TWO STUDIES IN CURRICULUM SUPERVISION IN THE TULSA PUBLIC SCHOOLS:

PART I
THE IMPROVEMENT OF INSTRUCTION IN SPELLING IN GRADES FOUR, FIVE, AND SIX

PART II
THE CONSTRUCTION OF A PRIMARY ARITHMETIC TEST

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PREFACE

In July 1944, the Board of Education of the Tulsa Public Schools created the Department of Curriculum and Educational Planning and Evaluation. To administer the functions of the department and to coordinate all the activities of curriculum evaluation, planning, and construction, the office of Director of Curriculum was created, and the writer was appointed to that position.

As stated in the Rules and Regulations of the Board of Education, the duty of the Director of Curriculum is to conduct a continuous study of education practices in the school system and, in the light of the findings, to plan and direct activities for the improvement of instruction. Thus, the functions of the Department of Curriculum are threefold: evaluation, planning, and construction.

The function of evaluation is vested in a permanent committee called the Educational Research Council of which the Director of Curriculum is chairman. Other members of the Educational Research Council are the Director of Research, Director of Tests and Measurements, and the Director of the Reading Clinic. Other staff members and advisors are added to the Council as needed for specific projects.

The two studies reparted in this dissertation were developed as functions of the Educational Research Council. In both instances, however, the studies were initiated during the second semester of 1943-44 by the writer as chairman of a special committee appointed by the Assistant Superintendent of Schools. This committee later became the Educational Research Council when the Department of Curriculum was established.

The writer is indebted to many persons who gave assistance and counsel in the development of the two problems. For the cooperative working relationship on both problems, the writer is most deeply obligated to the members of the Educational Research Council: Dr. Amanda Herring, Director of Tests and Measurements; Dr. Earl C. Denney, Director of the Reading Clinic; and Dr. Frank R. Pauly, Director of Research. These people shared in all the planning and actual administration of both problems; in addition, they examined critically the manuscripts of both reports. For the construction of the primary arithmetic test, Mr. L. W. Lavengood, Director of Mathematics, was a member of the Council and shared the responsibility in carrying all aspects of the project to completion.

To the teachers who assisted by furnishing items for the original test and to those who administered the try-out tests to their pupils, grateful acknowledgment is made.

The writer wishes to express his deep appreciation to Mr. Guy A. Lackey, Head of the Department of Elementary Education of the Oklahoma A. and M. College, for his counsel and guidance during the course of these two studies. Appreciation is also expressed to Dr. H. Conger, Dean of the School of Education, to Dr. D. C. McIntosh, Dean of the Graduate School, and to Dr. S. L. Reed, Head of the Department of Psychology for their helpful suggestions and criticisms.

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CHAPTER I

THE PROBLEM

How the Problem Arose

Introduction. The impact of criticism emanating from certain sources within the Armed Forces concerning educational deficiencies of men accepted for military service has caused educators generally to review critically their educational programs. Particular concern has been evidenced over the so-called fundamentals, one of which is spelling.

Employers, long before the present war, complained about the inability of many of their employees to spell. Because of the increased need for labor and clerical employees brought by war activities, and because of the shortage of competent help, many people who formerly could not meet the competition of the labor market, due to their educational deficiencies, found themselves in jobs requiring accuracy in the use of the fundamental tools of reading, writing, spelling, and arithmetic. Under these conditions, the criticism of employers became more vocal, adding to the concern of educators over their teaching of these fundamental tools.

A further stimulus to the investigation of the instructional program in spelling was the vigorous and persistent complaints of teachers that the spelling of a majority of the pupils was poor.

Survey of spelling achievement. In an approach to the spelling problem in the Tulsa Public Schools, a survey was made of the results of standard tests of spelling which had been given to all pupils of grades four to eight inclusive during the five-year period from 1940

to 1944. Each testing had included from 2000 to 2500 pupils per grade from the thirty-eight white elementary and junior high schools.

The survey gave indication of the fact that the achievement in the Tulsa elementary and junior high schools was below the national norms for the tests given. Table I gives the median scores of the tests. It also shows the national norms and gives a comparison of the chronological age of the pupils for 1944 with the national age norm.

TABLE I

MEDIAN SCORES IN SPELLING FOR GRADES FOUR TO EIGHT OVER A FIVE YEAR PERIOD

Grade	Test Used	1940	1941	1942	1943	1944	Nat'l Norm	C.A. 1944	C. A. Nat'l Norm
4	Modern School Form I	4.74	4.80	4.68	4.59	4.57	4.8	10-2	10-8
5	Modern School Form II	5.48	5.53	5.53	5.44	5.55	5.8	11-1	11-8
6	Stanford Achievement (Intermediate)	7.0	6.6	6.7	6.6	6.5	6.7	12-1	12-0
7	Stanford Achievement Advanced	6.9	7.0	7.1	7.1	6.7	7.6	12-11	13-2
8	Stanford Achievement Advanced	Not Given	7.5	7.8	7.6	7.7	8.6	13-10	14-6

A study of the table revealed that the medians for grades four, five, and six were only slightly but rather consistently below the national norm. A comparison of the median age with the national age norm indicated that Tulsa pupils were considerably younger in grades four and five. On the basis of this comparison, Tulsa children were perhaps achieving fairly well.

However, in grade six the Tulsa age norm exceeded the national norm. In grade seven, the average achievement over the five-year period was eight-tenths of a grade lower than the national norm and in grade eight the achievement was nine-tenths of a grade lower than the national norm for a four-year period. (No spelling test had been given to the eighth grade in 1940.)

The conclusion was that in the middle grades, spelling achievement was somewhat below expectancy and that in grades seven and eight, the achievement was quite poor as measured by certain standard tests. The picture was even worse in view of the fact that repeated tabulations of intelligence scores had shown an average I.Q. of approximately 103 for Tulsa children, exclusive of the negro population.

Hypotheses for Accounting for Low Scores

Possible reasons for low scores. Before plans could be made for the improvement of spelling achievement, it was necessary to ascertain, if possible, wherein the weaknesses lay. Thus, it became necessary to formulate certain hypotheses which might account for the low scores as revealed by standard tests. Four possibilities were presented:

1. Lackof validity of the list of words taught
2. Lack of sufficiently adequate objectives in the teaching of spelling.
3. Lack of proper teaching methods
4. Lack of validity of the measuring instruments

A preliminary consideration of hypotheses. In considering the validity of the list of words taught, it was recognized that the purpose of instruction in spelling is to teach those words which will be needed in writing. To take the point of view that any words, regardless of

their need in writing, would serve to develop effective spelling is to assume that spelling is a general ability and that complete transfer takes place when one needs to spell a word not previously learned. The futility of assuming transfer in learning to spell has long been recognized due to the inconsistencies of spelling. Horn[1] points out that in grades one to three, a child's experience with the letter a will include as many as forty-seven different sound associations. Horn[2] also states that the word circumference may be spelled in more than 396,000,000 ways by utilizing the spellings of sounds which are identical or nearly identical with those in circumference.

Accepting the idea that the words taught in spelling should be those most commonly needed in writing, a consideration of the list of words used in the Tulsa schools is pertinent.

For fifteen years, according to the direct knowledge of the writer, the list of words included in the Horn-Ashbaugh, Progress in Spelling books has been used in grades four, five, and six. According to the authors,[3] each of the series of their spellers has "utilized all the dependable data on the vocabularies of adults and children which were available at the time of its publication".

On the basis of the recognized authority of these authors in the field of spelling, the writer felt justified in accepting the validity of the list of words used. Further validation would become a major

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[1]Ernest Horn, "The Child's Early Experience With the Letter A", Journal of Educational Psychology, XX (March, 1929), 161-168.

[2]Ernest Horn, "Source of Confusion in Spelling", Journal of Educational Research, XIX (January, 1929), 47-55.

[3]Ernest Horn and Ernest J. Ashbaugh, Progress in Spelling, p. x.

research problem, which in its requirements would exceed the limitations of time, energy, and finances available to the Educational Research Council.

On the junior high school level, however, no list of words had been used for a period of more than five years included in the survey of test results. There, spelling had been taught incidentally. Apparently, no common practice in the selection of words had been followed. Some teachers had given no weekly lists to pupils while others had. Some of these lists which came to the attention of the writer were for the greater part composed of words taken from literature classes, including many proper names and words infrequently used. It was reasoned that the low test results in grades seven and eight might have been due in part to the invalidity of the words taught for spelling.

The second possibility for accounting for low scores in spelling is the lack of sufficiently broad and sound objectives in the teaching of spelling. It is generally recognized that the aim in teaching spelling is to make pupils more effective in writing which means, from the viewpoint of spelling, that they should learn to spell the words which they will need in writing.

The first approach to the implementation of this aim is to teach those words which have been found to be most commonly and frequently used in writing. To be concerned, however, about effectiveness in writing, the objectives in spelling must extend beyond that of teaching a list of the words which have been found to be used most commonly and frequently in writing. To do effective writing, an individual will need to spell other words which are peculiar to one's occupation or one's interests. Less frequently used words are also often needed to express exactness or to

give color and individuality to one's writing. Spelling instruction should be concerned with the ability to learn such additional words as may be required. This objective involves the development of the techniques of self-direction in learning how to spell a new word; of the habit of noting new words in reading and observing their characteristics; and of an inquiring attitude toward the meaning and spelling of new words seen and heard.

A third general objective in teaching spelling is to make the words learned a part of the pupil's actual writing vocabulary and thus promote his ability in expression. To achieve this objective, the teacher must be concerned with the development of the meanings of all words taught; with provision for their use in written composition; and with the development of an attitude toward exactness of use and of spelling in all written work.

A fourth general objective, which may be implied in the first three, is to develop sound purposes for the study of spelling. The importance of this idea for motivation and for the development of certain attitudes toward spelling warrants its position as a general objective.

Observation of the Tulsa program in spelling left no doubt in the mind of the writer that broad comprehensive objectives were not evident in all classrooms. Accordingly, the hypothesis that lack of adequate objectives might account in a measure, for below average spelling results was tentatively accepted. However, due to the intangible nature of objectives, it was decided that only a subjective determination could be made of them as they might be revealed through classroom practices.

The third possibility for the cause of low scores in spelling was that of inadequate methods. In no other area of the curriculum has there

been more complete research, perhaps, than in that of spelling, and much of this research has centered around methods. In discussing methods in spelling and the need for further research, Horn[4] says, "Perhaps the greatest need, however, during the next few years is the skillful incorporation of present knowledge into classroom practice". Consequently, the writer felt that here was a possibility for improvement that definitely needed to be explored —— the extent to which Tulsa teachers were utilizing the evidences of research in their teaching of spelling.

The fourth possibility to account for low scores in spelling was the lack of validity of the tests in measuring what had been learned. Teachers had complained frequently that there were relatively few words on the test that had been taught in the particular grade for which the test was used. Some teachers had made a count of the words that were common to the test and their particular grade list, but no one had determined the number of words found on the test which had been included in the lists of previous grades. A test which included relatively few words which had been taught would be of questionable validity. In the light of the questions raised, the validity of the various tests which had been used was proposed for further investigation.

Delimitation and Statement of the Problem:

The problem was to improve achievement in spelling in the Tulsa schools.

Four hypotheses which might account for below average achievement, as revealed by certain standard tests, were considered. The first, that of the invalidity of the list of words for grades four, five, and six was

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[4]Ernest Horn, "Spelling", Enclyclopedia of Educational Research, p. 1180.

rejected and eliminated from further investigation in this study. On the junior high school level, there was doubt concerning the validity of the list but this phase of the study was also eliminated for reasons stated later.

