A study to determine the relationship of reading to reasoning problems in arithmetic as revealed by analysis and interpretation of data secured by administering certain standardized tests to a selected group of sixth grade pupils of first ward elementary school, Lake Charles, Louisiana

Mary Belle Williams
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A STUDY TO DETERMINE THE RELATIONSHIP OF READING TO REASONING PROBLEMS IN ARITHMETIC AS REVEALED BY ANALYSIS AND INTERPRETATION OF DATA SECURED BY ADMINISTERING CERTAIN STANDARDIZED TESTS TO A SELECTED GROUP OF SIXTH GRADE PUPILS OF FIRST WARD ELEMENTARY SCHOOL, LAKE CHARLES, LOUISIANA

A THESIS SUBMITTED TO THE FACULTY OF THE SCHOOL OF EDUCATION, ATLANTA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

BY

MARY BELLE WILLIAMS

SCHOOL OF EDUCATION

ATLANTA UNIVERSITY

August, 1954
ACKNOWLEDGEMENTS

The writer wishes to express her sincere thanks to Dr. Matilda L. Saine Rickers, Dr. Edward K. Weaver, Advisor and co-advisor respectively, who unselfishly supplied valuable information, advice and suggestion. The writer would also like to dedicate this research to her understanding mother, Mrs. Lucy M. Williams.

M. B. W.
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CHAPTER I

INTRODUCTION

Rationale.—Science has become one of the most important factors affecting the progress of civilization. The science of numbers is the basis of all scientific development. Every aspect of modern life requires use of number ideas. Number ideas not only mark off events of history into manageable periods, but also make possible the division of time and space into understandable units, and distinguishes one unit from the other. Number thinking is a universal activity that is practiced by all.\(^1\)

The arithmetic of modern man is part of his everyday equipment to live in society. In a democratic society especially, arithmetic must be the possession of the citizen; else the democratic state exists only in theory. The arithmetic we teach pupils in school is a way to think about the number of things—about quantities, amount, sizes—it is a particular, special way. It is an orderly way, a definitely systematic way to think.

The dread of arithmetic is not always due to the dullness of students but most times to the poor quality of teaching arithmetic in our schools. The "average" teacher does not know what to teach in arithmetic on the basis of fundamental purposes or how to teach it to accomplish legitimate aims; she does not know the technique of problem solving.\(^2\)

Problem solving is the basic procedure for teaching arithmetic in the elementary school. It is the procedure through which the learner discovers basic mathematical ideas. It is the fundamental approach for making

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When a child has developed the ability to solve problems, he has attained a prerequisite to a well-ordered way of life. Studying numbers through problem situations, then, is of educational value.

With the elementary school child, the types of thinking involved in number study can be used to project the problem-solving process into a general way of thinking. In this sense, then, arithmetic offers opportunities for the improvement of the individual's thinking in any field of study. That is, problem-solving in arithmetic can be of value in the development of the thinking processes of the individual. The behavior evolving in the solution of a problem is identical with that employed any time that the individual makes an adjustment to his environment, whether quantitative or not.

Although problem-solving activities are conceived of as the basis for all learning, arithmetic, when presented through problematic situations can be a stony and thorn-strewn road for children who are not skilled in the aspects of reading. It can be a "royal road" to those who have mastered these skills. Difficulty in reading frequently complicates the situation in such a way as to make the individual appear deficient in arithmetic.

The teaching of both arithmetic and reading constitutes two of the most crucial responsibilities of the elementary school. Children must be helped to become skillful in these subjects so that they may live intelligently and with pleasure in our complex civilization. A child must learn to read so that he might come to grasp whatever else the school tries to teach through the medium of reading.


Statement of the Problem.—The problem involved in this study was to determine the relationship of certain aspects of reading to arithmetic reasoning as manifested by a selected group of Sixth Grade pupils in First Ward Elementary School, Lake Charles, Louisiana.

Purposes of the Study.—The purposes of this study were to answer the following questions: (1) What is the general reading level of the group as indicated by the scores derived from the Sangren-Woody Reading Test?\(^1\) (2) What is the status of arithmetic reasoning of the group as measured by the scores of the Otis Arithmetic Reasoning Test?\(^2\) (3) What is the efficiency with which the group read and grasp total meaning and central thought of reasoning problems in arithmetic as measured by scores of the reading and arithmetic reasoning tests? (4) What is the relationship, if any, between the arithmetic reasoning power of the group and their skillful use of the seven aspects of reading: (1) Word Meaning (2) Fact Material (3) Rate (4) Total Meaning (5) Central Thought (6) Following Directions (7) Organization, as indicated by the results from the reading and arithmetic reasoning tests?

Definition of Terms.—The significant terms used throughout this study were defined as follows:

1. Aspects of reading in this study refers to seven areas of silent reading abilities as measured by the Sangren-Woody Reading Test. These areas are: (1) Word Meaning (2) Fact Material (3) Rate (4) Total Meaning (5) Central Thought (6) Following Directions (7) Organization.

2. Reasoning has been defined as an attempt to meet adequately any

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\(^1\)Paul V. Sangren, and Clifford Woody, Sangren-Woody Reading Test Test: Form B (New York, 1953)

\(^2\)Arthur S. Otis, Otis Arithmetic Reasoning Test Test: Form A & B (New York, 1953)
situation, by recognizing certain elements in that situation which are identical with known situations and reacting to them accordingly. Acuteness of reasoning depends on ability to analyze situations carefully and to detect minute resemblances.

**Locale of Study.**—This study was conducted during the first semester of the school term 1953 and 1954, at First Ward Elementary School, Lake Charles, Louisiana.

**Subjects Involved.**—Forty pupils were used in this study. There were twenty girls ranging in the ages from ten years four months to fifteen years. There were twenty boys ranging from the ages of ten years five months to fourteen years ten months.

**Method of Research.**—The Normative Survey Method of research was employed in gathering the pertinent data required for this study. The special techniques of testing and statistics were used for the interpretation of the data.

The following tests were utilized to measure arithmetic reasoning and reading level:

a. Otis Arithmetic Reasoning Test: A & B Form
b. Sangren-Woody Reading Test: A & B Form

description of the tests: The Sangren-Woody Reading Test was selected because the test consists of a series of seven parts so constructed as to measure seven parts or distinct phases of silent reading ability. The seven phases of silent reading measured by the parts represent the more important ones so far as may be determined by the generally accepted aims of silent reading instruction. The seven phases and their functions are:

**Part I. WORD MEANING.** Part 1, is designed to measure the extent of the child's silent reading vocabulary.
Part 2. RATE. Part 2 has for its purpose the determination of the child's rate of reading a continuous selection.

Part 3. FACT MATERIAL. Part 3 is designed to determine the efficiency with which the child can read and get the facts from the material.

Part 4. TOTAL MEANING. The purpose of this part is to measure the efficiency with which children read and grasp the total meaning of the paragraph read.

Part 5. CENTRAL THOUGHT. This reading aspect is designed to measure how efficiently children read silently and detect the central thought of the paragraph read.

Part 6. FOLLOWING DIRECTIONS. This part is intended to determine with what efficiency children read and follow directions on the basis of the material read.

Part 7. ORGANIZATION. This part is designed to determine how efficiently children can read and organize logically the ideas contained in a series of paragraphs read.

Otis Arithmetic Reasoning Test:

It is becoming a prevalent custom to convert scores into ages in order to find educational quotients as well as intelligence quotients. In order to find the arithmetic age corresponding to any score the reader may consult the table given in the manual.

The Otis Arithmetic Reasoning Test is supplied with grade norms given in the manual to assist the examiner in grade placement.

The Otis Arithmetic Reasoning Test was selected by the writer because, the test measured the arithmetical ability and the comprehensive reading ability which is very pertinent to this study.

Limitation of the Study: This study was limited to administration of the Sangren-Woody Test and the Otis Arithmetic Reasoning Test to forty subjects...
of First Ward Elementary School who were selected for use in the study. Twenty of the forty subjects selected were boys and the remaining twenty were girls.

Method of Procedure.—Beginning December 17, 1953, the Otis Arithmetic Reasoning Tests, Form A and B were administered. December 18, 1953, the Sangren-Woody Reading Tests, Form A and B were administered to forty subjects in the sixth grade at First Ward Elementary School, Lake Charles, Louisiana. These pupils were selected on the basis of their high average daily attendance for the first three months of the present school term. All tests were given in the Cafeteria—Auditorium, where satisfactory testing conditions prevailed. Two sixth grade teachers assisted the writer in administering the test. Scores obtained from the administration of the tests to the subjects of this study were tabulated separately so as to show the relation of each aspect in reading to reasoning problems in arithmetic. Tables were set up to show the frequency distribution, mean, standard deviation and coefficient of correlation. The data from the tests were treated further through the use of graphs, tables and profile charts in order to determine the relation existing between the children's reading capacities and reasoning problems in arithmetic.

Value of the Study.—It is hoped that this study will provide and acquaint teachers with knowledge of the types of arithmetic and reasoning problems which the children involved in this study have. It is possible, furthermore, that this study may lead certain teachers to correct teaching procedure and thereby improve and enrich pupil approaches to reasoning problems in arithmetic, through increased use of meaningful experiences. It is further hoped that the results of this study, and other
similar studies, will be helpful to teachers who are concerned with the future of our democratic society by having them realize the benefits of shifting from the text or isolated type of instruction to emphasis on real life situations and needs.

**Related Literature.**—A review of the literature related to this study reveals that many investigators have been concerned with research concerning the relationship of reading comprehension to reasoning problems in arithmetic in the elementary grades.

The review of the literature in this study presents various viewpoints from authoritative sources and the results of scientific experiments. The studies reported in the first part of the literature give their ideas and conclusions of authorities bearing on the problem of this study. The latter part of the review of related literature gives the results of the actual findings from experiments given.

Semmelmeyer\(^1\) discusses the use of abstractions in problems, which confuse the child. She feels that this is one of the chief obstacles to understanding in our schools, this "use of abstractions of a relatively high order which means little or nothing to the child." It is necessary for a child to get the significance of the meaning or he has no conception of what the problem states to be solved. She states that we tend to believe that if a child pronounces a word correctly he knows its meaning. This is indeed a fallacy. She quotes McKee\(^2\) who gives this discouraging picture of the ability of pupils to read with understanding:

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The reading ability of our pupils and students is much lower than most teachers think it is. It is much lower than scores on standardized tests . . . show it to be . . .

The understanding which 80 per cent of the pupils in an average class achieve in reading the textbook in any content subject is almost unbelievably vague and incorrect.

Brueckner\(^1\) shows the place of problem-solving in arithmetic. He says that in the lower grades it is necessary to build a background of meanings and concepts through concrete experience, so that their direct application is the only way to learn problem solving.

David Snedden\(^2\) concludes that there is an accumulation of evidence which indicates that the reading of verbal problems calls for some special reading skills as well as for an acquaintance with the vocabulary and convention employed in the problem statement.

Morton and Clapp\(^3\) and other investigators have found that, in general, pupils make slightly higher scores on a test consisting of familiar problems or problems stated in familiar terminology, such findings support the conclusion that pupils tend not to reason when they attempt to solve problems of the usual textbook type.

McCallister\(^4\) analyzed the reading errors in several subjects including arithmetic, and found certain difficulties were peculiar to each subject, with some common to several subjects. He stated:

The reading difficulties identified by this investigation demonstrate the need for giving special attention to reading activities in connection with the teaching of each content subject.

\(^1\)Leo J. Brueckner, and Foster E. Grossnickle, How to Make Arithmetic Meaningful (Philadelphia, 1947) Chapter XII, p. 43ff.


\(^3\)Guy Wilson, Teaching the New Arithmetic (New York, 1951), p. 389.

R. A. Doty,\textsuperscript{1} studying fourth and sixth grade children, noted that a high percentage did not engage in problem solving in the psychological sense.

White\textsuperscript{2} found a statistically reliable relationship between experience of reading and ability in solving problems. Conner and Hawkins\textsuperscript{3} showed that when pupils at the junior high school brought in their own problems, they showed significant gains over pupils who continued with text problems.

Towle\textsuperscript{4} states that the subject of arithmetic is still a real "bugaboo" to children of the elementary school today. First, she points to the child in the third or fourth grade who apparently has no real arithmetical sense. He knows the "facts" in his drill answers but he cannot put them into practice in working examples. He is lost, that is, he cannot use what he knows. Then there is the pupil who knows the method but does not know his facts.

