	11	64	83
Marian	43	63	20	75	87
Mildred	43	63	20	74	88
Ruth	38	64	26	84	85
Lodema	46	62	16	86	89
Donovan	51	68	17	99	91
Nathan	47	68	21	63	87
Fern	47	63	16	61	85
Elizabeth	35	63	28	37	80
Lowell	47	56	9	49	83
Barabara	50	67	17	86	90
Wayne	33	54	21	32	75



TABLE VIII

ORIGINAL DATA FOR COURSE NUMBER V, NINTH YEAR  
LATIN, IN A STUDY IN PUPIL ACHIEVEMENT

Total possible score on this test  
130 raw score points

Student	Score on 1st test	Score on 2nd test	Differ- ence in Scores	Intelli- gence test %ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Thompson	11	49	38	39	77
Madge	5	55	50	33	68
Liston	18	69	51	77	89
Ferrest C.	7	45	38	64	83
Helen	17	103	86	87	92
Paul	4	56	52	6 $\frac{1}{2}$	64
Pauline	6	54	48	4 $\frac{1}{2}$	65
Hazel	3	56	53	17	63
Mary	6	61	55	33	71
Hershel	17	64	47	77	88
Max	16	104	88	98	93
Ovid	15	71	56	72	82
Crystal	14	104	90	99	91
Wilma	14	97	83	85	91

TABLE IX

ORIGINAL DATA FOR COURSE NUMBER VI, TENTH YEAR  
LATIN, IN A STUDY IN PUPIL ACHIEVEMENTTotal possible score on this test  
87 raw score points

Student	Score on 1st test	Score on 2nd test	Differ- ence in scores	Intelli- gence test %ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Marg. Bo.	31	59	28	43	68
Marg. Br.	25	64	49	39	87
Charlotte	54	81	27	61	90
George	39	68	29	35	75
Audrey	48	83	35	64	81
Marian	54	82	28	75	85
Mildred	65	86	21	74	88
Ruth	49	84	35	85	83
Lodema	42	84	42	86	85
Donovan	44	71	27	99	80
Nathan	44	74	30	63	81
Clayton	47	65	18	34	68
Fern	39	79	40	61	76
Elizabeth	20	57	37	37	75
Lowell	53	76	23	49	83
Barabara	48	80	32	86	83

TABLE X

ORIGINAL DATA FOR COURSE NUMBER VII, SEVENTH GRADE  
ARITHMETIC, IN A STUDY IN PUPIL ACHIEVEMENT

Total possible score on this test  
50 raw score points

Student	Score on 1st test	Score on 2nd test	Differ- ence in scores	Intelli- gence test %ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Billy	33	37	5	45	87
Joy	6	17	11	15	67
Maurice	36	37	11	41	89
Alice	24	34	10	87	90
Julia	3	13	10	39	74
Mable	23	34	11	38	95
John	3	9	7	7	65
Paul	14	33	19	13	78
Raymond	13	17	4	22	83
Gilbert	12	24	12	53	84

TABLE XI

ORIGINAL DATA FOR COURSE NUMBER VIII, EIGHTH GRADE  
ARITHMETIC, IN A STUDY IN PUPIL ACHIEVEMENT

Total possible score on this test  
50 raw score points

Student	Score on 1st test	Score on 2nd test	Differ- ence in scores	Intelle- gence test %ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Alice	32	37	15	90	92
Maida	24	39	15	99	88
Helvin	23	27	4	39	70
Annabell	21	26	5	39	64
Walter	24	32	8	31	80
Esther	29	45	16	81	90
Malcolm	26	45	19	77	92
Victor	23	23	0	55	64
Hola	24	42	18	76	86
Nancy	26	32	6	93	86
Kathlene	28	34	6	47	80
Doris	15	19	4	23	78
Mary	13	36	23	50	86
Herbert	14	27	13	39	80
Lester	16	22	6	36	78