Investigation of the second hypothesis, that of inadequate objectives was not deemed feasible for this study. For practical purposes, the objectives might be judged in a general way, in the light of classroom practice.

The third hypothesis that of inadequate methods was retained for further investigation.

A study of the curricular validity of the tests was also to be retained for two reasons: for the implications which the results might have on the need for developing or finding other evaluative instruments, and for the bearing the findings might have on the final evaluation of the improvement program to be inaugurated as a part of this study.

Finally, on the basis of the findings of the study of methods, a program for the improvement of instruction, with particular emphasis on correct methods, was to be developed.

The junior high school aspect of the study was eliminated from this report because of insufficient data, although incomplete data and subjective evidence indicate results which were almost identical with those in grades four, five, and six. All the practical aspects of the study, including the program for improvement of instruction were carried out in the junior high schools.

CHAPTER II

REVIEW OF THE LITERATURE ON METHODS OF TEACHING SPELLING

The Purpose

The first phase of the problem was to investigate the adequacy of the methods employed by teachers of grades four, five, and six in their spelling instruction. Adequacy of the methods used was to be judged by the extent to which they agreed with those methods which had been established as desirable by scientific investigations. It is the purpose, therefore, of this chapter to review that portion of the literature on the teaching of spelling which might have significant bearing on the selection of accepted methods to be used as criteria for judging teacher practice.

Methods of Teaching Spelling

Direct teaching versus incidental teaching. Direct systematic teaching of spelling is superior to incidental or opportunistic teaching. The early work on this controversial issue by Rice, Cornman, Wallin, and Winch is discussed by McKee.[1] Rice concluded that instruction in school had little to do with the child's ability in spelling, and that direct teaching was of little value. Cornman concluded from an experimental study in Philadelphia that the teaching of spelling should be confined chiefly to the incidental study of words encountered in other school work. Wallin later, however, conducted a study in the Cleveland schools with the results highly favoring direct teaching, and Winch showed

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[1] Paul McKee, Language in the Elementary School, pp. 367-370.

further that a systematic organization of incidental teaching was not as effective as a direct attack. McKee[2] concludes that the studies of Wallin and Winch are more valid than those of Rice and Cornman because of their experimental nature, and also because at the time of the earlier studies knowledge of proper teaching of spelling was inadequate.

Later, Gates,[3] taking advantage of more refined research techniques and means of measurement found, with first grade pupils, an advantage favoring the direct method which was over four times the corresponding error of the difference. Thompson[4] and Woody (quoted by Thompson) in separate studies of the permanent effects due to direct teaching reported substantial gains over the normal expectancy of incidental learning.

In view of all the later studies of this problem, there seems to be little doubt of the superiority of direct teaching over incidental teaching of spelling.

Much incidental learning of spelling takes place. All teachers who use a pre-test are familiar with the fact that children spell a large per cent of the words of a new lesson without previous direct study. Granting that a few such words have been included in the lists of previous grades, there is no doubt that much incidental learning has taken place in connection with the reading and writing activities of other subjects. McKee[5] has summarized studies by Ogle, Standing, Bugbee, Coast, and others which show that incidental learning takes place at all

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[2]McKee, loc. cit.

[3]Arthur J. Gates, "A Modern Systematic Versus an Opportunistic Method of Teaching", Teachers College Record, XXVII (April 1926), pp. 679-700.

[4]Robert S. Thompson, The Effectiveness of Modern Spelling Instruction, p. 81.

[5]McKee, op. cit., p. 369.

grade-levels; that children learn to spell many words through reading; that training in phonics and in pronunciation secures the learning of some words; and that improvement in handwriting improves spelling.

Incidental learning is not to be confused with incidental teaching; neither is it a function peculiar to incidental teaching. It should be recognized that incidental learning of words may be a product of all direct teaching, which is characterized by a systematic effort to improve basic habits, skills, and attitudes related to spelling, and by encouraging the pupils to apply them in all situations involving reading and writing. While all the factors involved in incidental learning of spelling are not known, the following emphases in method seem certain: (1) the development of self-direction in learning to spell a new word through application of systematic study techniques, through use of the dictionary, through use of generalizations, and through relating the sounds of words to their spelling; (2) the development of an attitude of caring about correct spelling; (3) the practice of calling attention in all classes to new words, to their meanings, their pronunciation, and their spelling.

Test-study versus study-test method. For the purposes of this investigation the test-study method is interpreted to mean, first, that a pre-test of the words for the week is given before the pupils begin their individual study of the words, and, second, that the pre-test is actually used by each individual for determining the words which he needs to study. The writer has found a number of instances in which a pre-test was given, but not actually used for individualizing the work. Following the test, all pupils studied all the words. Such use of the pre-test does not imply the test-study method.

Scientific research is in almost complete agreement on the superiority of the test-study method in the middle grades, although some evidence favors the study-test method in the primary grades. Studies by Kingsley, Keener, Woody, and Kilzner, all reviewed by Foran,[6] indicate gains of one type or another of the test-study method over the study-test method. In most instances the superiority in gains was in terms of the number of words learned, except in the case of Woody's investigation where such gains were negligible. In every case, however, the investigators cited a gain in the conserving of time which could be used for other studies.

The most extensive and perhaps the most conclusive study was by Gates.[7] Ninety-eight classes, including grades two to eight inclusive, were used in the experiment. Each class alternated the methods used for two periods of eighteen weeks each. While the gains were not statistically significant yet they were consistently in favor of the test-study method in all grades with the possible exception of the second and third.

From the objective data available, it is safe to make the conclusion that the test-study method is superior for those pupils who have developed self-direction and independence in study habits. However, objections based largely on opinion have been frequently raised to the test-study method. The two chief objections have been: first, that a single pre-test is not reliable because a pupil may guess correctly or his error may not be detected; second, that an attempt to spell an unknown word may result in an error which will tend to persist. The first

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[6]Thomas G. Foran, The Psychology and Teaching of Spelling, pp. 64-74.

[7]Arthur J. Gates, "An Experimental Comparison of the Study-test and the Test-study Methods in Spelling", Journal of Educational Psychology, xxii (January 1951), pp. 1-19.

objection is met by the argument that the pupil will not likely guess correctly the spelling on both the initial test and the subsequent test given on the third day; by the same reasoning, the error is not likely to be overlooked twice in succession. The second objection has been largely refuted by experiments conducted by Evans and by Heilig and reported by McKee,[8] which show that one misspelling of a word does not result in a fixed pattern.

Use of a pronunciation exercise. Authorities are in full agreement as to the value of a pronunciation exercise, which should precede the pre-test. McKee[9] says "There seems to be no question but that the ability to pronounce a word correctly is an important factor in learning to spell it". He cites studies by Stoddard and by Kay which show the beneficial effect of pronunciation on spelling. Tidyman[10] says that in learning to spell a new word, we are irresistably impelled to divide it into syllables, to pronounce each syllable and then to pronounce the word as a whole. Horn[11] agrees and cites evidence of research.

The writer has observed the effect of mispronunciation on the spelling of words in numerous classroom situations. Frequently words which were mispronounced by the pupils during the pronunciation exercise, due to faulty auditory perception or faulty pronunciation by the teacher, were subsequently misspelled to agree phonetically with the mispronunciation.

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[8] McKee, op. cit., p. 390.

[9] McKee, op. cit., p. 376.

[10] Willard F. Tidyman, The Teaching of Spelling, p. 44.

[11] Ernest Horn, "Principles of Method in the Teaching of Spelling as Derived from Scientific Investigations", Eighteenth Yearbook, Part II, National Society for the Study of Education p. 65.

Syllabication of words. All authorities in spelling are agreed upon the importance of syllabication in both the oral presentation and the study of a word. There is less agreement, however, about the advisability of writing words by syllables on the blackboard. Tidyman[12] suggests that words should be written on the blackboard by syllables. Foran[13] reviews a study by Heilman in which the investigator concluded that "in general, the syllabized form of the word promotes the learning process in spelling." He also cites the results of a study by Wolfe and Breed in which the differences between the use of the syllabized form and the unsyllabized form were negligible, although the authors interpreted their results as slightly favoring the syllabized form. Greene, also according to Foran, found differences that were not important.

Apparently, the evidence does not warrant the practice and neither does it prove it to be bad. Foran doubts the advisability of its use because of the distortion of the visual image which it causes. McKee[14] suggests that perhaps the emphasis should be placed on oral syllabication rather than visual.

Development of the meanings of words. The meaning of each word in the spelling lesson should be developed if it is unknown.

The acceptance of this principle could be justified solely on the basis of reason, because an individual has no purpose for spelling a word unless he can use it in writing. Learning to spell a word which

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[12]Tidyman, op. cit., p. 45.

[13]Foran, op. cit., p. 86.

[14]McKee, op. cit., p. 377.

may later have meaning and thus become functional at a later date is psychologically unsound.

The effect of meaning, however, as an aid in learning to spell a word has been demonstrated through research. Reed[15] reported the results of an experiment in grades three and six, in which words were studied both with and without the development of meanings. The gains as measured by a test immediately following the teaching strongly favored the class which had studied the meanings as well as the spelling. Similar results were obtained on a review test given four weeks later.

Appeal to many types of imagery in a systematic plan of presenting words. In presenting words to the pupils, an appeal should be made to as many senses as possible. Tidyman[16] in discussing psychological principles of presentation has the following to say:

> We have found as general principles, visual presentation is superior to auditory presentation and that the effectiveness of either is increased by oral and written spelling. The successive steps of presentation appear to be: the close association of the visual, auditory, and speech-motor forms of the whole word with the meaning of the word; the visual and auditory presentation of the word in syllables; the pronunciation of the word by syllables with a clear visual analysis of the letters of the syllables; the written and oral spelling of the word.

Studies in types of imagery have shown elementary school children to be strongly visual. Emphasis, therefore, should be placed on precise visual perception of the word, but not to the exclusion of other types of imagery. Auditory, speech-motor, and hand-motor images of the word

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[15] Homer B. Reed, Psychology of the Elementary School Subjects, p. 252.

[16] Tidyman, op. cit., p. 41.

should also be formed through hearing the word, saying the word, spelling the word, and writing the word.

Lay according to Breed,[17] found that methods of presenting nonsense words or syllables which combined an appeal to two or more of the senses were more effective than methods which utilized only one of the senses. Baird, reported by Reed,[18] used words rather than syllables and arrived at the same conclusions. Table II gives a summary of Baird's findings.

Table II

PERCENTAGE OF WORDS MISSPELLED ACCORDING TO METHOD OF PRESENTATION

Method of Presentation	Percentage Misspelled
Pronounced only	6.48
Heard and spelled aloud by pupil	4.86
Seen only	2.60
Seen and spelled aloud by pupil	2.27
Seen, used, spelled and written by pupil	1.00

Foran[19] summarized experiments by Winch which compared a combined visual, motor-articulatory, and auditory method of presentation with a predominantly visual method. The first experiment in a boy's school

[17] Frederick S. Breed, How to Teach Spelling.

[18] Reed, op. cit., pp. 224-72.

[19] Foran, op. cit., pp. 83-84.

indicated a clear superiority for the combined method although a later experiment in a girl's school gave superiority to the visual method. Winch explained the apparent contradiction on the basis of the mental maturity of the pupils.