There is the child who does mechanically any example put before him but who cannot think of reason in his attempt to solve problems. It does not mean that the child has no ability to reason if he is unable to do problems. It means usually, that part of his learning process has not been sufficiently developed.\textsuperscript{5}

Von Engen\textsuperscript{6} feels that, "the greatest weakness of arithmetic instruction


\textsuperscript{3} Wilson, op. cit., p. 390.


\textsuperscript{5} Ibid.

today is the blind faith in the memorization of clusters of symbols with the hope that such a process will ultimately develop basic concepts . . . . " He concludes that:

" . . . Instructional programs based on a psychology which does not weaken generalizations (concepts), meanings, and understandings, its foundation stones, it is not adequate for today's schools. A program which places too heavy an emphasis on the rapid development of skills can easily fail to teach the child to be quantitatively literate and can also fail to protect the personality of the child. The improvement of the arithmetic program, both as regards to skills and understandings awaits a more general acceptance of the part that meaningful instruction plays in the intellectual development of the child.

Studies by Merton and Banting, Osburn, Morton, Clapp, Washburn and Morphett, Brownell, Stevens, Kramer and others have proven that the work on the usual isolated written problems is of little value because, no matter what adjustments or adaptations may be made, the results are always poor.

Spitzer2 states that "most of the procedures emphasize careful reading and some of the steps associated with the formal steps in problem-solving." However, he points to the fact that teachers are not satisfied with the results obtained and they are "especially distressed because many pupils have a dislike for this phase of arithmetic." He feels the problems used in modern arithmetic are fundamentally an error because they are, in most cases, just exercises and not problems at all. "The situations in science, social studies, and other areas of school life where numbers might aid in the solution of genuine problems are for the most part avoided."

1 Wilson, op. cit., p. 389.

Among the studies that have a bearing on this study is that of Monroe.\textsuperscript{1} In a study of the performance of a large number of seventh grade pupils on a relatively simple problem test, Monroe concluded that a large per cent of the pupils did not reason in attempting to solve a verbal problem. Instead, many of them appeared to perform almost random calculation upon the numbers given.

Johnson\textsuperscript{2} refers to the often repeated remark by teachers that the reason children cannot solve problems is because they cannot read. He admits that reading is essential to the solution of problems but says that it is not a sufficient reason, that there is something beside reading ability which is required and to prove this he points to the many numbers of good readers who are "poor" in arithmetic. He analyzed some fifty investigations, conducted from 1931-1949 and reached the general conclusion that research on the relationship of reading and problem-solving in arithmetic should be in terms of specific reading skills rather than in terms of general reading ability.

Turner C. Chandler,\textsuperscript{3} Principal of Burnside School, Chicago, Ill. made a study on solutions of verbal problems of students from grades 4 through 8, and concluded that care should be taken to keep the arithmetical problems within the experience, interest, and understanding of the pupils and based upon significant social situations.


Some years ago a Committee of Seven\(^1\) of the Northern Illinois Conference on Supervision, made a preliminary study of grade placement of verbal problems and came to the conclusion that the topic should be further investigated. Isaac Stright,\(^2\) as a result of a controlled experiment in freshmen high school classes, found that increase in reading comprehension is related to the student's ability to solve algebraic problems.

Wilks \(^3\) in a controlled experiment reported superior results for the experimental group, which studied only 60 per cent of the problems solved by the control group. Clark's general theory is that general intelligence, reasoning, and memory have some significant part to play in solving arithmetical problems. He refers to the six primary mental abilities which are "fairly well known" as: number, vocabulary, space perception, word fluency, reasoning, and memory. These have been worked up into a battery of tests called the Chicago Primary Mental Abilities test (CPMA). Clark notes that vocabulary as a factor of intelligence is a potent factor in problem-solving in arithmetic, with reasoning as so measured, standing next in relation.\(^4\)

Lessenger conducted an experiment in which the pupils were given intensive training in reading. The increase in ability in reading arithmetic

\(^1\)Ibid.


problems was closely related to the progress made in reading. He concluded, "The errors due to faulty reading virtually disappeared as a result of training in reading without any specific reference to arithmetic. The transfer of the improved skills from reading proper to reading in arithmetic was extensive."¹

The pertinent literature reviewed has been concerned with the relation of problem solving ability in arithmetic to comprehension in reading. From the findings of the research ten major points were stressed as follows:

1. If reading and arithmetic are to function effectively in life, they must become an integral part of life.

2. A large per cent of pupils do not reason in attempting to solve verbal problems.

3. Care should be taken to keep arithmetical problems within the experience, interest, and understanding of the pupil and based upon significant social situations.

4. What children learn meaningfully stays with them better and is applied more successfully than what they learn from the text.

5. Reasoning problems should be worded to necessitate careful reading and thinking.

6. Reading ability is needed to facilitate the solution of arithmetical problems.

7. There is a statistically reliable relationship between experiences of reading and ability in solving problems.

8. Investigators differ in their operations as to whether the ability to read non-mathematical subject comprehendingly is accompanied by ability to interpret arithmetic problems.

9. Research indicates that the findings from studies should stimulate teachers to try to improve the child's reading as a possible aid in improving his ability in arithmetic.

10. In conclusion, the resource persons in the pertinent literature reached the conclusion that the arithmetic program should center around the child and his environment.
CHAPTER II

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

Introductory Statement.—This chapter presents, analyses and interprets data collected for the purpose of achieving the major aims of this study. It is devoted primarily to the presentation of data designed to answer questions which were raised earlier in this study. They were:

What is the general reading level of the group?

What is the status of the group in performing reasoning problems in arithmetic?

With what efficiency does the group read and grasp the total meaning and central thought of arithmetical problems to be solved?

What is the relationship, if any, between the ability in silent reading and the ability to solve reasoning problems in arithmetic?

The data for this study were taken from scores obtained on the following tests:

1. The Sangren-Woody Reading Test
2. The Otis Arithmetic Reasoning Test

Selection of Subjects.—Forty pupils were selected in making this study, twenty boys and twenty girls. They were selected from the three divisions of the sixth grade on the basis of their high average daily attendance. Their ages ranged from ten years and five months to fourteen years and ten months for the boys and from ten years and four months to fifteen years for the girls.

Statistical Techniques Used.—After administering and scoring the test, tables, graphs, frequency polygons and profile charts were set up to present the results of the testing. The statistical treatments used were the mean, median, standard deviation, and "r", using the Pearson Product Moment coefficient of correlation, and "t". Specifically these statistical techniques were used for the following reasons: the mean, to show how closely each group
approached normality; the median, to show the point in the distribution above which and below which lie fifty per cent of the cases; the standard deviation, to measure variability within a group; the coefficient of correlation for determining any relationship which might exist between arithmetic reasoning and silent reading abilities of the sixth grade pupils involved in this study; and "t" for testing the reliability of the coefficient. In using the latter statistic the writer was satisfied to test the coefficient of correlation at .05 level of confidence.

Results on the Otis Arithmetic Reasoning Test.—The data obtained from the scores on the Otis Arithmetic Reasoning Test which were made by forty sixth grade pupils are presented in Table 1 and Figure 1, and shows that the scores ranged from a low of 3 to a high of 11, having a median score of 7.65, a mean score of 7.58, a standard deviation of 2.28, which showed that 10 or 25 per cent of the pupils scored above the mean, 10 or 25 per cent scored below the mean, and 20 or 50 per cent scored within the mean class interval.

The obtained median score of 7.65 was 0.3 below the norm of expectancy of achievement for sixth grade pupils. It would appear that these sixth grade pupils could be considered as normal achievers; for 63.5 per cent of them were revealed to be at a level of achievement at or above the norm of 8 established for the sixth grade.

Results of the Total Scores on the Sangren-Woody Reading Test.

Data on the total scores on the Sangren-Woody Reading Test were obtained by the scores of forty boys and girls, and are presented in Table 2 and Figure 2. From the interpretation of the table, 17 or 42.5 per cent scored above the mean class interval, 14 or 35 per cent scored below the mean class interval, and 9 or 22.5 per cent scored within the mean class
TABLE 1

BASIC DATA DESCRIBING THE DISTRIBUTION OF SCORES MADE BY FORTY-SIXTH GRADE PUPILS ON THE OTIS ARITHMETIC REASONING TEST

<table>
<thead>
<tr>
<th>SCORES</th>
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<th>PER CENT</th>
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<tr>
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<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>9 - 11</td>
<td>9</td>
<td>22.5</td>
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<td>6 - 8</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>3 - 5</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>TOTAL</td>
<td>40</td>
<td>100</td>
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</tbody>
</table>

Mean 7.8
Median 8.5
Sigma 2.28
Fig. 1.—Frequency polygon showing distribution of "Arithmetic Reasoning" Scores made by forty-sixth grade pupils
interval. The scores ranged from 55 to 102, and showed a median of 83.9, a mean score of 84.5, and a standard deviation of 10.05. The median score of 83.9 was equivalent to a grade placement of 710 as given in the Manual of Directions. As a result of the test these subjects were considered 17 grade above the grade placement.

Results on Word Meaning Sections of the Sangren-Woody Reading Test.

An examination of Table 3 and Figure 3 reveals a median score of 22.6, a mean of 22.5, and a standard deviation of 2.25. Table 3 further, reveals that 20 per cent scored above the mean interval, 17.5 per cent scored below the mean interval, which 62.5 per cent scored within the class interval. From all indications these subjects were 13 grade equivalent above the median score from the Manual of Directions. The median of 22.6 was equivalent to grade 76, which showed that these subjects were 13 grade above the grade placement of 63 grade.

Results on Rate Section of the Sangren-Woody Reading Test.

The data indicated the median to be 21.3, the mean 21.5 and the standard deviation, 2.6. Only 1 or 2.5 per cent scored above the mean interval, 13 or 32.5 scored below the mean interval, and 26 or 65 per cent scored within the class interval. The median score of 21.3 was equivalent to a grade placement of 710 in the Manual of Directions. From all indications these subjects are 17 grade above the grade placement of the 63 grade.

Results on Fact Material Section of the Sangren-Woody Reading Test.

An analysis of Table 5 and Figure 5, showed the scores ranged from a low of 5 to a high of 19. The median of 11.9, the mean 12.38, having a standard deviation of 1.7, which showed 10 per cent scored above the mean interval, 11 or 27.5 scored below the mean interval. The results of the test showed the subjects to be 28 grades above the grade placement. The subjects as a group were found to be above or average in demonstrating
### Table 2

**Basic Data Describing the Distribution of Scores Made by Forty-Sixth Grade Pupils on the Sangren-Woody Reading Test**

<table>
<thead>
<tr>
<th>Scores</th>
<th>N</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 - 104</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>95 - 99</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>90 - 94</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>85 - 89</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>80 - 84</td>
<td>9</td>
<td>22.5</td>
</tr>
<tr>
<td>75 - 79</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>70 - 74</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>65 - 69</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>60 - 64</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>55 - 59</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Mean</td>
<td>84.5</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>83.9</td>
<td></td>
</tr>
<tr>
<td>Sigma</td>
<td>10.05</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 2.—Frequency polygon showing the distribution of Total Reading scores made by forty-sixth grade pupils
TABLE 3

BASIC DATA DESCIBING THE DISTRIBUTION OF SCORES MADE BY FORTY-SIXTH GRADE PUPILS ON THE WORD MEANING TEST

<table>
<thead>
<tr>
<th>SCORES</th>
<th>N</th>
<th>PER CENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 - 29</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>20 - 24</td>
<td>25</td>
<td>62.5</td>
</tr>
<tr>
<td>15 - 19</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>10 - 14</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

Mean
Median
Sigma

22.5
22.6
2.25
Fig. 3.—Frequency polygon showing the distribution of Word Meaning scores made by forty-sixth grade pupils.
### Table 4

**Basic Data Describing the Distribution of Scores Made by Forty-Sixth Grade Pupils on the Rate Test**

<table>
<thead>
<tr>
<th>SCORES</th>
<th>N</th>
<th>PER. CENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25–29</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>20–24</td>
<td>26</td>
<td>65</td>
</tr>
<tr>
<td>15–19</td>
<td>13</td>
<td>32.5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>40</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>Mean</td>
<td>21.5</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>21.3</td>
<td></td>
</tr>
<tr>
<td>Sigma</td>
<td>2.6</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 4.—Frequency polygon showing the distribution of Rate scores made by forty-sixth grade pupils.
TABLE 5

BASIC DATA DESCRIBING THE DISTRIBUTION OF SCORES MADE BY FORTY-SIXTH GRADE PUPILS ON THE FACT MATERIAL TEST

<table>
<thead>
<tr>
<th>SCORES</th>
<th>N</th>
<th>PER CENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 - 19</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>10 - 14</td>
<td>25</td>
<td>62.5</td>
</tr>
<tr>
<td>5 - 9</td>
<td>11</td>
<td>27.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

Mean 12.38
Median 11.8
Sigma 1.7
Fig. 5.— Frequency polygon showing the distribution of Fact Material scores made by forty-sixth grade pupils
their efficiency in getting facts from the material read.