TABLE XII

ORIGINAL DATA FOR COURSE NUMBER IX, FOURTH GRADE  
ARITHMETIC, IN A STUDY IN PUPIL ACHIEVEMENT

Total possible score on this test  
52 raw score points

Student	Score on 1st test	Score on 2nd test	Differ- ence in scores	Intelli- gence test $\frac{1}{2}$ ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Paul	10	33	23	79	89
Freeda	41	43	5	71	93
Fay	28	42	14	50	90
Jane	25	11	-14	87	79
Nora	19	23	4	8	78
Eurtice	26	45	19	90	91
Helen	18	38	20	50	84
Gertrude	26	35	9	49	84
Cynthia	13	42	30	66	83
Royal	38	24	-4	37	81
Billie	22	41	19	94	82
Fredrick	7	29	22	95	82
Betty	17	39	22	95	82

TABLE XIII

ORIGINAL DATA FOR COURSE NUMBER X, THIRD GRADE  
ARITHMETIC, IN A STUDY IN PUPIL ACHIEVEMENTTotal possible score on this test  
85 raw score points

Student	Score on 1st test	Score on 2nd test	Differ- ence in Scores	Intelli- gence test %ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Irene	46	73	27	73	93
James	12	58	46	66	85
Margaret	8	51	43	50	85
Lloyd	5	34	29	55	79
Maneva	17	64	47	91	88
Alberta	77	78	1	90	94
Harvey	41	77	36	45	90
Dorothy	62	76	14	92	93
Hildred	5	48	43	73	75
Elizabeth	7	51	44	93	85
Anna	21	73	52	66	90

TABLE XIV

ORIGINAL DATA FOR COURSE NUMBER XI, SECOND GRADE  
ARITHMETIC, IN A STUDY IN PUPIL ACHIEVEMENT

Total possible score on this test  
110 raw score points

Student	Score on 1st test	Score on 2nd test	Differ- ence in scores	Intelli- gence test %ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Max	61	100	39	99.2	98
Leonard	12	37	25	90	82
Joy	11	33	22	35	83
Robert	2	9	7	61	80
Thelma	71	86	15	91	97
Rosella	33	59	26	25	89
Rex	12	25	13	39	86
Dolores	23	77	54	86	92
Charles	9	8	-1	86	78
Milburn	4	8	4	73	79
Anna Mae	48	75	27	84	93
Naomi	28	50	22	86	89
Ruth	39	60	21	39	88

TABLE XV

ORIGINAL DATA FOR COURSE XII, FIRST GRADE ARITHMETIC  
IN A STUDY IN PUPIL ACHIEVEMENT

Total possible score on this test  
80 raw score points

Student	Score on 1st test	Score on 2nd test	Differ- ence in scores	Intelli- gence test %ile	Semester mark
(1)	(2)	(3)	(4)	(5)	(6)
Herman	23	54	31	45	92
Nellie	6	8	2	55	76
Von	9	27	18	68	86
Dorothy	53	78	25	68	98
Richard	34	71	37	77	98
Marcella	17	37	20	84	87
James	9	41	32	53	93



TABLE XVI

DATA FOR AVERAGE STANDING IN SCHOLARSHIP AND  
INDEX OF BRIGHTNESS FOR ALL HIGH SCHOOL  
STUDENTS INCLUDED IN A STUDY OF  
STUDENT ACHIEVEMENT