Other investigations have dealt specifically with types of visual presentation, all of which emphasize the importance of such presentation. For example, Zyve[20] found that "the use of a lantern for presentation of words gave better results than the use of a blackboard when a method which was the same in other respects was used."

Still other investigations by Abbott and by Arps as to the relative merits of presenting words singly or in groups have been summarized by Tidyman.[21] Both investigators found that presenting words singly on the blackboard was better than presenting them in a group. These studies emphasize the importance of a clear visual image unimpaired by divided attention and incidental relationships due to proximity of other words.

Research in the matter of presentation of words clearly establishes the value of strong visual imagery but at the same time indicates the effectiveness of a combined appeal to as many senses as possible.

Column form versus context form for presentation and testing of words. Research evidence indicates that better results are obtained when words are presented and tested in column form rather than in sentence form. The probability is that visual perception is more precise when

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[20]Claire T. Zyve, An Experimental Study of Spelling Methods, p. 71.

[21]Tidyman, op. cit., p. 52-53.

full attention is directed to the word.

McKee[22] reports an experiment with four hundred seventh grade pupils in which the column form of presentation was compared with the phrase, sentence, and paragraph forms. The column form was clearly favored over the context form. McKee's results confirmed those of earlier investigations. Hawley and Gallup[23] found with 1100 pupils that the list form of presentation was superior to that of sentence presentation. Winch, reported by McKee,[24] found that pupils who studied words in column form learned more words than those who studied them in sentence form.

It should be understood that the matter under consideration is the effectiveness of a method of presentation on learning to spell words. It does not refer to the application and use of words in the pupil's writing. Neither does it minimize the necessity of being sure that the pupils have the meanings of the words before they are studied.

The teaching of spelling rules. The evidence on the advisability of teaching rules in spelling is inconclusive. The present trend is to place little emphasis on rules except on those relatively simple rules which have wide application and few exceptions.

The most extensive study of rules and their application to the most commonly and frequently used words is that by Sartorius.[25] In an analysis of twenty current spellers, she found thirty-eight rules which

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[22] McKee, op. cit., pp. 387-389.

[23] W. E. Hawley and Jackson Gallup, "The List Versus the Sentence Method of Teaching Spelling", Journal of Educational Research, V (April, 1922), pp. 306-310.

[24] McKee, loc. cit.

[25] Ina C. Sartorius, Generalizations in Spelling, pp. 1-59.

were contained in five or more spellers. Two spellers contained as many as forty-eight rules, while two spellers contained no rules.

Sartorius then determined the number of words to which twenty-seven of these rules applied, using a list of 4,065 words which represented the basic spelling vocabulary. Eleven of the thirty-eight rules were eliminated from this study because they were generalizations rather than rules. She found 1067 words to which the rules applied and 430 exceptions. One rule, "words of one syllable having the long sound of the vowel usually end in silent e", had 248 applications and 339 exceptions. Fourteen of the rules had no exceptions but they applied to only 193 words.

These data indicate the limited usefulness of rules and the need for discrimination in their use. Foran says:[26]

> Fortunately, the majority of the rules that have few exceptions are fairly short and clear.....This does not mean that rules should be taught but it limits the problem, for few will contend that it is worth while trying to teach pupils rules that they will seldom use and will soon forget.

The major study of the teaching of rules is that of King.[27] She selected six of the rules having the most applications, taught them to pupils in grades three to eight, and then tested the pupils' ability to apply them in a spelling test. Her results were rather inconclusive.

In view of the evidence on rules, Horn[28] recommends that only those rules should be taught that apply to a large number of words and have few

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[26] Foran, op. cit., p. 131.

[27] Luella M. King, Learning and Applying Spelling Rules in Grades Three to Eight, pp. 1-80.

[28] Ernest Horn, "Spelling" Enclyclopedia of Research, p. 1176.

exceptions. He lists the following rules as meeting those requirements:

a. Words ending in silent e usually drop the final e before the addition of suffixes beginning with a vowel, but they keep the final e before the addition of suffixes beginning with a consonant.

b. When a word ends in consonant and y, change the y to i before adding all suffixes except those beginning with i. Do not change y to i in adding suffixes to words ending in a vowel and y, or when adding a suffix beginning with i.

c. Words of one syllable or words of more than one syllable accented on the last, ending in a single consonant preceded by a single vowell, double the final consonant when adding a suffix beginning with a vowel.

d. The letter q is always followed by u in a word.

e. Proper nouns and adjectives always begin with capital letters.

The rules for the use of periods in writing abbreviations and for correct use of the apostrophe to show possession or the omission of letters in contractions also meet the above requirement.

Use of an effective method of studying a word. One of the fundamental weaknesses in many spelling programs is thought to be the failure to develop an effective method of studying a new word.

While research in psychology has shown that there are differences among individuals as to "image-types" and that children are predominantly visual, Horn[29] says that "Most people use readily two or more types of imagery, shifting unconsciously from one to the other, often for no discoverable reason." He further states in discussing a study by Kline that when the learner uses a method designed to be opposed to his image type, the differences are slight.

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[29]Ernest Horn, "Principles of Method in Teaching Spelling as Derived from Scientific Investigations", Eighteenth Yearbook, Part II, National Society for the Study of Education, pp. 70-71.

Differences which may actually exist in image-types could not be discovered by the regular classroom teacher; therefore, the practical approach is to develop a method of study that utilizes all types of imagery. Further justification for this conclusion is the evidence of research previously discussed in connection with the effectiveness of a method of presenting words which combines the use of different types of imagery.

The steps in learning to study a word were first developed by Horn,[30] as the result of a study at the Elementary School of the University of Iowa. The idea of the nine steps originally suggested by him have subsequently been adopted for use by practically all spellers which advocate the use of the test-study plan. These steps, which are too well-known to be included here, provide for emphasis on visual imagery in looking at the word carefully; on auditory and motor-vocal imagery in pronouncing the words; on motor-vocal imagery in spelling the word; and on hand-motor imagery in writing the word.

The steps provide for recall and checking after each step and for repetition after the correct images have been formed. Horn did not originally recommend the saying of the letters, but he later says that it is apparently effective in the case of some pupils.[31]

Opportunity for use of words in writing. There is general agreement that opportunity should be provided for the pupil to use the words he learns in writing. This principle involves more than mere opportunity for pupils to write; it implies that the opportunities should be

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[30] Ibid., pp. 71-72.

[31] Ernest Horn, "Spelling", Enclyclopedia of Educational Research, p. 1177.

provided under teacher direction as a means of further improvement of the pupil's spelling.

The aim of spelling instruction is to make pupils more efficient in spelling the words he uses in writing; therefore, spelling cannot be divorced completely from the writing situation. Research previously cited has indicated that words presented in list form will be learned more easily than when presented in context. This refers, however, to first learning and not to complete learning which occurs only when the words are spelled correctly in the writing done by the pupils. One of the most frequent complaints made by teachers is that spelling fails to "carry over" to writing situations.

Apparently, there are two major reasons for this failure of "carry over": first, an attitude of carelessness or not caring about one's spelling in writing and second, the competition of other processes involved in writing. Book and Harter[32] in a study of spelling errors, involving a total of 18,840 mistakes classified 49.46 per cent of the mistakes as due to lack of knowledge of the correct spelling. The remaining 50.53 per cent was classified as mistakes of expression. In the latter case, the pupils really knew how to spell the words but made mistakes in writing them. While the authors interpretation of their date is open to some question, the importance of their classification deserves some consideration.

Foran suggests:[33]

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[32]William F. Book and Richard S. Harter, "Mistakes Which Pupils Make in Spelling", Journal of Educational Research, (February, 1929), pp. 106-118.

[33]T. G. Foran, op. cit., p. 103.

> The remedy lies in better control of the writing process and this can be achieved only through practice which renders the writing of the word easy enough to permit the even distribution of attention over all parts of the word. Mistakes can also be prevented through cultivating the habit of reviewing what has been written.

Paragraph or sentence writing is a complicated process which involves the construction of ideas, the selection of words to express the ideas, spelling the words, and writing them. Spelling therefore, in a writing situation has much more competition than it does in an isolated situation. The writer contends that complete instruction in spelling includes direction and supervision of the spelling of words in situations for which the pupils learn them. In no other way can spelling under competition with other processes be practiced; moreover, it is only in actual writing situations that habits of caring about one's spelling, of looking up words rather than guessing, and of proof reading what one has written can be developed.

Summary of Methods

As the result of a review of the literature on methods in spelling, eleven principles of method were selected as having been established through scientific investigations. While the writer makes no claim that the eleven principles of method constitute a complete list, he feels that they are the most important ones which have a direct bearing on instruction, and that they will serve the purposes of this study. The following were selected as criteria for judging teacher practice and for emphasis in a supervisory program:

1. Direct systematic teaching is superior to incidental teaching.

2. Much incidental learning takes place normally. It can probably be promoted through good teaching techniques.

3. The test-study method is superior to the study-test method.

4. A pronunciation exercise in which all pupils pronounce all words should precede the pre-test.

5. Syllabication should be emphasized in oral presentation of words. There is doubt about the advisability of syllabizing words on the blackboard.

6. The meaning of each word should be developed if it is unknown.

7. A systematic presentation of words which appeals to as many senses as possible should be made.

8. Better results are obtained when words are presented and written in column form rather than in context.

9. The teaching of rules is questionable. If taught, only a few simple rules with many applications and few exceptions should be used.

10. Pupils should be taught an effective method of learning how to spell a new word.

11. Opportunity should be provided for the pupils to use in writing the words he learns.

CHAPTER III

INVESTIGATION OF TEACHERS' METHODS

Preparation and Administration of the Questionnaire

The most feasible approach to the determination of teacher practice seemed to be through the use of a questionnaire.

The reliability of questionnaires, purporting to secure information as to teacher practices, has been criticised on the basis that they reveal what the teacher knows rather than what she does. The investigator, accepting the validity of this criticism, reasoned, however, that one is not likely to do better than one knows what is good to do. If the results of the questionnaire revealed deficiencies in knowledge of accepted methods, one could conclude that there were also deficiencies in actual practice. In order, however, to minimize discrepancies between response and actual practice, two precautions were to be taken: first, to protect the identity of the teacher replying, and second, to select and word certain questions which would serve as checks on other important questions.

A questionnaire incorporating twenty-eight questions was prepared. (A copy of the questionnaire may be found in the Appendix.) The questions were not confined strictly to methods but included practices other than methods, such as the time allotted to spelling, and whether systematic attention was given to the spelling of words not on the regular list.

Brief instructions were included at the beginning of the questionnaire, and detailed instructions were given to all principals, who were directed to explain the purpose of the questionnaire and make any necessary interpretations. Teachers were asked not to sign their names, unless they desired, and not to identify their schools. Each teacher was to place her completed questionnaire in a blank envelope, and send it directly to the office of the assistant superintendent.

Ninety-nine teachers of grades four, five, and six received the questionnaire. Sixty-eight returned them. The relatively small percentage of returns was due doubtless to the fact that all means of identifying returns had been removed, and there could be no follow-up.

Certain questions were included for the purpose of providing a check on the reliability of answers to other important questions which had been directly stated. For example, item No. 24, which directed the teacher to outline all the activities for each day of the week, served to check the reliability of answers to question No. 11 and also to questions No. 14 and No. 17 which dealt with meaning and pronunciation exercises during the presentation of words.