**Results on the Central Though Section of the Sangren-Woody Reading Test.**

The scores in this table ranged from a low of 3 to a high of 11, showing a median of 6.5, a mean of 7.9, and a standard deviation of 2.04. showed 5 or 12.5 percent scored above the class interval, 17 or 42.5 scored below the class interval, with 45 percent scoring within the class interval. It would appear that these pupils were achieving at the expected grade level of development in detecting the central though of the paragraph read. (This data will be found in Table 6 Figure 6).

**Results of the Total Meaning Section of the Sangren-Woody Reading Test.**

Table 7 and Figure 7 are presented to show the data on the Sangren-Woody Reading Test. The median was found to be 9.7, the mean of 10.5, and the standard deviation 3.7. The lowest score was 6 and the highest, 11. A large per cent scored above the mean class interval, showing 18 or 45 percent scored within the class interval. As a result of the test these subjects indicated a grade equivalent of 91 or 28 grades above the grade placement as given in the Manual of Directions.

**Results of Following Directions Section of the Sangren-Woody Reading Test.**

An examination of Table 8 and Figure 8 reveals the median to be 7.2, the mean score of 7.9, with a standard deviation of 1.92, and the scores ranged from a low of 3 to a high of 11. The pupils scored 12 grade above the grade placement of 63 grade. These pupils seemed to be efficient in following directions on the basis of the material read. The table indicated that over one half of the subjects scored within the mean class interval, while 35 per cent of the subjects scored above and below the mean class interval.

**Results of the Organization Section of the Sangren-Woody Reading Test.**

An analysis of Table 9 and Figure 9 showed a median of 7.5, the
TABLE 6

BASIC DATA DESCRIBING THE DISTRIBUTION OF SCORES MADE BY
FORTY-SIXTH GRADE PUPILS ON THE CENTRAL THOUGHT TEST

<table>
<thead>
<tr>
<th>SCORES</th>
<th>N</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 - 11</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>6 - 8</td>
<td>18</td>
<td>45</td>
</tr>
<tr>
<td>3 - 5</td>
<td>17</td>
<td>42.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>40</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Mean 7.9  Median 6.5  Sigma 2.04
Fig. 6.-- Frequency polygon showing the distribution of Central Thought scores made by forty-sixth grade pupils.
### Table 7

BASIC DATA DESCRIBING THE DISTRIBUTION OF SCORES MADE BY FORTY-SIXTH GRADE PUPILS ON THE TOTAL MEANING TEST

<table>
<thead>
<tr>
<th>Scores</th>
<th>N</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 - 14</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>9 - 11</td>
<td>18</td>
<td>45</td>
</tr>
<tr>
<td>6 - 8</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>3 - 5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

Mean 10.5
Median 9.7
Sigma 3.7
Fig. 7.— Frequency polygon showing the distribution of Total Meaning scores made by forty-sixth grade pupils
TABLE 8

BASIC DATA DESCRIBING THE DISTRIBUTION OF SCORES MADE BY FORTY-SIXTH GRADE PUPILS ON THE FOLLOWING DIRECTIONS TEST

<table>
<thead>
<tr>
<th>SCORES</th>
<th>N</th>
<th>PER CENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 - 11</td>
<td>16</td>
<td>40</td>
</tr>
<tr>
<td>6 - 8</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>3 - 5</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

Mean  7.29
Median 7.2
Sigma 1.92
Fig. 8.— Frequency polygon showing the distribution of Following Directions scores made by forty-sixth grade pupils
Fig. 2. — Frequency polygon showing the distribution of Organization Scores made by forty-sixth grade pupils
TABLE 9

BASIC DATA DESCRIBING THE DISTRIBUTION OF SCORES MADE BY FORTY-SIXTH GRADE PUPILS ON THE ORGANIZATION TEST

<table>
<thead>
<tr>
<th>SCORES</th>
<th>N</th>
<th>PER CENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 - 14</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>9 - 11</td>
<td>9</td>
<td>22.5</td>
</tr>
<tr>
<td>6 - 8</td>
<td>21</td>
<td>52.5</td>
</tr>
<tr>
<td>3 - 5</td>
<td>9</td>
<td>22.5</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>7.5</td>
</tr>
<tr>
<td>Mean</td>
<td>7.7</td>
</tr>
<tr>
<td>Sigma</td>
<td>2.22</td>
</tr>
</tbody>
</table>
mean of 7.7, with a standard deviation of 2.22 showed 10 or 25 per cent scored below the mean class interval, and 21 or 52.5 per cent of the pupils scored within the class interval. The median of 7.5 is a grade equivalent of 63 grade whereas, the pupils are 0.5 above the grade according to information taken from the manual.

This group as a whole excelled all grade equivalents by a small margin. This does not indicate that all in the group can be rated as average of above average, because, there were pupils in the group that had a grade placement of 48 and 53 grades.

Relationships Between Arithmetic Reasoning and Reading Comprehension.

This section of the report of the research will present a series of (8) correlations as derived from the test scores on the Arithmetic Test and the components of the Reading Test. The obtained correlations are presented in Table 10. The "criterion of reliability" for the observed correlation was established as 2.03 with thirty-eight degrees of freedom and at the five per cent level of confidence for the respective "t" values of the "r".

Relationship Between Arithmetic Reasoning and Reading Comprehension.

The data in Table 10 reported the coefficient of correlation for arithmetic reasoning and reading comprehension, to be 0.37. This coefficient of 0.37 was considered as indicative of slight relationship in a positive direction. It was assumed therefore; that there was a slight tendency for pupils to assume similarly high, average and low positions on the respective tests. When this value of 0.37 was tested against the null hypotheses the resulting "t" of 2.45 was found to be significant at the .05 and .02 levels of confidence. Specifically, when Table "t" was entered with 38 degrees of freedom it was found that a "t" of 2.03 was significant at a .05 level of
confidence. Obviously, the obtained "t" permitted the conclusion that at this level the "r" of 0.37 was reliable and not the result of chance.

Relationship Between Arithmetic Reasoning and Word Meaning.

The data in this Table report the coefficient of correlation for arithmetic reasoning and word meaning. The "r" was found to be 0.27 and its "t" 1.73 at a .05 level of confidence, which was not significant, because it was less than 2.03 with thirty-eight degrees of freedom. It is very confident that there is some degree of relationship between arithmetic reasoning and word meaning.

Relationship Between Arithmetic Reasoning and Rate.

The "r" was found to be 0.17 and indicated a very slight degree of relationship. When this value of 0.17 was tested against the null hypotheses the resulting "t" of 1.06 was found to be not significant at the .05 level of confidence. The obtained "t" permitted the writer to conclude that at this level of confidence, the "r" of 0.17 was not significant.

Relationship Between the Arithmetic Reasoning and Fact Material.

Table 10 presented the data on "r" between the scores obtained on the Otis Arithmetic Reasoning Test were found to be .28 and "t" was 1.79, at the five per cent of confidence, which was not significant because it was less than 2.03 with thirty-eight degrees of freedom.

Relationship Between Arithmetic Reasoning and Total Meaning.

The data in Table 10 reported the coefficient of correlation of arithmetic reasoning and reading comprehension, "r" to be 0.35, which showed a slight relationship in a positive direction. It was assumed therefore, that there was a slight tendency for pupils to assume similar positions on the respective tests. When this value of 0.35 was tested against the null hypotheses the resulting "t" of 2.31 was found to be significant at the .05 and .02 levels of confidence. Specifically, when the Table "t" was entered
with thirty-eight degrees of freedom it was found that a "t" of 2.03 was necessary in order to reject the possibility of chance.

Relationship Between Arithmetic Reasoning and Central Thought.

The data in Table 10 report the coefficient of correlation for arithmetic reasoning and reading comprehension to be 0.36. This coefficient of 0.36 was considered as indicative of slight relationship in a positive direction. It was assumed therefore, that there was a slight tendency for the pupils to assume high average and low positions on the respective tests. When this value of 0.36 was tested against the null hypotheses the resulting "t" of 2.38 was found to be significant at the .05 and .02 levels of confidence. Specifically, when the Table of "t" was entered with thirty-eight degrees of freedom it was found that a "t" of 2.03 was significant at the .05 level of confidence.

Relationship Between Arithmetic Reasoning and Following Directions.

Table 10 showed the data on the "r" between the scores obtained on the Otis Arithmetic Test and Following Directions was found to be 0.29 and "t" was 1.87, at the .05 level of confidence. A "t" of 1.87 was found to be not significant because it was less than 2.03, with thirty-eight degrees of freedom.

Relationship Between Arithmetic Reasoning and Organization.

The "r" was found to be 0.17 and indicated a very slight degree of relationship. When this value of 0.17 was tested against the null hypotheses the resulting "t" of 1.06 was found to be not significant at the .05 level of confidence. The obtained "t" permitted the writer to conclude that at this level of confidence, the "r" of 0.17 was not significant.

Further, a close study of Table 10 showed that the seven "r" indicated some type of relationship; three showed a significant "t". These being
Arithmetic and Reading, Central Thought, and Total Meaning. The "t" for Rate, Word Meaning, Following Directions, and Organization were not significant.
TABLE 10

STATISTICAL DATA SHOWING THE RESULTS OF THE CORRELATION OF ARITHMETIC REASONING TEST RESULTS AND THE SANGREN-WOODY READING TEST RESULTS ON TOTAL TESTS AND READING COMPONENTS BASED ON PERFORMANCES OF FORTY-SIXTH GRADE PUPILS

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>&quot;r&quot;</th>
<th>Obtained &quot;t&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arithmetic Reasoning and Total Reading</td>
<td>40</td>
<td>.37</td>
<td>2.45*</td>
</tr>
<tr>
<td>Arithmetic Reasoning and Word Meaning</td>
<td>40</td>
<td>.27</td>
<td>1.73</td>
</tr>
<tr>
<td>Arithmetic Reasoning and Rate</td>
<td>40</td>
<td>.17</td>
<td>1.06</td>
</tr>
<tr>
<td>Arithmetic Reasoning and Fact Material</td>
<td>40</td>
<td>.28</td>
<td>1.79</td>
</tr>
<tr>
<td>Arithmetic Reasoning and Total Meaning</td>
<td>40</td>
<td>.35</td>
<td>2.31*</td>
</tr>
<tr>
<td>Arithmetic Reasoning and Central Thought</td>
<td>40</td>
<td>.36</td>
<td>2.38*</td>
</tr>
<tr>
<td>Arithmetic Reasoning and Following Directions</td>
<td>40</td>
<td>.29</td>
<td>1.87</td>
</tr>
<tr>
<td>Arithmetic Reasoning and Organization</td>
<td>40</td>
<td>.17</td>
<td>1.06</td>
</tr>
</tbody>
</table>

* Significant at the .05 level of confidence
Rational.—Reasoning with numbers is a required and universal activity of all effective participants in the democratic social order. Hence, the arithmetic competency of modern man is a part of his everyday equipment to live in society. Thus, the arithmetic which is taught in our schools should provide the learner with a way to think about the number of things, a scientific, orderly, reflective, logical, and rational way. Therefore, when a child has developed the ability to reason through and solve problems he has attained one prerequisite to a well ordered and socially significant way of life. However, despite general acceptance of the necessity for a minimum competency in arithmetic, there is too little agreement as to how arithmetic should be in relation to its social implications and the other aspects of learning. This is especially true when it is recognized that there continues to exist a lower level of performance in reading and arithmetic competency than is felt to be desirable if we are to successfully develop the kind of enlightened and effective participating citizens which our society desires. There is need, then, for further study of the relations, if any, which exist between arithmetic reasoning and ability to read.