Student	IB	Scholarship
Crystal	172	92
Donevan	170	90.75
Max	163	83.75
Royer	150	95.25
Martin	149	92.5
Clark	138	95.75
Helen	134	81
Lodema	132	91.25
Barbara	132	91
Wilma T.	131	89
Ruth H.	131	86.25
Virgil	131	94
Evelyn	123	86.25
Hershell	122	87.5
Liston	122	85.25
Ruth G.	120	89.25
Marian	120	84.25
Mildred H.	119	91.5
Ovid	117	83
Dorothy	117	85
Audrey	111	87.25
Forrest G.	111	83
Nathan	110	89
Charlotte	108	92.5
Fern	108	86.75
Frances	107	83.5
Wilma B.	106	87
Robert B.	106	70.5
Walter	101	78.25
Mazo	101	81.25
Lowell	99	87.25
Esther	88	90.5
Margaret Ho.	84	75.75
Margaret Br.	82	85.75
Thompson	82	74.5
Elisabeth	80	73.25
Clayton	88	75.75
Mildred T.	87	92
Nadge	87	79.75
Nicie	85	81
Carmelita	83	87
Gertrude	81	85

Cont.

TABLE (Continued)

George	80	82.5
Forrest B.	79	78.75
Mary	78	81
Nila	78	81.5
James	75	83.75
Robert K.	73	77.25
Hazel	72	72.5
Merle	69	87.25
Louis	59	79
Yuma	55	80
Paul	55	74.5
Pauline	50	74.5

C. Questions and Diagnostic Charts  
for Course I, Economics 12

Pupils \_\_\_\_\_ Date \_\_\_\_\_

Subject \_\_\_\_\_

Directions. Write a word or short phrase on each blank line which will make each statement true.

1. The principal methods of economizing labor are:

- a. \_\_\_\_\_ b. \_\_\_\_\_
- c. \_\_\_\_\_ d. \_\_\_\_\_
- e. \_\_\_\_\_

2. The kinds of division of labor are:

- a. \_\_\_\_\_ b. \_\_\_\_\_

3. Man's work on the physical side at least consists in  
.....

4. The chief sources of power are \_\_\_\_\_ and  
\_\_\_\_\_.

5. Goods which satisfy our desires directly are called  
\_\_\_\_\_ goods.

6. Capital is any kind of property, aside from land,  
which a man uses \_\_\_\_\_.

7. The methods of combining wealth in business are a. \_\_\_\_\_  
b. \_\_\_\_\_ c. \_\_\_\_\_.

8. A \_\_\_\_\_ is an organization of corporations  
for the purpose of controlling the market.

9. Land gets its value because of its \_\_\_\_\_ and  
its \_\_\_\_\_.

10. The types of civilization are the \_\_\_\_\_  
type and the \_\_\_\_\_ type.

11. The fundamental of management is the problem of \_\_\_\_\_ the factors of production.
12. The extractive industries are a. \_\_\_\_\_  
 b. \_\_\_\_\_ c. \_\_\_\_\_  
 d. \_\_\_\_\_ d. \_\_\_\_\_
13. Civilized man is more prosperous than the savage because he relies upon \_\_\_\_\_ as a means of getting what he wants.
14. \_\_\_\_\_ is the most valuable natural product of our soil.
15. \_\_\_\_\_ is the greatest of our extractive industries.
16. The genetic industries are a. \_\_\_\_\_  
 b. \_\_\_\_\_ c. \_\_\_\_\_
17. If we consider the world at large \_\_\_\_\_ is the most important of all industries.
18. Transportation differs from other work in that it consists in moving materials \_\_\_\_\_.
19. \_\_\_\_\_ transportation developed first.
20. Merchandising is productive work when it saves \_\_\_\_\_.
21. Advertizing is useful work when \_\_\_\_\_.
22. If you want a thing you have three choices. You may \_\_\_\_\_ it, or you may \_\_\_\_\_ it, or you may \_\_\_\_\_ it.
23. The willingness to give something in exchange for a thing has come to be regarded by most writers as the \_\_\_\_\_ of the thing.
24. The first law of the market is \_\_\_\_\_