Results and Conclusions

Time allotted to spelling. Time allotment is not strictly a matter of method; however, it seemed desirable to determine the amount of time allotted to spelling.

For the sixty-eight teachers, an average of 106 minutes per week was reported. No teacher reported less than seventy-five minutes per week.

Horn[1] in reviewing the studies pertaining to the time factor in spelling concluded that fifteen minutes per day was sufficient. Tidyman,[2] however, preferred to interpret the results not as setting a time limit, but as indicating that time itself was not the important factor. The important thing is the way the time is used.

In view of the research available, the average time of 106 minutes per week is adequate, though not excessive if properly spent.

Direct systematic teaching versus incidental teaching. For a number of years previous to 1936-37, spelling was incidentally taught in grades one and two, and directly taught from a spelling list in the subsequent grades of the elementary school. Since that time, it has been directly taught in all grades of the elementary school with the exception of the first. While no definite list has been used in the first grade, special emphasis has been placed on spelling in connection with vocabulary development. Because of this fixed and general policy, no inquiry was needed on this point in the questionnaire. However, all questionnaires returned indicated a definite time allotment to spelling as a subject.

Encouragement of incidental learning. In spite of the importance attached to systematic teaching of spelling, research shows that more words are learned incidentally than through studying a list. Promotion of incidental learning is, therefore, important. Perhaps all the methods

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[1]Ernest Horn, "Principles of Methods in Teaching Spelling as Derived from Scientific Investigations", Eighteenth Yearbook, Part II National Society for the Study of Education, p. 59.

[2]Tidyman, op. cit., p. 135.

employed by the teacher in teaching spelling have a bearing on the promotion of incidental learning of words. This is particularly true of methods which develop self-direction in studying words and certain attitudes such as caring about one's spelling, exactness in writing, and wanting to be certain of the correct spelling. Most of these are intangible. However, it was decided that the teachers' awareness of the possibilities of teaching beyond the list might be judged; consequently, questions number three to eight dealt with this point.

Table III shows the replies to the question, "Does your spelling instructions include words other than those of the list?"

TABLE III

THE INCLUSION OF WORDS OTHER THAN THOSE OF THE LIST

Other Words Included	Grade 4	Grade 5	Grade 6	Total	Percentage of Those Replying
Yes	15	19	25	59	86.7
No	3	4	2	9	13.4

While these data indicate that a favorable majority of the teachers recognizes the possibilities for teaching beyond the list, eighty-three per cent of those replying affirmatively said it was only an occasional practice; moreover, sixty-two per cent said that attention to other words was incidental rather than systematic. Only ten teachers said they added important words to the weekly spelling list. In view of these qualifying answers, it would appear that the amount of regular, systematic attention to words other than those of the list is quite small.

The test-study versus the study-test method. Question number 11, "What general method do you use?" was accompanied with an explanation of each method, and three alternate answers were indicated for checking; test-study method, study-test method, and other general method. Table IV gives the results of the tabulation of the replies.

TABLE IV

GENERAL METHODS USED IN SPELLING AS INDICATED BY TEACHER REPLIES

Method Used	Grade 4	Grade 5	Grade 6	Total	Percentage of Those Replying
Test-study	11	12	18	41	62.1
Study-test	5	2	3	7	10.6
Other Method	2	7	6	18	27.3
No Response		2		2	

The reliability of the responses to this question was checked by the replies to question number 24, which asked for a detailed description of the daily activities during the spelling period. All sixty-eight teachers responded. It was found that the eighteen teachers who indicated "other general method" and the two who failed to respond to question number 11 actually used either the test-study or the study-test method. It was also found that eleven teachers who said they used the test-study method did not use the pre-test as a means of individualizing the pupils' work but had all pupils study all the words. As indicated previously, a pre-test used in this manner fails in its purpose except for the incidental and undirected effect it may have on developing an awareness of the pupils of their individual needs. The method thus becomes essentially a study-test method.

On the basis of the responses to question number 24, a redistribution of the replies was made. Table V shows the results.

TABLE V

GENERAL METHODS USED IN TEACHING SPELLING AS REVEALED BY THE DAILY ACTIVITIES IN SPELLING

Method Used	Grade 4	Grade 5	Grade 6	Total	Percentage of Those Replying
Test-Study	11	12	13	36	52.9
Study-Test	7	11	14	32	47

A comparison of Table IV and Table V indicates misconception on the part of many teachers of the basic differences of the two methods. Of those who professed to use the test-study method, a relatively large per cent misconstrued completely the purpose of the pre-test. The results of Table V reveal that only a small majority of the teachers used the test-study method, which has been established as superior to the study-test method in the middle grades.

The use of a pronunciation exercise. Table VI summarizes the replies to question number 17, "Before the pupils begin study of the words, do you have a pronunciation exercise in which all pupils pronounce all the words?"

TABLE VI

TEACHER RESPONSES ON THE USE OF A PRONUNCIATION EXERCISE

Use of Pronunciation Exercise	Grade 4	Grade 5	Grade 6	Total	Percentages of Those Replying
Yes	12	19	22	53	80.3
No	5	3	5	13	19.7

Four teachers qualified "Yes" by commenting "not all words" and "sometimes", which would bring the percentage of those consistently using the pronunciation exercise below seventy-five per cent. Three teachers who said "no" justified their practice by commenting that there were always familiar words in the list or that the teacher pronounced the words. These comments indicate a misconception of the purpose for the pronunciation exercise, which is to develop not only an auditory image of the word but also a motor-vocal image of the word.

Because of the established validity of this procedure, the percentage of teachers using it was too low.

Syllabication of words. Research is inconclusive as to the practice of dividing words into syllables on the blackboard, but competent authorities agree that it is important to syllabize words in the pronunciation exercise. Consequently, question number 21 was stated, "Do you regularly emphasize syllabication during the pronunciation exercise?" Table VII gives the results of the teacher responses.

TABLE VII

THE PRACTICE OF SYLLABICATION DURING ORAL PRESENTATION

Syllabication Practiced	Grade 4	Grade 5	Grade 6	Total	Percentage of Those Replying
Yes	16	18	25	59	88
No	2	5	1	8	12

The percentage of teachers who followed the practice of syllabication in pronouncing words was reasonably good, although a few teachers qualified their answers by "sometimes" and "usually". The practice is of sufficient importance that all teachers should follow it.

The development of meanings. Item number 14 of the questionnaire was stated, "If you teach the meanings of words in the list, check the answer that applies". Three responses were listed for checking. Table VIII gives the results.

TABLE VIII

PRACTICE IN REGARD TO THE TEACHING OF MEANINGS OF WORDS OF THE LIST

Practice Followed	Grade 4	Grade 5	Grade 6	Total	Percentage of Those Replying
All the words each week	8	10	14	32	47.7
Certain selected words each week	10	10	10	30	44.7
Certain selected words occasionally		3	2	5	7.4

Unfortunately, the alternate responses provided for checking were stated in such a way that it is difficult to draw any conclusions. The important point (though not clearly implied in the questionnaire) was to what extent were teachers assured that all meanings were known to the pupils. It is not desirable that time be spent on discussing meanings that are already known to the pupils. Evidence in the replies to question number 15 led the investigator to conclude that many teachers interpreted "all the words each week" to mean all the words not known by the pupils. Other teachers no doubt interpreted the question literally.

The only safe conclusion that can be drawn from the replies is that not less than thirty-two teachers followed the practice of being sure that all meanings were known to all pupils; that thirty teachers might or might not have followed the practice; and that five teachers gave little attention to meanings.

In reply to question number 15 which asked how teachers determined the words for which meanings should be taught, forty-one teachers indicated that they depended on some type of testing or observation. They tested the pupils' knowledge of the meanings by questions or by asking for sentences using the words; they observed the need through misuse or mispronunciation of words. Four teachers said they depended on children's asking for the meaning. Washburne and Morphett[3] found that with proper encouragement children could be depended on to raise their hands when they did not know a meaning. Twenty-two teachers said they depended on their own judgment. The last method is likely to be less reliable than either of the first two methods because of their objectivity.

Thorough presentation of words through appeal to many senses. Whether teachers followed a plan of presenting words which made an appeal to the various senses was determined by checking the responses to item number 24 which asked for a detailed description of the activities of each day's spelling period. For example, for Monday it was suggested that they list any activities in presenting the words such as writing the words on the blackboard, pronunciation, syllabication, attention to details, and development of meanings. In tabulating the responses, it was considered an adequate presentation if an appeal had been made to visual, auditory, and motor-speech types of imagery. Hand-motor imagery would be developed later in the pre-test and in the study of words missed. Table IX shows a summary of the results.

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[3]Carleton Washburne and M. V. Morphett, "A Simple Technique for Determining Whether Children Know the Meaning of Spelling Words", Journal of Educational Research, XIX (March, 1929), 196-200.

TABLE IX

NUMBER OF TEACHERS USING A COMPLETE PRESENTATION OF WORDS WHICH EMPHASIZED AT LEAST THREE TYPES OF IMAGERY

Thorough Presentation	Grade 4	Grade 5	Grade 6	Total	Percentage of Those Replying
Yes	12	19	19	50	73.5
No	6	4	8	18	26.5

In view of the importance of this procedure, the percentage of teachers using it seems rather low.

Column form versus context form for the presentation and writing of words. Question number 12 was "How are the words presented to the pupils, and written by them on tests?" Two responses were supplied for checking: "in column form" and "in context form". Table X gives the results of the responses.

TABLE X

USE OF COLUMN AND CONTEXT METHODS IN PRESENTING AND WRITING WORDS

Method Used	Grade 4	Grade 5	Grade 6	Total	Percentage of Those Replying
Column form	17	23	22	62	91.2
Context form	1	0	5	6	8.8

The results indicate that the Tulsa teachers almost uniformly followed the recommendations of the research literature on this principle of method.

The use of rules in spelling. Table XI gives the response of teachers to question number 19, "Do you teach any spelling rules?"

TABLE XI

THE USE OF RULES IN TEACHING SPELLING

Rules Used	Grade 4	Grade 5	Grade 6	Total	Percentage of Those Replying
Yes	11	13	21	45	68.2
No	6	9	6	21	31.8

The writer does not attach much significance to the quantitative response to the general question on the use of rules. Research, as pointed out in Chapter II, is indefinite on the advisability of teaching rules, and the best authorities are divided in their opinion. Of much greater significance is the selection of rules to be taught. Question number 13 was a lead to question number 20 which asked "What rules do you teach?" Instructions were to state the rules specifically.

Thirty-nine teachers replied by listing certain rules they taught. Some of the rules were stated so generally that they were not used in the tabulation. A few were stated so briefly that the writer had to place some personal interpretation on the statements. Eliminating certain general rules such as "rules for past tense", "the use of the hyphen to break a word at the end of a line" and "rules for hard and soft c and g", there were twenty-nine rules or variations stated. The following list presents those rules with the total frequency of mention by the teachers of the three grades.