The Problem.—The problem of this study was to determine the relationship of reading to reasoning problems as revealed by analysis and interpretation of data secured by administering certain standardized tests to a selected group of sixth grade pupils of the First Ward Elementary School, Lake Charles, Louisiana.

Purposes of the Study.—The purposes of this study were to answer the following questions; They were:

What is the general reading level of the group?
What is the status of the group in performing reasoning
problems in arithmetic?
With what efficiency does the group read and grasp the total meaning and central thought of arithmetical problems to be solved?
What is the relationship, if any, between the ability in silent reading and the ability to solve reasoning problems in arithmetic?

Operational Steps.—The subjects used in this study were forty-sixth grade pupils of the First Ward Elementary School. These pupils were selected from three divisions of the sixth grade on the basis of their high average daily attendance for the first three months of the present school term. The ages for the boys ranged from 10 years and 5 months to 14 years and 10 months, the girls ranged from 10 years and 4 months to 15 years.

The Normative Survey Method of Research was used to gather the data necessary for the study. The special techniques of testing and statistics were employed for interpretation of the data. The following tests were administered to forty pupils.

a. The Sangren-Woody Reading Test
b. The Otis Arithmetic Reasoning Test

The data obtained from the administration of these tests were tabulated, treated statistically, evaluated and interpreted in terms of;

a. Significant correlations
b. Significant differences

Beginning December 17, 1953, the Otis Arithmetic Reasoning Test, Forms A and Form B were administered and on December 18, 1953, the Sangren-Woody Reading Tests, Form A and Form B were administered to forty subjects in the sixth grade at First Ward Elementary School, Lake Charles, Louisiana. All tests were given in the Cafeteria-Auditorium, where satisfactory testing
conditions prevailed. Two sixth grade teachers assisted in administering the tests. Scores obtained from the administration of the tests to the subjects of this study were tabulated separately so as to show the relation of each aspect in reading to reasoning problems in arithmetic. Tables were set up to show the frequency distribution, mean, standard deviation and coefficient of correlation. The data from the tests were presented further through the use of graphs, tables, and profile charts in order to determine the relation—existing between the children's reading capacities and reasoning problems in arithmetic.

Locale of Study.—This study was carried out during the first semester of the school term of 1953–54, at First Ward Elementary School, Lake Charles, Louisiana.

Review of Literature.—The pertinent literature reviewed has been concerned with the relation of problem solving ability in arithmetic to comprehension in reading. From the findings of the research, ten major points were stressed as follows:

1. If reading and arithmetic are to function effectively in life, they must become an integral part of life.

2. A large per cent of pupils do not reason in attempting to solve verbal problems.

3. Care should be taken to keep arithmetical problems within the experience, interest, and understanding of the pupil and based upon significant social situations.

4. What children learn meaningfully stays with them better and is applied more successfully than what they learn from the text.

5. Reasoning problems should be worded to necessitate careful reading and thinking.
6. Reading ability is needed to facilitate the solution of arithmetical problems.

7. There is a statistically reliable relationship between experiences of reading and ability in solving problems.

8. Investigators differ in their operation as to whether the ability to read non-mathematical subjects comprehendingly is accompanied by the ability to interpret problems.

9. Research indicates that the findings from studies should stimulate teachers to try to improve the child's reading as a possible aid in improving his ability in arithmetic.

10. In conclusion, the resource persons in the pertinent literature reached the conclusion that the arithmetic program should center around the child and his environment.

Studies, investigations, and conclusions reviewed in this study were made by Monroe, Johnson, Spitzer, Doty, White, Gray, Morton, Summelmeyer, Bueckner, McCallister, Towle, Von Engen, Chandler, Wilks, Lessenger and others.

Findings.—The analysis and interpretation of the data of this study reveal the following findings:

1. Arithmetic Reasoning.—The following statistical measures were obtained. A median score of 7.65, a mean of 7.58, a standard deviation of 2.88. The obtained median score of 7.65 was 0.3 points below the norm of expectancy of achievement for sixth grade pupils. 62.50 per cent of them were found to be at the level of achievement at or above the norm established for sixth grade.

2. Reading Ability.—On word meaning of the Reading Components of the Sangren-Woody Reading Test the following statistical measures were obtained; the median of 22.6, a mean of 22.5, a standard deviation of 2.25, with a
low score of 10 and a high score of 29. From all indications these pupils were 13 grade above the median score found in the manual of directions. The median of 22.6 is equivalent to grade 7^6, and showed that these pupils were 13 grade above the sixth grade equivalent.

On Rate of the reading component of the Sangren-Woody Reading Test the following statistical measures were obtained: The median was 21.3, the mean 21.5, having a standard deviation of 2.6. The median score of 21.3 was equivalent to a grade placement of 7^{10}. From all indications these pupils were 17 grade above the 63 grade.

On Fact Material of the Reading Component of Sangren-Woody Reading Test the following statistical measures were obtained, the median of 11.8, a mean of 12.38, having a standard deviation of 1.7. The results of the test showed the pupils to be 28 grades above the grade level. According to information found in the test manual, the pupils as a group were found to be above or average.

On Central Thought of the Reading Components of the Sangren-Woody Reading Test the following statistical measures were obtained, the median of 6.5, a mean of 7.9, standard deviation of 2.04, with a low score of 4 and a high of 10. It appeared that these pupils were achieving at the expected level of development in detecting the central thought of the paragraph read.

On Total Meaning of the Reading Components of the Sangren-Woody Reading Test the following statistical measures were obtained; a median of 9.7, a mean of 10.5, with a standard deviation of 3.7, and having a low score of 7 and a high of 12. The pupils scored very high on Total Meaning of the Test.

It was noted that there were about 65 per cent of the pupils had been
exposed to various types of standardized tests, which may account for this high scoring of this section.

On Following Directions of the Sangren-Woody Reading Test, the following statistical measures were obtained, the median of 7.2, the mean of 7.9, and the standard deviation, 1.92. The pupils scored 12 above the grade level. The pupils seemed to be efficient in following directions on the basis of the material read.

On Organization of the Reading Components of the Sangren-Woody Reading Test, the following statistical measures were obtained, a median of 7.5 is a grade equivalent of 6\textsuperscript{8} grade whereas the pupils were 0\textsuperscript{5} above the grade according to information from the "Manual".

The group as a whole excelled all established grade equivalents by a small margin. This did not mean that all in the class be rated as average or above, because, there were pupils in the group that had a grade equivalent of 4\textsuperscript{8} and 5\textsuperscript{3} grade.

On the Sangren-Woody Reading Test the following statistical measures were obtained; a median of 83.9, a mean of 81.5, standard deviation of 10.05, and with a low of 55 and a high of 102. These results indicated that these pupils were 1\textsuperscript{7} grade above the grade level of 6\textsuperscript{3}.

3. **Correlation Between Reasoning and Reading Test.**—The observed relationship between the total scores of the Otis Arithmetic Reasoning Test and the total scores of the Sangren-Woody Reading Test were:

1. Between Arithmetic Reasoning and Reading Comprehension there were an "r" of 0.37 and a "t" of 2.45 which indicated that the relationship was significant.

2. Between Arithmetic Reasoning and Word Meaning there were an "r" of 0.27 and a "t" of 1.73, which indicated that the relationship was not significant.
3. Between Arithmetic Reasoning and Rate there were an "r" of 0.17 and a "t" of 1.06, which indicated that the relationship was not significant.

4. Between Arithmetic Reasoning and Fact Material there were an "r" of 0.28 and a "t" of 1.79 which indicated that the relationship was not significant.

5. Between Arithmetic Reasoning and Total Meaning there were an "r" of 0.35 and a "t" of 2.31, which indicated that the relationship was significant.

6. Between Arithmetic Reasoning and Central Thought there was an "r" of 0.36 and a "t" of 2.38 which indicated that the relationship was significant.

7. Between Arithmetic Reasoning and Following Directions, there were an "r" of 0.29 and a "t" of 1.87, which indicated that the relationship was significant.

8. Between Arithmetic Reasoning and Organization there were an "r" of 0.17 and a "t" of 1.06, which indicated that the relationship was not significant.

All correlations showed a slight degree of relationship in a positive direction. There were three "t"'s that rated as significant and four "t"'s that were not significant.

**Summary of Findings:** An analysis of the data collected in this study provided the following findings. The Arithmetic Reasoning Test showed a median score of 7.65, a mean of 7.58, a standard deviation of 2.88, and a low and high score of 3 and 14. Ten of 25 per cent scored above the class interval, 10 or 25 per cent scored below the class interval, while 20 or 50 per cent scored within the class interval. The obtained median score of 7.65 was .3 below the grade norm for the sixth grade. Sixty-two and five tenth
of the pupils scored at the level of achievement at and above the grade norm of 8.

On the Sangren-Woody Reading Test, the median was 83.9, the mean 84.5, the standard deviation 10.5, and the range 55 to 102. As a result of the test these pupils were 1^7 grade above the grade level of 6^3. Ninety per cent of the pupils scored at or above the level, while 10 per cent scored below the grade level.

The statistical data obtained from Arithmetic Reasoning and Reading Comprehension were based on the criterion of reliability of the statistics pertaining to the Sangren-Woody Reading Test and its major components and the Otis Arithmetic Reasoning Test. The data were established as the respective "t" values of the "r's" at a five per cent level of confidence as based on thirty-eight degrees of freedom for a "t" of 2.03. There was a slight degree of relationship found in all the "r's". Three of them showed a significant "t", these being, Total Reading, Total Meaning, and Central Thought. The "t's" for Rate, Word Meaning, Following Directions, and Organization were not found to be significant, because the "t's" were less than 2.03 at thirty-eight degrees of freedom at the .05 level of confidence.

Conclusion.—The conclusions of this study stem directly from the findings of the study and are stated below as answers to the specific questions asked in the purposes of the study.

1. The general reading level of the group was above the established norms of the test. This group demonstrated on the reading test, a reading level of 7^8 grade equivalent, which shows the subjects were 1^5 grades above their actual grade placement which was 6^3 grade. Ninety per cent of the subjects scored above the 6^3 grade average and 10 per cent scored below. On the basis of grade placement it was concluded that these subjects should
be generally able to master reading materials at an slightly above their present grade level.

2. The status of the group in performing arithmetic reasoning problems showed that they did not reach the grade norm. A large per cent of the pupils appeared to perform almost random calculations upon the numbers given, thereby indicating that they did not attempt to reason in attempting to solve verbal problems.

3. The subjects were very efficient in grasping the total meaning and getting the central thought from the material read on the reading test, but showed a deficiency in solving verbal problems. This may be due to several causes, namely, poor ability in computation, inadequate arithmetical vocabulary and a failure to reason as to the What? and How? of the problem.

4. There is a slight statistical relationship between reading ability in silent reading and the ability to solve reasoning problems in arithmetic.

**Educational Implications:**

1. The relatively high level of performance of these students on the general reading level and their comparatively lower level of performance in solving arithmetic reasoning problems indicates need for study of factors which structure the relationship between reading and arithmetic competency in this school.

2. The relatively high degree of efficiency with which students in this school grasp total meaning and getting the central thought and their deficiency in solving verbal problems indicates need for study for the factors involved in problem solving in this school.

3. Teachers should explore and determine the causes for the significant relation between arithmetic reasoning, total meaning, central thought, and total reading comprehension and then attempt to isolate relationships and causes for the lower correlations in the other area of reading.
4. There is a possibility that improvement in the methods and materials of instruction in both arithmetic and reading may result in improvement of performance in solving arithmetic reasoning problems.

Recommendations.—The findings, conclusions, and implications derived from the data appear to warrant the following recommendations:

1. The First Ward Elementary School should continue the extensive reading program that was organized for the purpose of aiding poor readers.

2. The First Ward Elementary School should organize an arithmetic program centering around the needs of the child and his community.

3. The First Ward Elementary School might consider having standardized tests administered at appropriate intervals during the school year so as to acquaint teachers with the value of testing and to give pupils the benefit of such a program.