25. Water has value when it is \_\_\_\_\_.
26. Things are scarce for these reasons: a. \_\_\_\_\_  
 b. \_\_\_\_\_ c. \_\_\_\_\_  
 d. \_\_\_\_\_.
27. A \_\_\_\_\_ is an agency which has sufficient control over the supply of a given commodity to fix its price.
28. A substance used for money should have the following qualities: a. \_\_\_\_\_ b. \_\_\_\_\_  
 c. \_\_\_\_\_ d. \_\_\_\_\_ e. \_\_\_\_\_  
 f. \_\_\_\_\_.
29. Standard money is \_\_\_\_\_.
30. The business of a bank is dealing in \_\_\_\_\_.
31. Banknotes are different from other notes in that they pass from person to person without \_\_\_\_\_.
32. A financial crisis is brought by a \_\_\_\_\_.
33. A slight change in the value of a product tends to produce a \_\_\_\_\_ change in the value of the factory producing it.
34. Three popular arguments in favor of a protective tariff are: a. \_\_\_\_\_  
 b. \_\_\_\_\_  
 c. \_\_\_\_\_
35. The laws of the land do not recognize anyone's title to an object procured by \_\_\_\_\_ or \_\_\_\_\_.
36. Of the various factors of production the one that is \_\_\_\_\_ commands the highest price.
37. The \_\_\_\_\_ man like the \_\_\_\_\_ commodity commands the high price.

38. Wages are high in those occupations in which \_\_\_\_\_ men are needed.

39. Owing to the law of \_\_\_\_\_ a large number of people can not be so well provided from the produce of a restricted area as a smaller number can.

40. Skilled labor commands a higher price than unskilled because \_\_\_\_\_.

41. A shop which employs only union labor is called a \_\_\_\_\_ shop.

42. The income which the owner derives from land whether he uses it himself or lets it out to some one else is called \_\_\_\_\_.

43. The value of land is determined by its \_\_\_\_\_ and its \_\_\_\_\_.

44. \_\_\_\_\_ is the income which goes to the owner of capital.

45. There are two forms of cost: a. \_\_\_\_\_  
b. \_\_\_\_\_.

46. Interest rates are high when capital is \_\_\_\_\_ and low when capital is \_\_\_\_\_.

47. The income of the independent business man who receives neither wages, rent nor interest is called \_\_\_\_\_.

48. The chief forms of public revenue are: a. \_\_\_\_\_  
b. \_\_\_\_\_ c. \_\_\_\_\_.

49. A \_\_\_\_\_ is a compulsory payment to the government for which the government does not return to the individual payer a commodity or a service.

50. The value of a man is determined by the formula \_\_\_\_\_.

51. When consumption exceeds production national prosperity  
\_\_\_\_\_.

52. A rational standard of living is one which increases the gap between \_\_\_\_\_ and \_\_\_\_\_.

53. Consumers goods are divided into four classes:

a. \_\_\_\_\_ b. \_\_\_\_\_ c. \_\_\_\_\_  
d. \_\_\_\_\_.

54. He who does less well than he can does \_\_\_\_\_.

55. Luxurious consumption \_\_\_\_\_ the demand for labor.

56. The Chinese and Japanese farmers and gardeners are displacing the Americans because they have a \_\_\_\_\_ standard of living.

57. \_\_\_\_\_ is a type of social organization in which all wealth both producers and consumer's goods, is owned and controlled by the community.

58. \_\_\_\_\_ proposes that the community shall own and operate only producer's goods, leaving the consumer's goods to be owned and enjoyed by individuals.

59. Communistic experiments have failed because of lack of \_\_\_\_\_ among the members.

60. Socialists are opposed to any one receiving any income for the use of \_\_\_\_\_.

61. By the \_\_\_\_\_ is meant a policy under which all the public revenue is to be raised on land value.

62. The \_\_\_\_\_ is opposed to all forms of government which are voluntary.

63. In time of war compulsion takes the place of \_\_\_\_\_.

64. Universal education benefits the laborers because it

\_\_\_\_\_ the number of labors and \_\_\_\_\_  
the number of employers.





## C. Bibliography

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