1. Form most plurals by adding s or es - - - - - - - - - - - 10
2. Change final y preceded by a consonant to i before adding a suffix beginning with a vowel - - - - - - 1
3. Change final y to i before adding es if a consonant precedes the y; retain the y and add s if the y is preceded by a vowel - - - - - - - - - - 1

4. Change final y to i before adding es - - - - - - - - - - - - 13

5. Change final y to i before a suffix is added - - - - - - - 2

6. Change final y preceded by a consonant to i before a suffix not beginning with i- - - - - - - - - - - - 1

7. Change final y to i before adding ed- - - - - - - - - - - - 1

8. I before e except after c or when sounded as a in neighbor or weigh -23

9. In one syllable words, the final consonant preceded by a vowel is doubled before a suffix beginning with a vowel - 2

10. Double the final consonant before adding a suffix beginning with a vowel - - - - - - - - - - - - - - - - - 1

11. In one syllable words with a short vowel, double the final consonant before adding ing - - - - - - - - - - - - 2

12. Double the final consonant before adding ing- - - - - - - 1

13. Double the final consonant before adding ed - - - - - - - 1

14. Drop the final e before adding a suffix beginning with a vowel - 6

15. Drop final e before adding ing or ed - - - - - - - - - - - 1

16. Drop final e before adding ing - - - - - - - - - - - - - 4

17. Drop final e before adding ed - - - - - - - - - - - - - - 1

18. Drop final vowel before adding a suffix beginning with a vowel - 1

19. An apostrophe is used in possessives - - - - - - - - - - 5

20. An apostrophe is used in the place of a letter omitted in contractions - 5

21. Proper nouns begin with a capital - - - - - - - - - - - - 2

22. An abbreviation must be followed by a period - - - - - - - 1

23. Monosyllabic words with a long vowel sound end in e - - - 1

24. Final e makes the preceding vowel say its name - - - - - - 4

25. One vowel separated from an e by one consonant says its name - 1

26. Q is always followed by u - - - - - - - - - - - - - - - - - 2

27. Q is always followed by u except in Iraq- - - - - - - - - 1

28. Words ending in f, change the f to v and add es to form the plural; those ending in fe drop the e and change f to v before adding es - - - - - 2

29. Words ending in ie, drop the e and change the i to y before adding ing - - - - - - - - - - - - - - - - - 1

Only a casual inspection of this list will suggest the confusion that might develop for pupils who learn and attempt to apply certain of the rules. For example, rule number 25, learned literally and applied, would do more harm than good. Also, rules number 4 and 5 are stated so that there are too many exceptions.

Only one rule, number 26 is stated in the same form as that recommended by Horn. The rules for a period after abbreviations and for an apostrophe in contractions will also meet the requirements set up by Horn, although they are not among the five rules recommended. The rule i before e as listed by twenty-three teachers is recommended by Wheat[4] with slight modifications. King according to Foran[5] accepts the first rule in the list concerning the formation of plurals.

The remainder of the rules are variations of rules recommended by various authorities; consequently, they have even fewer applications and more exceptions than rules when stated in their best form.

From a study of the rules used by Tulsa teachers, the writer concluded that they have been empirically selected in a rather inexact manner. An effort, therefore, should be made to correct this phase of the instructional program.

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[4]Leonard B. Wheat, "Four Spelling Rules", Elementary School Journal, XXXII (May, 1932), 697-706.

[5]Foran, op. cit., pp. 139-144.

Use of a systematic study plan. As pointed out in Chapter II, one of the greatest weaknesses in many spelling programs is the failure to teach the pupils an effective method for studying words. To check the practice of Tulsa teachers on this point, they were asked in item 23 "What procedures or steps do you have the pupils use in learning to spell a word?" The answers were classified according to the use or non-use of a systematic plan of study. The recommended plan provides for looking at the word, pronouncing it, spelling it, looking away and trying to visualize it, checking the visualization, writing the work and checking, and finally writing it twice more, checking each writing. If the plan suggested by the teacher included looking at the word, attempting to visualize it, checking the visualization, and writing the word at least once, the method was interpreted as meeting the recommendations sufficiently well.

Table XII gives the results of the tabulation.

TABLE XII

USE OF A SYSTEMATIC PLAN FOR STUDYING WORDS

Systematic Plan Used	Grade 4	Grade 5	Grade 6	Total	Percentage of Those Replying
Yes	12	15	12	39	60.9
No	5	8	12	25	39.1

The results of this study indicates much to be desired in developing good study habits in learning to spell a word. The use of a systematic study plan should be developed and emphasized by all teachers, if the Tulsa program is to be as effective as it should be.

Provision for use of the words in writing. Determination of the extent to which this principle is practiced in any classroom would be extremely difficult. If the words of the list are those actually needed in writing, the amount of writing the pupils do would be a measure of its application. Even this measure would be inaccurate and unreliable for any individual. Because of the individual differences of the pupils in interests and in general language development, they will not use the same words with the same frequency. All authorities recommend many and varied writing opportunities at school in the hope that a maximum use may be made by each individual of the words he learns to spell. However, since neither the quantity nor quality of this writing in terms of individual usage of words from the spelling list can be easily measured, the writer decided to investigate the extent to which teachers actually created a situation requiring the use of the spelling words in writing. Consequently, question number 18 was worded "As a regular practice do the pupils use the words in written sentences or written stories during the week's spelling activities?"

Table XIII gives the results of the teachers' responses to the question.

TABLE XIII

PRACTICE OF USING THE SPELLING WORDS IN WRITTEN SENTENCES OR STORIES EACH WEEK

Regular Practice	Grade 4	Grade 5	Grade 6	Total	Percentage of Those Replying
Yes	10	9	13	32	47.8
No	7	14	14	35	52.2

The writer feels that this practice is of sufficient importance that a much greater percentage of teachers than that shown should be utilizing it. It is not suggested that this type of writing experience should be substituted for any amount of functional writing, nor that the emphasis on spelling in functional writing should be lessened. This method is suggested as one of the direct teaching techniques for spelling. Until words can be spelled in sentences, when there is competition with other factors involved in the writing process, they have not been learned.

Summary of Conclusions

1. Generally, the percentage of Tulsa teachers using the principles of method which have been established through scientific investigations and by competent authority is much lower than it should be.

2. Only in the use of the column form of studying words, and perhaps in the practice of syllabizing words in pronunciation is the percentage as high as might be reasonably expected among a large group of teachers.

3. The most fruitful sources for improvement in instruction, based on this study and in the light of their importance, seem to be the following: (1) the use of the test-study method for individualizing instruction; (2) a thorough presentation of the words; (3) and the development of a systematic study plan for learning how to spell a new word.

CHAPTER IV

THE IMPROVEMENT OF INSTRUCTION

Introduction

The results of the investigation of methods used by the Tulsa teachers in grades four, five, and six indicated several possibilities for the improvement of instruction. While a more complete acceptance by all teachers of all the methods investigated was to be sought, certain of these methods were selected for particular emphasis, in the belief that they would have the greatest effect on the efficiency of teaching and learning. Such methods to be emphasized were the following: the use of the test-study plan to individualize instruction; a systematic plan of presentation of words to include a pronunciation exercise, careful oral syllabication, attention to peculiarities of words, notation of the relation of the sounds to the spelling, and the development of meanings; and an emphasis on learning how to study a word.

Procedures Used

Three general procedures were used to promote the plan: the use of bulletins; meetings for discussion of spelling; and encouragement of principals to give special emphases to spelling in their supervision.

A series of seven bulletins was issued to all teachers. The first bulletin covered the general and specific aims of instruction in spelling and the methods for implementation of those aims. Another dealt with the methods of teaching which had been definitely established through scientific investigations. A third bulletin was a check sheet listing important criteria for the instructional program. A fourth described the steps to be used in presenting words, as formulated by three teachers for giving demonstrations. The others dealt with the importance of different types

of imagery and with studies of errors. (Copies of these bulletins may be found in the Appendix.)

A series of five meetings was held with the teachers of each grade, or a total of fifteen meetings. Principals were asked to attend at least one of each of the series. Following the established policy for departmental meetings, all teachers were expected to attend unless excused by the assistant superintendent. The discussion of each meeting revolved about the contents of one or more of the bulletins. One demonstration lesson on the proper presentation of words was held for each grade.

The principal, as the chief supervisory officer of his school, was asked to give special emphasis during the year to the promotion of the program. In some instances, principals held meetings within their buildings for discussion of spelling in the light of the various emphases which were recommended.

Evaluation of the Supervisory Program

The results of standard tests. A comparison of the results of standard test scores for 1943-44 and 1944-45 is shown in Table XIV. The same tests were given in March of both years to the sixth grades and in April to the fourth and fifth grades.

TABLE XIV

COMPARISON OF STANDARD TEST SCORES
FOR THE YEARS, 1943-44 AND 1944-45

Test Used	Grade Level 1943-44	Grade Level 1944-45	Grade Level Gain
Modern School, Form I	4.57	4.7	.13
Modern School, Form II	5.35	5.37	.02
Standard Achievement Intermediate, Form F	6.5	6.4	-.1

The gains as measured by standard tests were small and probably insignificant. This was to be expected, however, in view of the fact that standard tests in spelling measure the efficiency of instruction or the growth in learning only to the extent that such tests include the words that have been taught. The curricular validity of these tests is discussed in the following chapter.

The only means of objectively measuring increased efficiency in instruction is through increased growth in the ability of pupils to spell the words taught. For this purpose, the same test or an equivalent test composed of words actually taught should be given to the groups for whom a comparison is desired. No general test of this kind had been given during the year, 1943-44; consequently no reliable comparisons were possible.

Second use of the questionnaire. A less direct means of evaluating the results of the effort to improve instruction was secured through re-submitting the questionnaire used in 1943-44 to the teachers at the close of the year 1944-45. It was reasoned that the teacher's second response would reveal, at least, her increased knowledge of correct methods.

One hundred three teachers received the questionnaire the second year. The group was the same except for four new teachers. Even more precautions than had been used with the first questionnaire were taken to conceal the identity of those replying. Eighty-five teachers replied.

Table XV gives a comparison of the percentages of the teachers in 1943-44 and in 1944-45 whose responses indicated they were using the methods recommended in this study.

TABLE XV

COMPARISON OF THE PERCENTAGES OF TEACHERS IN 1943-44 AND IN 1944-45 USING THE METHODS RECOMMENDED

Method Recommended	1943-1944	1944-1945	Gain
Direct Teaching	100	100	
Inclusion of needed words other than those of the list	86.7	88.	1.3
Test-study plan	52.9	94.1	41.2
Pronunciation exercise	80.3	95.2	14.9
Syllabication in pronunciation	88	96.4	8.4
Thorough presentation of words before study	73.5	85.4	11.9
Use of column form	91.2	94.2	3.
Emphasis on steps in studying a word	60.9	83.1	22.2
Use of words in writing	47.8	61.1	13.3

Responses to the development of meanings were not included because of the apparently inaccurate interpretation of the question as pointed out in Chapter III. The practice with respect to the use of rules also is not included in Table XV because the practice is controversial, and no effort was made to increase the general use of rules. In the first bulletin and the first discussion meeting suggestions were made that if rules were used, only a few simple rules which have many applications should be developed inductively. While the responses to the 1944 questionnaire listed twenty-nine rules, twenty-three were mentioned in 1945, a decrease of only six. However, the frequency of mention of the more widely applicable rules increased over three hundred per cent on an average, while the frequency for the more inconsistent rules dropped sharply.

According to the results of Table XV, the increase in the use of proven methods of teaching is gratifying. Whether the results indicate actual practice or merely knowledge of good methods, the conclusion remains the same. Teacher training is primarily in terms of knowledges and skills. The application in classroom practice depends on the teacher's professional attitude.

Teachers' opinion. One other attempt at evaluation of the supervisory program was made through another questionnaire which was to obtain teacher evaluation of the program. Table XVI gives the questions and a tabulation of the replies.