4. The faculty and administration of the First Ward Elementary School should seriously consider conducting research designed to isolate causal factors which presently inhibit desirable levels of performance in solving arithmetic reasoning problems. Serious consideration should be turned toward improvement of the materials and methods of teaching arithmetic.
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APPENDIX
PART I. WORD MEANING

DIRECTIONS. On page 3 are such exercises as:
A book is something to 1 wear, 2 read, 3 eat, 4 sail ____________________________ (2)

Here the word that completes the meaning of the sentence or makes it true is "read"; so a line is drawn under "read." The sentence now reads, "A book is something to read." As the word "read" is No. 2, a figure 2 is placed in the parentheses at the end of the sentence. In each exercise on page 3 there is a choice of four words or groups of words, but only one completes the meaning of the sentence or makes it true. Draw a line under that word which makes the sentence true, as shown in the sample above. Then put the number of the right word in the parentheses at the end of the line. Work as rapidly as you can, being sure that all your marks are correct. Do not start until you are told, and when you are told to stop you must stop at once.
# READING PROFILE CHART

Showing the Reading Status of the Pupil in Silent Reading

<table>
<thead>
<tr>
<th>Grade Equivalent</th>
<th>Part I Word Meaning</th>
<th>Part II Fact Rate</th>
<th>Part III Fact Material</th>
<th>Part IV Total Meaning</th>
<th>Part V Central Thought</th>
<th>Part VI Following Directions</th>
<th>Part VII Organization</th>
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**Directions.** Draw a small circle around the number in each column representing the score of the pupil in that part; then join the circles with lines to form the profile. The abilities in which the pupil is strong or weak then stand out clearly.
PART I. WORD MEANING

DIRECTIONS. Underline the word that makes the sentence true. Then write the number of that word in the parentheses.

SAMPLE. A book is something to 1 wear, 2 read, 3 eat, 4 sail. 

Begin here.

1. A dress is something to 1 drink, 2 eat, 3 wear, 4 throw. 
2. A letter comes in the 1 water, 2 wind, 3 store, 4 mail. 
3. A rock is a big 1 stone, 2 animal, 3 train, 4 flower. 
4. To buy something means to 1 drink, 2 pay for, 3 run, 4 play. 
5. A yardstick is three feet 1 heavy, 2 hard, 3 long, 4 smooth. 

6. A lake is made of 1 sand, 2 water, 3 hills, 4 oceans. 
7. Spain is the name of a 1 king, 2 country, 3 woman, 4 car. 
8. An automobile is a kind of 1 paper, 2 chair, 3 car, 4 horse. 
9. A kettle is used for 1 colds, 2 games, 3 fishing, 4 cooking. 
10. Honest means to be 1 funny, 2 old, 3 truthful, 4 pretty. 

11. An enemy is one who 1 loves, 2 pleases, 3 weeps, 4 hates. 
12. Freedom means to have 1 war, 2 liberty, 3 care, 4 trouble. 
13. To reply means to 1 answer, 2 cry, 3 laugh, 4 sleep. 
14. To strike means to 1 carry, 2 stop, 3 hit, 4 play. 
15. A huge rock is one that is 1 big, 2 rough, 3 pretty, 4 smooth. 

16. To enlist is to 1 accept, 2 enroll, 3 disgrace, 4 explain. 
17. A reward is a kind of 1 town, 2 story, 3 payment, 4 school. 
18. A member is one who 1 speaks, 2 believes, 3 belongs, 4 talks. 
19. A tribe is a big 1 house, 2 animal, 3 family, 4 plant. 
20. A luxury is something 1 unnecessary, 2 young, 3 long, 4 heavy. 

21. A bead is an 1 officer, 2 injury, 3 error, 4 ornament. 
22. Utmost means the 1 oldest, 2 greatest, 3 triumph, 4 disguise. 
23. To be positive means to be 1 untrue, 2 certain, 3 careless, 4 great. 
24. To irrigate is to 1 water artificially, 2 annoy, 3 object, 4 talk. 
25. An annoyance is a 1 vehicle, 2 proclamation, 3 vexation, 4 mistake. 

26. A jerk is a sudden 1 pull, 2 terror, 3 curve, 4 noise. 
27. To pour means to 1 drive, 2 empty, 3 lack, 4 hurt. 
28. An alderman is an 1 artist, 2 old man, 3 official, 4 element. 
29. Theft means 1 covering, 2 doctrine, 3 robbery, 4 music. 
30. An oath is a 1 murder, 2 trial, 3 treaty, 4 pledge. 

31. Garlic has 1 odor, 2 curiosity, 3 discretion, 4 banners. 
32. Ignorance means without 1 freedom, 2 vision, 3 knowledge, 4 art. 
33. To observe means to 1 shoot, 2 follow, 3 destroy, 4 notice. 
34. To shudder means to 1 shake, 2 burst, 3 deny, 4 neglect. 
35. To be riotous is to be 1 unconscious, 2 obedient, 3 noisy, 4 lovely. 

36. A bonbon is a 1 heresy, 2 bonnet, 3 dainty, 4 explosive. 
37. A maze is a kind of 1 conspiracy, 2 robbery, 3 puzzle, 4 machine. 
38. A zest is a great 1 snake, 2 relish, 3 arbitrator, 4 disdain. 
39. A mediator is one who 1 invents, 2 lectures, 3 governs, 4 intercedes. 
40. Chronicle is a kind of 1 disease, 2 poetry, 3 king, 4 record. 

Number right ............. (Score)
Is It Lead That Is in Your Pencil?

The “lead” in your pencil is not made of lead. Long ago people had lead in their pencils; that is probably why the pencils we use are called lead pencils. Another mineral called “graphite” is now used. This mineral is taken from mines in the same way as coal or iron ore.

When people began to use graphite for pencils, they took it just as it came from the mines, sawed it into strips, and put it into wooden casings. The lines these pencils made were too black, and the “lead” was so soft that it wore away very fast. Men afterward learned to mix other materials with the graphite to make the mark less black and the “lead” harder and more lasting.

This is the way your pencils are made. The graphite is ground into powder and mixed with the powder of a clay that is found in Central Europe. Very little clay is put in if the lead is to be quite soft, but if it is to be hard, more clay is added. The hardest lead pencils, marked with six H’s like this, have much more clay mixed with the graphite than the soft ones, marked B B B B B. Sometimes a little lampblack is mixed in to make the lead blacker.

After the graphite, clay, and lampblack are mixed together, they are ground in mills. They are stirred round and round until they look like black dough. The dough is then put into a press which has holes in the bottom. The press squeezes this black dough out through these little holes. This is done over and over again until the mixture is smooth enough.

The dough is finally squeezed through a hole of just the size and shape the lead is to be. If the lead wanted is to be square or round, then the hole is square or round. If the size of the lead is to be large or small, then the hole is large or small. The soft string of lead comes slowly through this hole. It is cut into pieces as long as pencils, and these are put on a tray to dry.

As soon as a tray is filled with pieces, it is sprinkled with a dust called “carbon dust” and put in the oven to bake. The pieces are left in the very hot oven several hours, until they are perfectly dry. When they are dry, they are put into small blocks of wood and made into pencils.

\[
\text{Number of words read first minute} \div 10 = \text{(Score)}
\]
PART III. FACT MATERIAL

DIRECTIONS. Write the answer to each question on the dotted line. Use one word if possible.

The “lead” in your pencil is not made of lead. Long ago people had lead in their pencils; that is probably why the pencils we use are called lead pencils. Another mineral called “graphite” is now used. This mineral is taken from mines in the same way as coal or iron ore.

When people began to use graphite for pencils, they took it just as it came from the mines, sawed it into strips, and put it into wooden casings. The lines these pencils made were too black, and the “lead” was so soft that it wore away very fast. Men afterward learned to mix other materials with the graphite to make the mark less black and the “lead” harder and more lasting.

This is the way your pencils are made. The graphite is ground into powder and mixed with the powder of a clay that is found in Central Europe. Very little clay is put in if the lead is to be quite soft, but if it is to be hard, more clay is added. The hardest lead pencils, marked with six H’s like this, H H H H H H, have much more clay mixed with the graphite than the soft ones, marked B B B B B B. Sometimes a little lampblack is mixed in to make the lead blacker.

After the graphite, clay, and lampblack are mixed together, they are ground in mills. They are stirred round and round until they look like black dough. The dough is then put into a press which has holes in the bottom. The press squeezes this black dough out through these little holes. This is done over and over again until the mixture is smooth enough.

The dough is finally squeezed through a hole of just the size and shape the lead is to be. If the lead wanted is to be square or round, then the hole is square or round. If the size of the lead is to be large or small, then the hole is large or small. The soft string of lead comes slowly through this hole. It is cut into pieces as long as pencils, and these are put on a tray to dry.

As soon as a tray is filled with pieces, it is sprinkled with a dust called “carbon dust” and put in the oven to bake. The pieces are left in the very hot oven several hours, until they are perfectly dry. When they are dry, they are put into small blocks of wood and made into pencils.

1. What did people use in their pencils long ago?
2. What mineral is used in the pencils now?
3. From what is the mineral taken?
4. Did people ever use graphite alone in the pencils?
5. What is mixed with the graphite in pencils?
6. Where is the clay powder found?
7. How much clay is mixed with graphite to make a soft lead?
8. What does H H H H H H mean on a pencil?
9. What is sometimes mixed with graphite to make blacker lead?
10. Where are the graphite, clay, and lampblack ground?
11. What do the mixed materials look like?
12. What is the color of the dough?
13. For square lead through what kind of hole is the dough squeezed?
14. For large lead through what kind of hole is the dough squeezed?
15. How long are the pieces of lead cut?
16. Why are the pieces of lead placed on a tray?
17. With what are the pieces of lead sprinkled?
18. After being sprinkled, where are the pieces of lead placed?
19. How long are the pieces of lead left in the oven?
20. Into what are the dry pieces of lead put?
DIRECTIONS. Read each paragraph, and then draw a line under the one of the four words given beneath the exercise which correctly answers the question asked.

SAMPLE. The sun is warm and bright this morning. The birds are beginning to come back from the South, and the buds are coming out on the trees and bushes.

What season of the year is it? autumn spring summer winter

1. The waves rolled mountain high. They cut and slashed the sides of the ship. The wind howled and hissed like the voice of the angry sun-god himself. The heavy hail beat upon the deck like stones. Lightning struck the doomed ship and tore it into a thousand pieces.

What do these sentences describe? summer storm mountain rain

2. Tall, slender trees and fragrant shrubbery were near it, and bright-colored birds and butterflies flashed about here and there. A clear little stream rippled and gurgled its way through the grounds. Sweet mint and purple violets, poppies, and tulips grew all around in dreamlike stillness.

What word best describes this scene? beautiful great ugly cloudy

3. The servants were busy roasting oxen, sheep, and hogs. Some of them were making all sorts of cakes and pies. The long, brown tables fairly groaned with good things to eat: roasts of beef and mutton, bread and fruit in heaping baskets, and bowl after bowl of yellow honey and sweet wine.

What is about to take place? fight parade feast show

4. Jan had the largest farm, the greenest pastures, the sleekest cattle, and the greatest windmill of all the men in the country of Holland. His barns were full of hay, his granary full of all kinds of grain. His house was the most beautiful and his grounds the most elaborate of any in the neighborhood.

What word best describes Jan? poor unhappy brave rich

5. A yell, a shriek, breaks the awful stillness of night. There is a great clatter of steel and a sounding of drums. The Scots spring to their feet, sword in hand. They hurry from their hiding places, charge down the long hillsides, cutting the greatly surprised Romans to pieces.

What is taking place? battle ball game circus fire

6. My father could see very plainly that I was not doing my work very well. It seemed to cause him more or less trouble. I was not at all surprised when one morning he said to me: "John, what will become of you? Do you want to become a good-for-nothing and some day beg for your bread?"

How did the father feel? hungry happy worried brave

Go right on to the next page.
7. You can imagine my terror as the sailors cried out in loud voice, "The ship has sprung a leak." The water began to pour into the vessel in torrents, we began to sink rapidly. Every one rushed about frantically from place to place and called loudly for help and safety.

What word tells how the people on the ship felt?

excited    honest    angry    lazy

8. We gathered a great many dried grapes. Corn we husked by the hundred bushel. From the twenty-two bushels of wheat sown, two hundred and twenty bushels were gathered. The field of rye yielded many more bushels than we had expected, and the rice crop was very good.

What time of the year is pictured?

spring    planting time    harvest time    winter

9. It was a happy bunch of boys. Will carried the blankets, the tent, a hunter's ax, and a good-sized bag of provisions. Harry carried the fishing tackle and cooking kit. Bob carried everything from bundles of old clothes and swimming suits to musical instruments. Each of the boys had some matches and a knife.