TABLE XVI

TEACHER EVALUATION OF THE SUPERVISORY PROGRAM

	No. Responses	Percentage of those responding
1. Number of teachers responding	80	
2. Would there be any value in organizing the ideas presented in the various bulletins and meetings into a brief monograph called *A Guide to the Teaching of Spelling*, to be used in lieu of a course of study in spelling?		
Little value	4	5.3
Some value	25	33.3
Much value	46	61.3
3. and 4. What ideas or principles, emphasized this year have been most helpful to you and to your pupils? (List in the space provided.)[1]		
Systematic steps in learning a new word, utilizing all types of imagery	42	52.5

[1] No suggestions as to type of response were given. Teachers listed their own ideas, which were then compiled.

TABLE XVI - Continued

	No. Responses	Percentage of those responding
Systematic presentation of words	24	30
Careful pronunciation by syllables	22	27.5
Pointing out peculiarities of words	15	18.7
Development of meanings	14	17.5
Stress on use of words in writing	14	17.5
Use of pre-test in test-study method	13	16.2
Habit of checking or proof-reading	13	16.2
Stress on use of dictionary when in doubt	11	13.7
Relating sounds to the spelling	9	11.2
Writing words on the blackboard for presentation	7	8.7
Definite procedures for teaching spelling	6	7.5
Pointing out parts of words already known	5	6.2
Development of a few simple rules	4	5
Attention to correct letter formation	2	2.5
Emphasis on correct pronunciation by the teacher	1	1.2
Leading the pupils to see the need of spelling	1	1.2
Calling attention to spelling words in reading and language	1	1.2
Stress on exactness	1	1.2

TABLE XVI - Continued

	No. Responses	Percentage of those responding
5. Has there been any noticeable change in the attitudes of your pupils toward spelling?		
Better	51	63.7
About the Same	25	31.2
Poorer	0	
6. Check any of the following attitudes in which you have noted a change.		
a. General tendency toward caring about one's spelling		
Better	56	70.8
About the Same	23	29.1
Poorer	0	
b. Tendency toward finding out the correct spelling in all written work, rather than guessing		
Better	51	65.4
About the Same	27	34.6
Poorer	0	
c. Tendency toward proof-reading of words in the weekly test as soon as they are written		
Better	39	51.3
About the Same	37	48.7
Poorer	0	
d. Tendency toward proof-reading the spelling of words in other written work		
Better	37	47.4
About the Same	41	52.6
Poorer	0	
7. Check any of the following habits and skills in which you have noted a change		
a. Consistent method of study in learning how to spell a word		
Better	54	70.1
About the Same	23	29.9
Poorer	0	

TABLE XVI - Continued

	No. Responses	Percentage of those responding
b. Skill in relating the sound of the word or its parts to the spelling		
Better	61	79.2
About the Same	16	20.8
Poorer	0	
8. In your opinion has there been any appreciable change in the Friday test results over those of last year? (Assuming that your classes are of approximately the same ability)		
Better	40	55.5
About the Same	32	44.5
Poorer	0	
9. In your opinion, how have the results of Monday tests compared with those of last year? (Assuming that your classes are of approximately the same ability)		
Better	39	58.2
About the Same	28	41.8
Poorer	0	

At the bottom of the questionnaire, teachers were asked to comment, if they desired. Thirty-four teachers responded with comments, all of which were favorable. Nine other teachers made favorable comment elsewhere on their papers. A number of suggestions were made for emphasis next year. The following are samples of the comments.

> This year I have felt the comfort of official endorsement of many practices that I have employed with success.
>
> The bulletins listing aims in teaching spelling and principles of method have clarified my procedures and techniques.
>
> I feel our entire school has profited by the emphasis that has been placed on spelling this year.

Parents have become interested and concerned. Spelling is now a family problem.

The greatest improvement has been in being more careful about spelling in other written work.

The interest in spelling has increased since the first of the year.

I did not use the pre-test last year. I think perhaps our general improvement may be attributed partly to that. Several have shown marked improvement in better habits of study.

My pupils are more confident they can learn to spell; have more pride in correct spelling in composition work.

The results of the teacher evaluation need no interpretation. The writer feels that in view of the fact that none of the returned questionnaires could be identified, their bearing on the evaluation of the program is significant.

Summary of Conclusions

1. The standard tests given near the close of school in 1944 and in 1945 showed no increase in spelling growth which might have resulted from the efforts to improve instruction. As will be shown in the next chapter, however, these tests measure static ability in comparison with other groups who have taken the tests and are not suitable for measuring efficiency of instruction because the test items are not to any great extent the words taught.

2. The questionnaire on teacher practice of certain proven methods yielded evidence of teacher growth in knowledge of what constitutes good procedures. Since a knowledge of correct procedures is basic to correct practice, there is little doubt that efficiency of teaching was improved. No exact quantitative measure of the transfer of teacher knowledge into teacher practice is possible within the limitations of this study.

3. The teacher evaluation of the program was favorable.

4. While no quantitative evidence is offered on the achievement of the ultimate purpose of the supervisory program, that of growth in spelling efficiency of the pupils, the writer feels that the efforts spent on this problem have been justified. Techniques of teaching have been improved and greater efficiency in learning to spell should result. Additional time for a complete evaluation will be required.

CHAPTER V

THE CURRICULAR VALIDITY OF THE TESTS

Introduction

The purpose of studying the validity. The original purpose of examining the curricular validity of the standard tests used in this study was based on the hypothesis that the below average scores of Tulsa pupils might not be a true measure of their spelling accomplishment. A second reason for examining the tests was for the bearing that the findings might have on the evaluation of this study since the tests were used as a means of evaluation.

Tests used in the study. The standard tests used for many years in the Tulsa elementary schools are the Modern School Achievement Test, published by the Bureau of Publications of Teachers College, Columbia University, and the Stanford Achievement Test, published by the World Book Company. Forms I and II of the Modern School Test have been used in grades four and five, respectively. Form F of the Stanford Achievement Test has been used for the last two years in grade six. Both tests are battery tests of the survey type.

The factor of validity in the relation of a test to instruction. Wilson[1] gives two major criteria for any test: first, it should serve the curricular aims of the subject being tested; second, it should properly reinforce good methods of teaching. Other criteria of tests, such as validity, reliability and objectivity are minor criteria. Many

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[1] Guy M. Wilson, "The Purpose of a Standardized Test in Spelling", Journal of Educational Research, XX (December, 1929), 319-326.

spelling test makers, according to Wilson, sacrifice the two major criteria for the minor criteria.

To serve curricular aims, a test must have curricular validity. Foran[2] points out a difference between test validity and curricular validity. To have test validity, a spelling test must measure the spelling ability of the most proficient speller, much of which has been acquired through incidental learning. Standard tests are designed to measure the range of spelling ability of all pupils, and thus, must often exceed the curriculum limits. To have curricular validity, the test must measure the ability to spell words which are important for pupils to know how to spell. Wilson is more concerned with the latter than with test validity.

McKee[3] holds the same point of view as that of Wilson. McKee states two purposes for giving a spelling test. The first is to determine how well pupils can spell correctly the words which they should know how to spell, and which are valuable enough to be taught. This purpose is to determine the pupil's status in spelling ability. The second purpose is to measure the specific improvement in spelling gained as the result of teaching and study. McKee[4] contends that spelling scales and standard tests derived from scales will serve neither purpose. They will not give a true measure of real spelling ability, or a true measure of the teacher's teaching and the pupil's learning, because most spelling scales have been shown to contain words which are not important in writing.

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[2]Foran, op. cit., p. 177.

[3]McKee, op. cit., pp. 430-439.

[4]Ibid., p. 435.

Wilson,[5] Wilson and Parsons,[6] Foran,[7] and others have pointed out the fact that standard tests in spelling are deficient in curricular validity. Much of this criticism has been directed at the old form of the Stanford Achievement Test.

Procedures Used and Results

The writer, in a study of the curricular validity of the spelling tests used in the Tulsa elementary schools, approached the problem from two points of view: first, to check the number of words on each test with Horn's[8] Basic Writing Vocabulary to get an idea of the general curricular validity; and second, to check the words on each test with the Tulsa spelling lists, to determine the curricular validity with respect to the words actually taught.

Comparison of the words of the tests with the Basic Writing Vocabulary. The Basic Writing Vocabulary was selected because it is generally recognized as the most valid and reliable list of words used in adult writing. Table XVII shows the number of words on each test that fell within the various divisions of the Horn list. The position of the words on the Horn list is designated by a numeral and a letter. The numerals represent the thousandths of the total list and the letter designates the first or second half of the thousand groups. Thus 1B means that the word was within the second five hundred words of the first thousand most frequently used words, as found in the Horn compilation.

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[5] Wilson, op. cit., pp. 319-326.

[6] Guy M. Wilson and A. Rebecca Parsons, "Critical Examination of a Standard Test", Educational Administration and Supervision, XV, (October, 1929), 494-498.

[7] Foran, op. cit., pp. 174-177.

[8] Ernest Horn, A Basic Writing Vocabulary, pp. 1-225.

Above the fifth thousand, only numerals are used. The latter are the writer's interpolation, since Horn gave only frequency numbers above the first five thousand and a table for converting them into thousandth groups. Zero in Table XVII means that the words did not appear in the first ten thousand.

TABLE XVII

THE NUMBER OF WORDS OF EACH TEST FOUND IN EACH DIVISION OF HORN'S BASIC WRITING VOCABULARY

Test	Grade	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6	7	8	9	10	0
Modern School, Form I	4	4	9	7	5	3	2	3	1	2	1	3	3	3	1	2	1
Modern School, Form II	5	5	7	4	7	1	1	3	5	2	2	2	3		4	1	3
Stanford Form F	6	3	9	13	2	3	4	6	3			6			1		

Table XVII shows for the fourth grade test sixteen words above the fourth thousand on the Horn list; for the fifth grade, seventeen words; and for the sixth grade only seven words. One zero word appears on the fourth grade test and three zero words on the fifth grade test. Wilson and Parsons[9] contend that since four thousand words are considered the limit for the number of words usually taught through the eighth grade, words appearing above the fourth thousand on the Horn list are of doubtful validity for any grade. Certainly, those appearing in the upper thousands are not valid.

There can be little justification for the inclusion in the Modern School tests of the large number of words in the upper thousands,

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[9]Guy M. Wilson and A. Rebecca Parsons, op. cit., p. 496.

because these words give no true measure of the pupil's status in ability to spell those words he needs to know.

The new Stanford Form F, recently published has apparently met to a large extent the criticisms of curricular validity which were directed against the older forms. To provide test validity for measuring the complete range of spelling ability some words above the fourth thousand may be justified.

Comparison of the words of the tests with the words on the Tulsa spelling lists. The next approach to a study of the curricular validity of the tests was through a check of the test words with the words taught in each grade of the Tulsa elementary schools. The words of each grade list were first alphabetized to facilitate checking. Table XVIII shows the number of words on each test, appearing in the various grade lists. The numerals in the top row refer to the grade list. The table is read as follows: In the Modern School Test, Form I, for Grade 4, there are seven words which are taught in the third grade, five in the fourth, eight in the fifth, and six in the sixth. There are twenty-four words on the test which do not appear on any list used in the first six grades.

A number of words were found on the lists of two grades. Such words are taught in one grade and reviewed in the next. These words were counted only once, and credited to the grade in which they first appeared.

TABLE XVIII

THE NUMBER OF WORDS OF EACH TEST
FOUND IN EACH OF THE GRADE LISTS

Test	Grade 2	3	4	5	6	Not taught in first six grades
Modern School, Form I	4	7	5	8	6	24
Modern School, Form II	5 2	3	7	6	6	26
Stanford Form F	6	2	8	9	3	28

The table indicates that of the fifty words on the fourth grade test, five are taught in the fourth grade and seven in the third. Thirty-eight of the words are not taught until some later grade, if at all. Thirty-two of the fifty-words on the fifth grade test are not taught by the end of the fifth grade, and twenty-eight of the sixth grades are not taught by the end of the sixth grade.

One may conclude that such testing will offer little measure of pupil accomplishment as the result of teaching. As a measure of the improvement of instruction during the year 1944-45, the tests are of still less value. In that instance, only the words taught in a specific grade during that year would be valid for measuring the improvement of teaching and learning in that grade during the year. In view of these data, the standard tests used in this study as a means of evaluation of the efforts to improve instruction were of no value.

Correlations of Friday test scores with scores on standard tests. In a final effort to study the validity of the tests used, correlations were computed of the average scores made by pupils on their Friday spelling tests and their scores on the standard test. It was reasoned that the Friday scores were true measures of spelling achievement since

the pupils were tested only on the words studied. As true measures they would rank the pupils according to their achievement. Would the standard tests reveal the same ranking with respect to spelling achievement?

Complete Friday test scores for one semester were available from only a limited number of pupils. The average two-weeks score for a semester was computed for each pupil. Average scores for two weeks were used because in two weeks the pupils were tested on fifty words which was the same number as that of the standard test.

Table XIX shows the correlations and probable errors of the scores of the three grade groups.

TABLE XIX

CORRELATIONS OF FRIDAY TEST SCORES AND STANDARD TEST SCORES

Grade	No. Pupils	r	P.E.
4	75	.33	.07
5	154	.40	.05
6	142	.59	.04

All correlations were low, which the writer interpreted as further evidence of the invalidity of the tests for measuring accomplishment in spelling. The correlations for the three grade groups were progressively higher from the fourth grade to the sixth, which may be explained, in part, by the fact that the pupils of the fifth grade had studied more words of their test, as revealed by Table XVIII, than had the fourth grade pupils. Likewise, the sixth grade pupils had been taught more of the words of their test than had either of the other groups.

Conclusions

1. Both forms of the Modern School Test are deficient in general curricular validity, as revealed by a comparison of the words of these tests with the Horn rankings. As such, they are not suitable for measuring the status of the ability of pupils to spell the words that are important for them to spell.

2. The new form F of the Stanford Achievement Test has greater curricular validity than the Modern School Tests.

3. Neither the Modern School Tests nor the Stanford Achievement Test have curricular validity in terms of the word lists of the particular grades in which these tests have been used in Tulsa.

4. In view of the purposes for which these tests have been used in the Tulsa elementary schools, the writer concludes that both time and money are wasted in the regular yearly giving of these tests. To reveal progress that has been made due to instruction, spelling tests should be developed to conform more closely to curriculum materials.

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PART II

THE CONSTRUCTION OF A PRIMARY ARITHMETIC TEST

CHAPTER I

THE PROBLEM

In recent years, the emphasis in arithmetic has been directed more toward meaningful experiences in number and less toward the purely mechanical and abstract manipulation of processes. This trend which has been particularly noticeable in the primary grades was the result of the application of the readiness concept to arithmetic.

Various studies have shown that arithmetic readiness bears essentially the same relationship to early success in formal arithmetic that reading readiness bears to success in systematic reading.

Investigations by Woody,[1] Buckingham, and MacLatchy,[2] and others have shown that children entering the first grade very widely in their knowledge of number and consequently exhibit varying degrees of readiness for the traditional instruction in arithmetic which plunged them early into the number facts of addition and subtraction.

Sueltz[3] in discussing arithmetic readiness says,

> It should be apparent that readiness for the kind of arithmetic or mathematics that I described is a growing or changing thing. For example, there might be readiness for a concept of comparative size, or of shape, or of number and yet no readiness for the measurement of size, or the technical description of shape or of computations with number.

Based on conclusions drawn from a large body of scientific evidence and competent opinion, the Tulsa course of study in arithmetic has, since

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[1]Clifford Woody, "Achievement in Counting in the Primary Grades." Childhood Education, VII (March, 1931), 339-45.

[2]B. R. Buckingham and Josephine MacLatchy, Report of the Society's Committee on Arithmetic, Twenty-Ninth Yearbook of the National Society for the Study of Education, pp. 473-524.

[3]Ben A. Sueltz, "Arithmetic Readiness and Curriculum Construction," Mathematics Teacher, XXX (October, 1937), 290-92.

1938, deferred formal drill in number facts and computational processes until the third grade.

The Tulsa Program in Primary Arithmetic

Deferment of formal arithmetic until the third grade does not imply the absence of a systematic program in arithmetic in the first two grades. It refers only to the postponement of drill for mastery of abstract number facts until a background of number meanings has been established through meaningful experiences related to child life. A definite program in the kindergarten and grades one and two has included the following:

1. Rational counting to 100
2. Counting by 10's to 100
3. Counting by 2's to 20
4. Counting by 5's to 50
5. Reading and writing numbers to 100
6. Ordinals to fifths
7. Concepts of size such as large, big, small, short, long
8. Concepts of comparison such as big, bigger, biggest; tall, taller, tallest, etc.
9. Concepts of quantity such as many, more, most, few, fewer, fewest, etc.
10. Concepts of position such as left, right, upper, low, lower, lowest, top, bottom, and middle
11. Use of cent, nickel, dime, and quarter
12. Some understanding of simple measurements through classroom activities
13. Understanding of the first twenty-five addition and the first twenty-five subtraction facts as the need arose

14. Telling time to the hour

In the third grade the emphasis on broadening number concepts was continued with the gradual introduction of the one hundred addition facts and one hundred subtraction facts. After each fact was introduced in a meaningful situation, drill for mastery followed. Column addition of two digits without carrying and single column addition of three or four addends was required. Likewise, subtraction of two and three digits without borrowing was included. Considerable application of the addition and subtraction processes to problem solving was provided.[4]

The Need for an Evaluative Instrument

For each grade, the teacher was supplied with a check sheet listing the important concepts, facts, and processes by which each child's progress could be recorded. The need, however, for a test to be given at the end of the third grade seemed to be indicated. No commercial test with a valid content for the described program was available. Most tests were completely lacking in content for checking growth in concepts, and none could be found with norms based on the deferred grade placement as used in the Tulsa program.

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[4]Since this study was begun, some change in grade placement has been made. This change places the first forty-five addition facts (sums of 10 or less) and the corresponding subtraction facts in the last half of the second grade. There were two reasons for this shift in grade placement: (1) to make the problem of adjustment for pupils entering or leaving the Tulsa Public Schools of less magnitude; (2) to make the grade placement coincide with the textbook in use. The present program still defers the formal aspects of arithmetic from one-half to a full year in comparison with the program in general practice. The major emphasis in the first three grades is still placed on developing number meanings through child experiences. The final revision and the tentative norms of the test reported in this study are based on the new placement.

Statement of the Problem

The problem described in this study was one of constructing an arithmetic test, suitable for use in the third grade of the Tulsa Public Schools. The test was to provide three comparable forms which would give measures of the development of basic number concepts, of facts and computation, and of problem solving. The test was to be of a general survey type for ranking pupils in arithmetic ability. At the same time, it would be somewhat diagnostic in revealing each individual pupil's status in the three aspects of arithmetic to be tested.

CHAPTER II

PRINCIPLES OF TEST CONSTRUCTION

The construction of an achievement test involves two major problems. The first problem is to determine what is to be measured. The second problem is to construct the test in a manner that a reliable measure of achievement may be secured of those learnings which were determined to be the object of testing. It is the purpose of this chapter to discuss briefly the theory basic to these two problems.[1] The principles set forth in this discussion served as guides in constructing the arithmetic test described in the following chapters.

Objectives as the Basis for Test Construction

According to Tyler,[2] "the basic analysis required for the construction of a test is the analysis of the objectives which the pupil is expected to attain." The inadequacies of most tests in giving a comprehensive appraisal of growth of pupils are largely due to the fact that the tests are based on analysis of content alone with little or no attention given to the types of pupil growth to be attained through this content. Tests constructed in this manner usually place their emphasis on a recall of facts which may have little significance in the actual behavior of pupils. Facts of themselves are of little importance except as they function in establishing concepts, principles or understandings which may be applied to the interpretation of experi-

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[1]The writer has drawn heavily from two sources for the ideas presented in this chapter: (1) Herbert E. Hawkes, E. F. Lindquist and C. R. Mann, The Construction and Use of Achievement Examinations: and (2) Harry A. Greene, Albert N. Jorgensen and J. Raymond Gerberich, Measurement and Evaluation in the Elementary School. Other sources also used are listed in the bibliography.

[2]Ralph W. Tyler, "Newer Techniques in Evaluating Growth," Reading and Pupil Development, p. 276.

ences. Much of the material included in many school courses is not intended for retention but merely to illustrate certain principles which may be important to the pupil in solving life problems.

A statement of objectives, then, in terms of the aspects of growth expected of the pupils is essential to true appraisal of the results of teaching and study.

There is perhaps greater likelihood of inadequate appraisal in science, history, geography and other subject matter fields having a heavy factual content than in arithmetic which usually puts its facts to work immediately in problem solving. Here too, however, in both teaching and testing, the ultimate objectives may be ignored. For example, memorization of number facts and skill in computation are often of major concern to the teacher, yet they are no guarantee of the ability to solve the problems of everyday life situations.

Validity

It is generally recognized that validity is the most important characteristic of a test. The validity of a test depends upon the effectiveness with which it measures what it attempts to measure. Stated otherwise, validity means that the test must accomplish the purpose which the user had in mind in using the test.

It follows, then, that validity is a specific concept. A valid test in one situation might be highly invalid in another situation. Several illustrations will serve to point out the implications of this statement. The most obvious implication is that a valid test for one subject field would have little or no validity for another subject field. Even within the same subject, however, a test might be highly valid in the light of the objectives and emphhases in one classroom and be of low validity for use in another situa-

tion where the objectives were quite different. Moreover, a general achievement test which offers a single score for ranking pupils in the order of their achievement might have high validity for this purpose but relatively low validity for diagnostic purposes. This is because diagnostic tests require a much more detailed sampling in order to reveal specific weaknesses, errors, and gaps in the pupil's achievement. Finally, a test intended for use with a certain ability level might be only partially valid or completely invalid for a different ability level. Tests then, according to Greene,[3] "cannot be described as valid in general terms, but only in connection with their intended use and at the intended ability level of pupils."

Greene[4] discusses three types of validity--curricular validity, statistical validity, and psychological or logical validity. Of these three, he says that curricular validity is by far the most important for in the final analysis, any method of test validation must be based on subjective judgment concerning the degree to which the test covers the proper ground.

Curricular validity. The literature on test construction suggests three methods of obtaining curricular validity. The first and perhaps most commonly used method is to analyze courses of study and textbooks and to include as content of the test only those items which will give some measure of study or textbook used.

A second method employs the judgment of competent persons, or the pooled opinion of national and regional committees found in reports by such bodies. Test items which are definitely related to the objectives set forth in such

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[3]Harry A. Green, Albert N. Jorgensen and J. Raymond Gerberich, Measurement and Evaluation in the Elementary School, p. 54.