Where were the boys going?

city    ball game    store    camping

10. The sun was slowly fading in the west, and one by one the stars could be seen gleaming softly in the heavens. No robins were singing, no swallows flying about in the air. Only the shrill voice of the tree toad, the deep croaking of the frog, and the tiresome buzzing of the locusts could now be heard.

What time of the day is it?

afternoon    evening    noon    morning

11. Not a sound broke the stillness; not even the wind blew enough to cause a stir among the leaves. There seemed to be no man and no animal about. The little house was as silent as a grave; and so was the empty canyon. The boy was all alone in his great store-room prison.

What word best describes this scene?

excited    merry    sad    quiet

12. For days and days he kept waiting and listening for some one to come. Every bit of rock that fell, every rustle of the breeze, every snap of a falling twig made him look for a coming footstep. But it seemed that the boy was doomed. All that came were evening and morning.

How must the boy have felt?

lonely    idle    good    pleasant

Number right..........(Score)
PART V. CENTRAL THOUGHT

DIRECTIONS. Draw a circle around the letter before the statement that best tells the important thought of the paragraph.

1. Cod fishing is dangerous business. Thick clouds of fog often settle over the sea more quietly and quickly than showers of rain come down on us. In the thick fog, where one cannot see fifty feet, the men in the dories sometimes lose their way. Sometimes great storms come up and upset their little boats.

   a. Cod fishing is very dangerous business.
   b. Heavy fogs often settle over the sea.
   c. Men cannot see fifty feet in the heavy fog.
   d. Storms often upset the little boats.

2. There is not room enough in France for every one to have a large farm. The whole of France is in size about equal to Missouri, Kansas, and Nebraska; but it has seven times as many people as these three states. Each farm in France must be small, and its owner must cultivate it well to make it provide a living for the family.

   a. France is about the size of Missouri.
   b. Farmers in France raise many grapes.
   c. Every one has a large farm in France.
   d. In France the farms are very small.

3. California is a wonderland to people who have lived all their lives in the eastern part of our country. There one may look up from the orange orchards, yellow with fruit and sweet with blossoms, and see snow-covered mountains shining in the sun. There, too, we may see the largest trees in America and the highest waterfalls.

   a. There are many orange orchards in California.
   b. California is a wonderland to people living in the East.
   c. We may see snow-covered mountains in California.
   d. America's largest trees may be found in California.

4. Many changes that were not all for the best were brought about because of the great migration of peoples from over the sea to our country. Some of the men who came had lived as sea wolves and pirates, knowing no law; some of them had been fighting nearly all their lives against such people as the Britons, Scots, or Danes. They were in many cases restless, lawless men. It was no easy matter for such men to settle down to the quiet work of a peaceful country.

   a. The great migration brought over many rather undesirable men.
   b. Some men who came to this country were sea wolves.
   c. Some men who came here had been fighting the Danes.
   d. Pirates have no regard for the law.

5. It was a poor kind of housekeeping they had in that shiftless home on Little Pigeon Creek after the mother of Lincoln had been taken away. Sarah, the eldest child, was only twelve; Abraham was but ten; and little Dennis Hanks was eight. Sarah tried to keep the house, and her father, in his careless way, tried to help her. But about all they could do was to keep from going hungry.

   a. Sarah Lincoln was the oldest child in the family.
   b. Abraham Lincoln's father was very careless.
   c. The housekeeping in Lincoln's boyhood home was of a very poor kind.
   d. Abraham Lincoln sometimes went hungry.

Go right on to the next page.
6. The climate of the North Central states is healthful, it makes people feel like doing things. Everywhere the summers are warm or hot, with enough rain to make good crops grow. The winters are cold, with many clear, crisp days. Few parts of the world have so good a climate as has the group of North Central states.

a. People do things in the North Central states.
b. The winters are cold, clear, and crisp in the North Central states.
c. There is plenty of rain in the North Central states.
d. The North Central states have a very fine and favorable climate.

7. What we have a right to expect of the American boy is that he shall turn out to be a good American man. Now the chances are strong that he won't be much of a man unless he is a good deal of a boy. He must not be a coward or a weakling, a bully, a shirk, or a prig. He must work hard and play hard. He must be clean-minded and clean-lived, and able to hold his own against all comers.

a. A boy must never be a bully.
b. The best way to become a good man is to be a real good boy.
c. All boys must work hard and play hard.
d. We want all our boys to be brave.

8. Charles the First believed that God had given him the right to rule and that, therefore, he could do as he pleased. He soon made it known to the Parliament and to the people of England that he intended to rule as he saw fit. He declared that neither the people nor Parliament should question his doing so. At times he would say: “Am I not the king? Are not the English people my property to do with as I please? Do not the people exist only for my pleasure?”

a. Charles the First was a selfish and despotic king.
b. The king said that God made him a wonderful man.
c. The English people were very fond of their king.
d. Charles the First was a very kind and unselfish king.

9. No matter what people may say, many good times may be had on the farm in winter. The mailman delivers the mail to our door every day. When our school work is over, we have time to read a great many magazines and farm papers. Of course, we have many splendid chances for coasting and skating parties. Nearly every week there is an entertainment at the church or the school. Sometimes we have moving pictures, too. Usually on Saturdays we can go hunting for rabbits and quail.

a. Once a month we have moving pictures.
b. We have coasting and skating parties in the country.
c. Many good times may be had on the farm in the winter.
d. The mail is delivered right to the door on the farm.

10. The governments of white men do many things to help everybody. The people elect men to work for the government. The elected men attend to the building of roads and manage the post offices, the schools, and the courts. In this way many helpful things can be done that a single family cannot do for itself.

a. The people elect men to work for the government.
b. The elected men manage the schools.
c. The family cannot do many things for itself.
d. The governments of white men are very helpful to everybody.

Number right................(Score)
PART VI. FOLLOWING DIRECTIONS

DIRECTIONS. Do what each paragraph tells you to do.

1. At the right are two squares of different sizes. The larger square is a playground for children, and the smaller one is a garden into which children must not go. There should be a fence between the playground and the garden. Make this fence by drawing a line to separate the squares.

2. At the right are six circles. They stand for one-half dozen eggs. The second egg in the row is not a good one and cannot be used for cooking. In order that Mother will not make a mistake and use it, you must take your pencil and mark it with a cross.

3. The flag of our country is made up of stars and stripes. The stars stand for the states, and the stripes stand for the thirteen colonies. At the right is written the word which stands for the colonies. There is a blank space left on which you must tell what part of the flag stands for the states.

4. There are several numbers written at the right. These numbers tell how many years old children usually are when they begin the different grades in school. Children are usually nine years old when they begin the fourth grade. Draw a line around the number that tells how old children are when they begin the fourth grade.

5. At the right is a square. John lives at A and James lives at B. But, when John and James go to visit each other, they never go all the way around the block. They go straight across the back way. Draw a straight line from A to B to show the path the boys take whenever they go to visit each other.

6. Jack and Ben were playing marbles in their back yard. The boys played all the afternoon. It began to grow dark and they could not see very well. They both lost some of their marbles. Jack lost two of his, and Ben lost many more. Draw circles at the right to show how many marbles Jack lost.

7. James had two balls. One was an old rubber ball; the other was a new baseball that he received from his uncle on his birthday. The other day, when James and his friend were playing ball, the new ball was lost in a field of tall grass. Draw a line around the word at the right that tells which ball was lost.

8. Yesterday Grace bought three sticks of candy. On her way home from the store she met her little friends, Mary and Jane. She gave each of them a stick of candy and had one left for herself. Put a figure in the circle at the right to tell how many sticks of candy Grace had left for herself.

9. We children go to school almost every day of the week. Even on Sunday we usually go to Sunday school. But on Saturday there is no school, and we just play and help around home. Draw a line under the name of the day on which there is no school.

10. It was almost Easter time. Jennie had been coloring Easter eggs all day long. She made them many pretty colors. One of the eggs she colored so that one half was blue and the other half was yellow. At the right is the egg. Draw a line from the top to the bottom of the egg to separate the blue from the yellow.

Number right.............(Score)
Bobby's Dream

Directions. In the paragraph which you have just read, several things took place at different times. Indicate on the blank line before each of the following four statements the order in which they happened, by placing a “1” before the event happening first, a “2” before the event happening next, etc. Do not look again at the paragraph.

Bobby heard a queer voice saying, “I am a keewhack.”
Bobby tried to place the shining key in the keyhole.
Bobby sat down under a tree to rest.
The dog pushed his cold nose against Bobby's hand.

Now read the next paragraph.

The First Fishing Trip

At last came the afternoon when Rob and his brothers were to make their first trip after herring. All the fishermen of the village were out to see them start and to wish them luck. Rob was a proud lad as he stepped on board and took his seat at the oars, but he was secretly ashamed and felt condemned in the eyes of the watching fishermen. They stared watchfully at the surface of the water, but saw no signs of herring anywhere. Long after yard of dripping net they hauled in with back-breaking labor, for the brown meshes were starred with shining herring. Old Sandy was laughing all the while, and Rob was breathless with excitement and pointed to a great quantity of air bubbles rising to the surface of the sea. “Put stones with the sinkers, Rob,” he whispered, “and let the nets go deep, deep, deep.” The boys let out the seemingly interminable drift net as they pulled along gently, and then because they would have a long wait they lighted the little stove, boiled some tea, and had their supper. After a while the brothers fell asleep, but Rob was too excited to sleep and kept watch until in the gray dawn Sandy insisted they should try the nets. Yard after yard of dripping net they hauled in with back-breaking but joyous labor, for the brown meshes were starred at every point with shining herring. Old Sandy was laughing all the while, and Rob was breathless with excitement as they slowly made their way back to the quay.

Now turn over this page.

I. Bobby's Dream

PART VI. ORGANIZATION
The colonel ordered young Ladd to take his position in the government house.

The American fired a rocket high into the air.

The Mogul flashed the signal of her number and maneuvers.

The Amante began gliding imperceptibly toward the outer part of the port.

THE ESCAPE OF THE LUGGER

Indicate the order of these four events as before. Do not look again at the paragraphs.

Now, turn the page and end.

The British ship Mogul was sighted east of the island when the British ship Lion was sighted north of it. The Mogul was sighted by the Lion's captain, who reported it to the Lion's commander. The Lion's commander ordered the Lion to take up a position to the south of the Mogul's position. The Lion's commander then ordered the Lion to fire a rocket to the west of the Mogul.

THE ESCAPE OF THE LUGGER

Directions. Indicate the order of these four events as before. Do not look again at the paragraph.

Sum of differences + 2 = Score
PURPOSES

The purposes of the Sangren-Woody Reading Test are: (1) to call the teacher’s attention to the fact that silent reading is a complex process, having many aspects and phases, and that the measurement of a single phase by a single test does not give a complete diagnostic measure of the ability in question; (2) to provide a series of tests of achievement in reading which will more completely measure silent reading ability and which will make specific measures in several important and clearly distinguished phases of silent reading; (3) to make possible a comparison of the child’s achievement in various types of silent reading activity in which he should engage.

DESCRIPTION OF THE TEST

The Sangren-Woody Reading Test consists of a series of seven parts so constructed as to measure seven distinct phases of silent reading ability. The seven phases of silent reading measured by the parts represent the more important ones so far as may be determined by the generally accepted aims of silent reading instruction.

Part I. Word Meaning. Part I is designed to measure the extent of the child’s silent reading vocabulary. It consists of a series of forty exercises so constructed that the child indicates his knowledge of the meaning of a word by showing its proper use in a sentence. The multiple-choice method is used for recording the response. The words to be defined in this part were selected from The Teacher’s Word Book by Edward L. Thorndike, use being made of words of different frequencies of occurrence in the child’s vocabulary. In the test the exercises are arranged in order of their increasing difficulty.

Part II. Rate. Part II has for its purpose the determination of the child’s rate of reading a continuous selection. The test consists of a selection of approximately four hundred words which the child is asked to read as rapidly as he can understand what he reads. The rate of reading is indicated by the number of words read during the first minute. The selection is one which contains a rather large number of interesting facts so stated as to appeal to children of the grades tested.

Part III. Fact Material. Part III is designed to determine the efficiency with which the child can read and get the facts from the material. The test consists of a series of disconnected paragraphs based upon the story read in Part II, each paragraph being followed by a few fact questions. These fact questions are to be answered by writing the answer, usually a single word, in a blank space provided. The type of material used and the type of question asked resemble closely those which are used in the reading and study of fact subjects such as history, geography, and science.

Part IV. Total Meaning. The purpose of this part is to measure the efficiency with which children read and grasp the total meaning of the paragraphs read. The part consists of a series of short, disconnected paragraphs which contain a rather definite total impression or meaning. To each of these paragraphs the child is asked to respond by underlining one of four words following a question asked about it which best indicates the total impression gained. The sort of reading involved is that which is encountered in reading more or less descriptive accounts of scenes, events, and circumstances.

Part V. Central Thought. Part V is designed to measure how efficiently children read silently and detect the central thought of the paragraph read. The part is composed of a number of disconnected paragraphs, each of which contains a rather definite central thought or leading idea. The child indicates his response to each paragraph by checking the one
of the four statements following it which he thinks is the central or most important thought of the paragraph. The reading activity involved is that in which we engage in much of our reading of expository material.

Part VI. Following Directions. This part is intended to determine with what efficiency children can read and follow directions on the basis of the material read. The test consists of a number of short, disconnected paragraphs, each containing some simple direction which the child is to carry out exactly to indicate his response. The type of reading activity tested is that which is involved in our reading for the purpose of determining precisely what action to take and what order to pursue.

Part VII. Organization. This part is designed to determine how efficiently children can read and organize logically the ideas contained in a series of paragraphs read. The part consists of a number of sets of short paragraphs followed by a series of four statements in a disarranged order, and the child is asked to arrange them in their proper order, by numbering them. The type of reading involved is that encountered in reading historical accounts, scientific expositions, and narrative selections.

Standardization and Refinement of the Test

Experimental work on the Sangren-Woody Reading Test occupied a period of three years. A preliminary edition of the test was given to approximately 3000 pupils in Grades 4B to 8A, inclusive. The test was revised on the basis of the results obtained in this preliminary investigation. In its present form it has been given to approximately 3500 pupils in Grades 4B to 8A, inclusive. These 3500 pupils include those from large schools and small schools, from large cities and small towns.

Validity of the Test

To secure data bearing upon the validity of the constructed test, the following tests were given to children in the public schools at Ypsilanti, Michigan, between October 23 and November 6, 1925:

- Stanford Achievement Test, Form B
- Thorndike-McCall Reading Scale, Form II
- Monroe Silent Reading Test, Form II
- Burgess Silent Reading Test, Form II
- Thorndike Word Knowledge Test, Form II
- Woody Silent Reading Test, Form II
- Sangren-Woody Silent Reading Test, Form A

Table 1 gives a number of coefficients of correlation between scores on the Sangren-Woody Reading Test and the scores on other tests given to the Ypsilanti children. The table is made up in three parts.

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<thead>
<tr>
<th>Part A:</th>
<th>r</th>
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<tbody>
<tr>
<td>Word Meaning and Thorndike Word Knowledge</td>
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<td>.027</td>
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<td>Word Meaning and Stanford Word Meaning</td>
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<td>.021</td>
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<td>.018</td>
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<td>Rate and Monroe (Revised) Rate</td>
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<td>.027</td>
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<tr>
<td>Total score and Stanford Total Reading</td>
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<td>Total score and Burgess</td>
<td>.887</td>
<td>.016</td>
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<tr>
<td>Total score and Stanford Nature and Science</td>
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<td>.047</td>
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<tr>
<td>Total score and Stanford History and Literature</td>
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<td>.047</td>
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<tr>
<td>Total score and Stanford Language</td>
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<tr>
<td>Total score and Stanford Spelling</td>
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<td>.056</td>
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Part A deals with the correlation between the separate parts of the Sangren-Woody Reading Test and tests measuring similar phases of silent reading; Part B, the correlation between the total score in the Sangren-Woody Reading Test and other tests of silent reading; Part C, the correlation between the total score and tests of other school subjects.

Assumed Criterion of Achievement in Silent Reading

In connection with the present investigation it has been necessary to assume an independent criterion as a satisfactory measure of achievement in silent reading. This criterion was constructed as follows: Equal weight was given to the measures listed below by transmitting all the scores into comparable units.

- Stanford Achievement Test: Paragraph Meaning
- Stanford Achievement Test: Sentence Meaning
- Stanford Achievement Test: Word Meaning
- Thorndike-McCall Reading Scale
- Burgess Silent Reading Test
- Monroe Reading Test (Revised) — Rate
- Monroe Reading Test (Revised) — Comprehension
- Teachers’ Reading Marks (Averaged for 3 months)

Table 1

<table>
<thead>
<tr>
<th>Correlations between Scores on the Constructed Silent Reading Tests and Scores on Other Tests of Achievement</th>
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<tbody>
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</table>

1 Results based on 115 cases in Grades 6 and 7.
Throughout the present discussion reference to the "criterion" or "criterion score" will mean the composite score resulting from the above combination of measures. It must be kept in mind that it has not been assumed that the criterion is the true measure of the child's silent reading ability. On the contrary, the criterion score is a fallible score. However, it may be said that the assumed criterion probably represents as satisfactory an independent index of the ability in question as one could secure. At any rate, it is undoubtedly much to be preferred to a score on any single silent reading test.

Table 2 presents coefficients of correlation obtained between scores on the constructed silent reading test and the criterion scores. Outstanding facts which appear in this table are: (1) the average coefficient of correlation between the criterion scores and the scores on the separate parts of the test is .76; (2) the coefficient of correlation between the criterion scores and total scores in the test is .897; (3) considerable variation appears in the degree of correlation existing between the criterion scores and the scores on the separate parts.

TABLE 2
Correlations between Criterion Scores and Scores on the Separate Parts of the Sanger-Woody Reading Test

<table>
<thead>
<tr>
<th></th>
<th>6B</th>
<th>7B</th>
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<tr>
<td>Criterion and Word Meaning</td>
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<td>.921</td>
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<td>Criterion and Rate</td>
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<tr>
<td>Criterion and total score</td>
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(1) the average coefficient of reliability for the various parts is .88 in the case of the 6B group and .86 in the case of the 7B group; (2) the coefficients of reliability for the total score are .987 and .989 respectively in the 6B and 7B groups; (3) considerable variation in the size of the coefficients of reliability for the different tests is apparent.

RELIABILITY OF THE TEST

The traditional method of reporting the reliability of a test is to give its coefficient of reliability. Table 3 presents the coefficients of reliability for the various parts. The main facts appearing in this table are: (1) the average coefficient of reliability for the various parts is .88 in the case of the 6B group and .86 in the case of the 7B group; (2) the coefficients of reliability for the total score are .987 and .989 respectively in the 6B and 7B groups; (3) considerable variation in the size of the coefficients of reliability for the different tests is apparent.

It is not easy to interpret the facts found in Table 3, because there has never been a definite agree-
parts of the Sangren-Woody Reading Test. These means of the scores were obtained by giving both Forms A and B to groups of 6B and 7B pupils. A study of this table reveals the fact that Forms A and B of the Sangren-Woody Reading Test are approximately equivalent.

NORMS OF ACHIEVEMENT ON THE TEST

To secure data bearing upon the comparative achievement of children as measured by the present test, the test was given to 15,700 public school children. The following pages data will be presented as obtained from these results. Since alternate forms of the test appear to be practically equivalent, it has seemed justifiable to throw together the results on both forms to determine provisional norms of achievement and growth.

Table 5 gives the medians of the scores on the various parts. The table is read as follows: In Part I (Vocabulary) the median of the scores of pupils in the first month of the third grade is 8.3 points. The median of the scores of pupils in the second month of the third grade is 8.6 points, etc. In Part II (Rate) the median of the scores of pupils in the first month of the third grade is 12.0 points, etc.

DIRECTIONS FOR GIVING

The actual amount of time given for work on all the tests is 87 minutes. The time required to give the entire group of tests, including filling in the blanks and giving instructions, is between 35 and 40 minutes.

If necessary, the tests may be given in two sittings, giving the first four tests during the first sitting and the remaining three at the second sitting, not more than two days later.

To administer the test, begin by saying: "You are now to be given a test in reading. As soon as you receive a test booklet, fill the blanks on the first page, writing your name, grade, etc. Then you may read the directions on the first page. Do not open the booklet until you are told to do so."

Have the booklets passed to the pupils right side up. When all have finished filling the blanks (do not wait for all to read the directions), say: "Now listen while I explain about the test. You must do your best, because we want to compare your marks with the marks which other pupils make. You must play fair. Never start any part until you are told to do so, and you must always stop as soon as you are told. If you should finish any part before you are told to stop, wait quietly for the rest to finish. Never turn a page unless you are told to do so. When you turn a page, you must fold the book back this way." (Illustrate.)

"Now turn to page 3, where you see Part I. Hold your pencils up. Listen carefully. This is a test to
see whether you know the meanings of certain words. Look at the line at the top marked 'Sample.' It says, 'A book is something to—wear, read, eat, sail.' The right word, of course, is read; so the word 'read' is underlined. And the word 'read' is No. 2; so a figure 2 is placed in the parentheses at the end of the line.

"That is the way you are to answer this part of the test. Find the word that makes the sentence true, draw a line under it, and put its number in the parentheses. Ready; begin."

Note the exact position of the second hand of your watch as you say "begin" and with a pen put a small mark on the crystal to mark the second. (This will wipe off instantly with the finger.) Then write the exact time by the minute hand (e.g., 10:31½) on the margin of the Manual or other convenient place, and below it write the time to say "stop." For Part I this is 3 minutes later (e.g., 10:34½). When the minute hand is at 10:34½ and the second hand is at the ink mark, say: "Stop. Turn to page 4. This is a test to see how well you can read silently. When I say 'Go,' begin to read the story. Read silently and only as fast as you can understand what you read, for you will be asked questions about the story when you are through. You will be marked on how much you read and on how well you answer questions about the story.

"Every minute I will say 'Mark.' When I say 'Mark,' draw a line around the word you are reading, and keep right on reading. If you should finish before I say 'Stop,' lay your paper aside and wait until the rest have finished. Ready; go."

Mark your watch as before to show the exact time you say "go." Then each time the second hand passes the ink mark on the watch say "Mark." After you have said "Mark" the third time (i.e., at the end of 3 minutes), say, "Stop reading and turn to Part III on page 5.

"Notice that on this page there are several paragraphs, each followed by some questions. When I say 'Begin,' you are to read the first paragraph carefully; then read the questions following it, and write the answer to each question on the dotted line. You may read the paragraph again if you need to. Then go on to the next paragraph and answer the questions following it, and so on. Answer each question with one word if possible. Ready; begin."

Mark your watch as before and, after exactly 3 minutes, say: "Stop. Turn to Part IV on page 6. Notice that on this and the next page there are twelve paragraphs. After each paragraph there is a question followed by four answers. You are to choose the right answer and draw a line under it. For example, the sample paragraph reads, 'The sun is warm and bright this morning. The birds are beginning to come back from the South and the buds are coming out on the trees and bushes. What season of the year is it? Autumn, spring, summer, winter.'"

"The answer to this exercise is spring; so a line has been drawn under 'spring.'"

"Now read each paragraph, then read the question and draw a line under the right answer. Ready; begin."

Allow exactly 2 minutes. Then say: "Stop. Turn to Part V on page 8. On this and the next page are some paragraphs. After each one you will find four statements. Each statement tells something about the paragraph. You are to pick out the statement that you think tells best what the central thought of the paragraph is. Find the sentence that tells the most important thought in the paragraph. Then draw a circle around the letter before that statement. For example, if you think that statement 1 under the first paragraph tells best the central thought of the paragraph, draw a circle around a, but if you think some other sentence tells best the central thought of the paragraph, draw a circle around the letter in front of that sentence. Choose only one sentence after each paragraph. Ready; begin."

When you have finished page 8, go right on to page 9.

Allow exactly 5 minutes. Then say, "Stop. Turn to Part VI on page 10. This is a test to see how quickly and accurately you can read silently and follow directions. Each paragraph tells you to do something. Read the paragraph carefully and do exactly what it tells you to do. Ready; begin."

At the end of exactly 3 minutes, say: "Stop. Turn to Part VII on page 11. On this page are some paragraphs which you are to read carefully only once. After having read the first set of paragraphs through once, you are to turn the booklet around like this (Show how) and you will find four statements about the first set. You are to show the order in which the ideas in these four sentences were given in the paragraphs read. For example, if you think the second statement tells the idea that was mentioned first in the paragraphs, write the number 1 before that statement; then find the statement that tells the idea that came next in the paragraphs and write 2 before that statement; then put a 3 before the idea that came next in the paragraphs, and so on. Remember, do not read any paragraph more than once. When you have done the first set of paragraphs, go on to the next set according to the directions printed in the booklet. Ready; begin."

Allow exactly 8 minutes. Then say: "Stop. Close your booklets and leave them right side up on your desk." Have monitors collect booklets at once.
SUMMARY

Time is to be allowed for the parts as follows:

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part I</td>
<td>Word Meaning</td>
<td>3 min</td>
</tr>
<tr>
<td>Part II</td>
<td>Rate</td>
<td>3 min</td>
</tr>
<tr>
<td>Part III</td>
<td>Fact Material</td>
<td>5 min</td>
</tr>
<tr>
<td>Part IV</td>
<td>Total Meaning</td>
<td>2 min</td>
</tr>
<tr>
<td>Part V</td>
<td>Central Thought</td>
<td>5 min</td>
</tr>
<tr>
<td>Part VI</td>
<td>Following Directions</td>
<td>3 min</td>
</tr>
<tr>
<td>Part VII</td>
<td>Organization</td>
<td>8 min</td>
</tr>
<tr>
<td>Total working time</td>
<td></td>
<td>27 min</td>
</tr>
</tbody>
</table>

DIRECTIONS FOR SCORING AND RECORDING

The correct answers to the test are given on the Key, a copy of which is included in each package of tests. To score the test, place the Key so that the correct answers are opposite the responses of the pupil, and make a check mark opposite each correct response or a zero opposite each wrong response, or both checks and zeros.

In the case of any item where but one word is to be underlined, or one statement checked; count that item as wrong if two or more words or statements are underlined or checked, unless it is clear that one was intended as the final choice.

Give credit for the answer that was evidently intended as the final one. For example, if two words were underlined but it is evident that one of the two was the final choice, give credit for that one.

After scoring each test, count the number of right responses and write the number in the blank provided at the end of the test. As a check upon the count of right responses, count also the wrong responses, beginning with the next number above the number right. The number of the last response so counted should equal the number of items.

Note that in Part II the number of words read per minute is divided by 10 to get the score on that part.

To aid in the counting of the words read, the number of words in the story, including the title, up to the end of each line is given at the end of the line. Hence an easy way to count the words read is to begin with the number at the end of the last full line read and continue counting the words in the unfinished line up to the last word read.

To score Part VII, (1) find the amount by which the number given by the pupil opposite each sentence exceeds or falls below the correct order number as given in the Key; (2) write these differences in a column; (3) find the sum for the three groups of sentences; (4) divide the sum by 2, dropping any fraction; and (5) subtract the quotient from 12. The remainder is the score in Part VII.

If a pupil has omitted to write an order number in any blank in Part VII, a difference of 2 should be recorded for that blank. The four questions for any one story, therefore, if left blank count as 8 points of difference.

After counting and recording the scores in the several parts, copy these into the table provided on the first page of the test and add to find the total score.

There is provided in each package of tests a Class Record, to which the scores of a class may be posted for convenience in filing. Note also that the first sheet of each test may be torn off and filed as a record, since it contains provision on the second page for the making of a reading profile chart as described below.

DIRECTIONS FOR MAKING A READING PROFILE

To make a reading profile of a pupil, draw a circle around the number in the column of the profile chart headed Part I, corresponding to the pupil's score in Word Meaning, as entered on the first page of the test. In the same way draw a circle around the score in each of the other columns corresponding to the scores made in the succeeding parts of the test. Join the circles with straight lines. This will form a reading profile which will show graphically in which abilities the pupil is strong and in which he is weak.

The numbers in the column at the left indicate the grade for which the various scores are normal. Thus it will be seen that a score of 33 in Part I is normal for the end of the 10th grade; a score of 27 in Part II is normal for the end of the 10th grade; and so on.

The numbers in the chart are so placed that those having the same heights in the chart represent equal abilities. A pupil having a profile which is merely a horizontal line, is shown to have approximately equal ability in the several parts. On the other hand, if the profile projects upward in any column, this indicates that the pupil has unusual ability in that part. Conversely, of course, a drop in the profile shows comparative weakness.

UTILITY OF THE TEST

The Sangren-Woody Reading Test may well be put to the following uses:

1. To determine the weaknesses and strengths of individuals and groups in the various aspects of silent reading. This may be indicated by means of the profile chart.
2. To determine more adequately the general silent reading ability of individuals and groups through the use of the total score in comparison with the norms of achievement.
3. To serve as a basis for instructional procedure in building up practice exercises in the various important aspects of silent reading.
4. To serve as a basis for sectioning children into more homogeneous groups for purposes of reading instruction.
OTIS ARITHMETIC REASONING TEST
(Test 5 of Otis Group Intelligence Scale: Advanced Examination)

By ARTHUR S. OTIS, PH.D.
Formerly Development Specialist with Advisory Board, General Staff, United States War Department.

TEST: FORM A

Read this page. Do what it tells you to do.

Do not open this paper, or turn it over, until you are told to do so. Fill these blanks, giving your name, age, birthday, etc. Write plainly.

Name..................................................Age last birthday............years

First name, initial, and last name

Birthday...........................................Teacher.........................Date...........19

Month Day

Grade..............................................School.........................City

On the other side of this sheet there are 20 problems in arithmetic. You are to write the answer to each problem in the blank space after the problem as shown in the following sample.

Sample problem:
If a boy had 6 marbles but lost 1 marble, how many marbles did he have left? Answer: (5) marbles.

Notice where the answer is put. You will be given 6 minutes for the test. See how many problems you can get right in that time. You may use the margin of the paper to figure on if you need to. Wait until you are told to turn the paper.

<table>
<thead>
<tr>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARITHMETIC</td>
</tr>
<tr>
<td>AGE</td>
</tr>
<tr>
<td>ARITHMETIC</td>
</tr>
<tr>
<td>QUOTIENT</td>
</tr>
</tbody>
</table>

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TEST

Arithmetic

DIRECTIONS. Place the answer to each problem in the parenthesis after the problem. Do any figuring you wish on the margin of the page.

1. If a boy had 10 cents and earned 5 cents, how much money did he have then? .................................................. ( ) cents 1
2. At 4 cents each, how much will 12 pencils cost? .................................................. ( ) cents 2
3. If a man had $25 and spent $10, how much money did he have left? .................................................. ( ) dollars 3
4. At 6 cents each, how many pencils can be bought for 48 cents? .................................................. ( ) pencils 4
5. A boy spent 20 cents and then earned 30 cents. How much more money did he have than at first? .................................................. ( ) cents 5
6. How far can a train go in 5 hours at the rate of 40 miles per hour? .................................................. ( ) miles 6
7. How long will it take a glacier to move 1000 feet at the rate of 100 feet a year? .................................................. ( ) years 7
8. If 2½ yards of cloth cost 20 cents, what will 10 yards cost? .................................................. ( ) cents 8
9. If 2 pencils cost 5 cents, how many pencils can be bought for 50 cents? .................................................. ( ) pencils 9
10. If a man walks east from his home 7 blocks and then walks west 4 blocks, how far is he from his home? .................................................. ( ) blocks 10
11. If a boy can run at the rate of 5 feet in ½ of a second, how far can he run in 10 seconds? .................................................. ( ) feet 11
12. A ship has provisions enough to last a crew of 20 men 50 days. How long would they last a crew of 40 men? .................................................. ( ) days 12
13. One schoolroom has 7 rows of seats with 8 seats in each row, and another schoolroom has 6 rows of seats with 9 seats in each row. How many more seats does one room have than the other? .................................................. ( ) seats 13
14. If 10 boxes full of oranges weigh 500 pounds, and each box when empty weighs 5 pounds, what do all the oranges weigh? .................................................. ( ) pounds 14
15. Town X is 30 miles north of Town Y. Town Y is 15 miles north of Town Z. How far is Town Z from Town X? .................................................. ( ) miles 15
16. If 3½ yards of cloth cost 70 cents, what will 2½ yards cost? .................................................. ( ) cents 16
17. If a strip of cloth 36 inches long will shrink to 33 inches when washed, how long will a 48-inch strip be after shrinking? .................................................. ( ) inches 17
18. If Frank can ride a bicycle 300 feet while George runs 200 feet; how far can Frank ride while George runs 300 feet? .................................................. ( ) feet 18
19. A hotel serves a mixture of 3 parts cream and 2 parts milk. How many pints of cream will it take to make 25 pints of the mixture? .................................................. ( ) pints 19
20. If a wire 20 inches long is to be cut so that one piece is ⅜ as long as the other piece, how long must the longer piece be? .................................................. ( ) inches 20
Read this page. Do what it tells you to do.

Do not open this paper, or turn it over, until you are told to do so. Fill these blanks, giving your name, age, birthday, etc. Write plainly.

Name .............................................................. Age last birthday ...... years
   First name, initial, and last name

Birthday .................................................... Teacher .................. Date ........... 19...
   Month          Day

Grade .............. School .................................. City .......................

On the other side of this sheet there are 20 problems in arithmetic. You are to write the answer to each problem in the blank space after the problem as shown in the following sample.

Sample problem:
If a boy had 6 marbles but lost 1 marble, how many marbles did he have left? ........................................ Answer: (5) marbles

Notice where the answer is put. You will be given 6 minutes for the test. See how many problems you can get right in that time. You may use the margin of the paper to figure on if you need to. Wait until you are told to turn the paper.

Score

<table>
<thead>
<tr>
<th>ARITHMETIC AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARITHMETIC QUOTIENT</td>
</tr>
</tbody>
</table>

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TEST

Arithmetic

**Directions.** Place the answer to each problem in the parenthesis after the problem. Do any figuring you wish on the margin of the page.

1. If a boy had 15 cents and earned 10 cents, how much money did he have then? ............................................. (cents 1)
2. At 3 cents each, how much will 12 pencils cost? ...................... (cents 2)
3. If a man had $25 and spent $15, how much money did he have left? (dollars 3)
4. At 4 cents each, how many pencils can be bought for 36 cents? (pencils 4)
5. A boy spent 30 cents and then earned 40 cents. How much more money did he have than at first? (cents 5)
6. How far can a train go in 6 hours at the rate of 30 miles per hour? (miles 6)
7. How long will it take a glacier to move 2000 feet at the rate of 200 feet a year? (years 7)
8. If 2 1/2 yards of cloth cost 30 cents, what will 10 yards cost? (cents 8)
9. If 3 pencils cost 5 cents, how many pencils can be bought for 50 cents? (pencils 9)
10. If a man walks west from his home 8 blocks and then walks east 3 blocks, how far is he from his home? (blocks 10)
11. If a boy can run at the rate of 6 feet in 1/2 of a second; how far can he run in 10 seconds? (feet 11)
12. A ship has provisions enough to last a crew of 15 men 40 days. How long would they last a crew of 30 men? (days 12)
13. One schoolroom has 8 rows of seats with 8 seats in each row, and another schoolroom has 7 rows of seats with 9 seats in each row. How many more seats does one room have than the other? (seats 13)
14. If 10 boxes full of apples weigh 400 pounds, and each box when empty weighs 4 pounds, how much do all the apples weigh? (pounds 14)
15. If Town X is 15 miles south of Town Y, and Town Y is 30 miles south of Town Z, how far is Town X from Town Z? (miles 15)
16. If a strip of cloth 24 inches long will shrink to 22 inches when washed, how long will a 36-inch strip be after shrinking? (inches 16)
17. If Frank can ride a bicycle 30 feet while George runs 20 feet, how far can Frank ride while George runs 30 feet? (feet 17)
18. A hotel serves a mixture of 2 parts cream and 3 parts milk. How many pints of cream will it take to make 15 pints of the mixture? (pints 18)
19. If 4 1/2 yards of cloth cost 90 cents, what will 2 1/2 yards cost? (cents 19)
20. If a wire 20 inches long is to be cut so that one piece is 3/4 as long as the other piece, how long must the shorter piece be? (inches 20)