[4]Ibid., p. 54.

reports may be considered valid. This method may be superior to the method of analyzing courses of study and testbooks when the test is developed for wide use of many school systems. On the other hand, when the test is developed for a particular school, an analysis of the course of study used in that school should provide greater validity, because every test item can be directly related to the specific objectives of that particular school at any particular age or grade level. This method is the one used in the preparation of the arithmetic test described in this study.

A third method suggested by Ruch[5] for securing curricular validity is to harmonize the content of the test with the results of studies of social utility. Such studies are those by Wilson in arithmetic usage and by Horn and Thorndike in word studies. Certain spelling scales and spelling tests have been validated on the basis of Horn's Basic Spelling Vocabulary. This method, like the second method described, is better suited to the development of widely used tests than to the construction of local tests.

Statistical validity. The second general method of validating tests, discussed by Greene,[6] is by means of statistical techniques. Most such techniques involve the calculation of the correlation coefficient between scores on the test and criterion measures. These coefficients are called validity coefficients.

Criterion measures generally used in determining validity coefficients are school marks, ratings of expert judges, scores from other valid tests, and measures of future outcomes. The latter method is used primarily with prognostic or aptitude tests. The limitation of this method lies in the

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[5]G. M. Ruch, The Objective or New Type Examination, p. 29.

[6]Harry A. Greene, Albert N. Jorgensen, and J. Raymond Gerberich, op. cit., pp. 57-50.

validity of the criterion measure itself. Obviously, if the criterion measure is not highly valid the correlation will have little meaning for the validity of the experimental test.

Other statistical methods for determining validity are based on the differences in the percentages of success achieved on the test by groups of pupils of different subject-matter backgrounds and levels of ability. For example, a valid arithmetic test would be expected to show significant differences in scores made by pupils in the second, third, and fourth grades respectively.

The range of difficulty of items. The difficulty of any item in a test is measured by the percentage of pupils who fail to respond correctly to it. Items of zero difficulty, that is, items answered correctly by all pupils have no functional value in discriminating among those pupils. Test authorities are in agreement that such items are "dead timber" and should be eliminated. Such items are not only of no value but they contribute to invalidity of the test.

The form of distribution of item difficulty. According to Lindquist,[7] authorities are not in agreement as to form of distribution of item difficulty in a general achievement test. Some favor a rectangular distribution, that is, about an equal number of items at each difficulty level. Others favor a few very easy items and a few very difficult items with the majority near the fifty per cent difficulty level. The majority of authorities agree that there should be a range in difficulty from five to twenty

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[7]Herbert E. Hawkes, E. F. Lindquist, and C. R. Mann, The Construction and Use of Achievement Examination. p. 32.

per cent on the lower level to eighty to ninety-five per cent on the higher level with the average difficulty near fifty per cent.

Reliability

The second most important criterion of a test is reliability. Reliability refers to the effectiveness with which a test measures whatever it does measure. This definition appears to be quite similar to that given for validity, the difference being that validity refers to the effectiveness with which a test measures what it is intended to measure. A test may be reliable if it measures effectively what it does measure without any requirement that it measure what it is intended to measure. This means that a test may be reliable without being valid. For example, a reliable test in arithmetic would certainly not be a valid test if used to measure spelling ability. Likewise, a reliable test for measuring ability in addition would not be valid if intended for measuring general ability in arithmetic.

While a reliable test need not be valid, yet a valid test would of necessity be reliable. This is true because the chief essential of reliability is effectiveness of measurement, while validity involves effectiveness of measurement for an intended purpose. Thus, reliability is an essential aspect of validity.

Ruch[8] suggests two principle methods of securing reliability in a test. The first is to secure objectivity of scoring and the second is to secure an adequate sampling in the test items. These two aspects of reliability will be discussed later.

Statistical reliability. The literature on construction of tests sug-

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[8]G. M. Ruch, The Objective or New Type Examination, p. 42.

gests, in general, three methods of determining a measure of the reliability of a test through correlation coefficients. One method, when two equivalent forms of the same test are available, is to correlate the scores on the two tests after giving them successively to the same groups of pupils. A second method, when equivalent forms are not available, is to give the test to the same pupils twice and correlate the scores on the two testings. Lindquist,[9] claims that this method is not very satisfactory because spuriously high correlation coefficients will be obtained. A third method is known as the "Chance-Half" coefficient. This method consists of obtaining separate scores on odd-numbered items and even-numbered items and calculating the correlation coefficient between the two sets of scores. The reliability coefficient for a test as long as the two halves combined is then calculated from the correlation coefficient by means of the Spearman-Brown Prophecy Formula.

Greene,[10] quoting Kuder and Richardson, suggests another means of securing an estimate of reliability. This estimate is called the "Footrule" coefficient. Only the arithmetic mean, the standard deviation, and the number of test items are required for the calculation. While this is not the most accurate method, it never gives an over-estimate.

Objectivity. To be objective, a test must eliminate the personal judgment of the person scoring the test. This means that the test items must be free from ambiguity and they should be stated in such a manner that only one correct answer is possible. In constructing an arithmetic test, the matter of objectivity is a minor problem because of the specificity of re-

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[9]E. Lindquist, A First Course in Statistics, pp. 203-4.

[10]Harry A. Greene, Albert N. Jorgensen, and J. Raymond Gerberich, op. cit., pp. 63; 566-7.

sponse to almost any item that might be included in the test.

Adequacy. As stated by Greene[11] "Adequacy refers to the degree to which a test samples sufficiently widely that the resulting scores are representative of relative total performance in the areas measured." It is obvious that a test of only a few items could not measure performance in an area. Only a few aspects of growth could be sampled, and consequently, the score could not be considered a reliable measure of other aspects of growth in the same area. A short test is unreliable also because of the element of luck that may enter into a pupil's score. For example, the test of a few items may by chance contain those which the pupil knows while omitting those the pupil does not know. A common expression among students after an essay type test of only a few questions is "The questions were just those I studied" or "He didn't ask a thing which I expected."

Lengthening a test usually increases the adequacy of sampling which in turn increases the reliability of the test.

Comparability

Two means have been suggested by Greene[12] whereby comparability of results may be established for standardised tests: (1) the use of duplicate forms of the test and (2) the use of adequate norms. Through the use of norms, an individual pupil's score may be compared with the average performance of other pupils of similar age and grade placement. Through the use of duplicate forms of the test, achievement before and after the teaching of a specific unit of work may be compared.

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[11] Ibid. p. 64.

[12] Ibid., pp. 69-70

Comparability of results was considered of sufficient importance in this study that three duplicate forms of the arithmetic test were to be prepared and norms in terms of performance were to be established for the test.

CHAPTER III

CONSTRUCTION AND ADMINISTRATION OF THE ORIGINAL FORM OF THE TEST

Specifications for the Test

The validity of any test, as pointed out in chapter two, must be established in terms of its intended use and at the ability level of the pupils for whom it is intended. The specifications for the intended use of the test described in this report were implicit in the recognized need for such a test; however, the following specifications were formulated and explicitly stated as a guide for validation of the test:

1. The test is to be one for which a single score will give a measure of general achievement in arithmetic on the level for which it is designed.

2. The test is to be used chiefly during the second semester of the third grade.

3. The test is to be constructed on the basis of the intended outcome of arithmetic instruction in the primary grades. The specific aims of instruction in arithmetic in the Tulsa Public Schools through the third grade fall into the following categories:

    a. The development of concepts which are basic to number readiness, such as those involved in rational counting, in recognizing and understanding number groups, in understanding the relationships of size, quantity, position, and units of measure, in telling time, and in using small denominations of United States money.

    b. The knowledge and the use of the one hundred addition facts and the one hundred substraction facts in computational processes, with no carrying and no borrowing.

    c. The application of the acquired number concepts and computational processes in problem solving.

4. Within the limits of maintaining validity as a measure of general achievement, the test is to be diagnostic to the extent that it will reveal comparative strengths and weaknesses among the three aspects of achievement tested. The

> test, therefore, should be divided into three parts for obtaining part scores on concepts, computation, and problem solving.

It was recognized that a test could not be highly diagnostic and at the same time a valid measure of general achievement. Lindquist[1] points out the difference in validity for a diagnostic test and a general achievement test. A diagnostic test holds the pupils responsible for all elements of information included, and weaknesses in desirable information and skills are revealed in failure on the various items. Thus, desirable achivement on a diagnostic test is one hundred per cent accuracy. With this fact in mind, the constructors of the test decided to establish validity in terms of general achievement, and to provide incidentally a measure of diagnosis by grouping the items under the three aspects of achievement to be tested.

Preparation of the Test

It has been generally recognized that curricular validity must be based largely on subjective judgment concerning the degree to which the test covers the proper content of the course of study. To secure such judgments, five third grade teachers were asked to submit items for each of the three parts of the test. Each teacher selected items which in her judgment were appropriate, and arranged them in the form of a test which she gave to a few pupils in her room. These tests, with the pupil responses, were then submitted to the Research Council for evaluation in terms of potentially useful test items. A total of 708 items were included in the five tests submitted by the teachers. While the content covered by the five teacher tests was in general the same, only a few of the items

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[1] Herbert E. Hawkes, E. F. Lindquist and C. R. Mann, op. cit., p. 30.

were identical, these being for the greater part certain addition and subtraction facts. A careful check by the Director of Mathematics revealed the fact that all items were within the limits of the third grade curriculum.

From the 708 items, three forms of a test were prepared. Care was taken to secure an even distribution over the various types of content and to use only those items which indicated from pupil responses some discriminative power. As Form A was developed, Forms B and C were constructed with the idea of obtaining comparability, item by item. When comparable items were not available among those submitted by the teachers, they were constructed. Items were considered comparable if they dealt with some phase of the same or similar concepts, with the same unit skill or computational ability, or with problems involving the same or similar mathematical elements. The Director of Mathematics supervised and checked the matching of items for comparability.

When the items were finally selected and arranged, each form of the test contained the following number of items: Part I, (concepts), thirty-six; Part II, (facts and computation), fifty-nine; Part III, (reasoning and problem solving), twenty-nine. Thus, the total number of items for the entire test was 124.[2] It was felt that in the final form the test should probably contain not less than seventy-five items for adequacy. The inclusion of 124 items in the first try-out form was to permit elimination of faulty and undesirable items.

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[2]Through error in mimeographing, Part III (reasoning) of Form A contained only twenty-eight items, and thus, the entire Form A contained only 123 items.

Administration of the Test

Selecting the subjects. In the first try-out, the three forms of the test were administered to 287 third grade pupils, to ninety second grade pupils and to eighty-seven fourth grade pupils. The purpose of administering the test to second and fourth grade pupils was to obtain some statistical evidence of the validity of the test through the rise in percentage of success from one grade to another.

The entire third grade enrollment from the Springdale, Sidney Lanier, Osage, and Longfellow schools was selected as subjects for the test. The Springdale and Sidney Lanier schools were of approximately the same enrollment but near the opposite extremes of the range in the Tulsa schools of educational background and ability, as revealed by previous tests. The Osage and Longfellow schools were considered to be approximately average. The constructors of the test thought that these schools should furnish an approximately normal group of subjects for the test. Table I shows that the third grade group was average in chronological age (The test was given in May.) and I.Q. The mean reading level was 4.4 which was five tenths of a grade higher than the national norm of 3.9.

The selection of the second and fourth grade subjects was not so fortunate, due to the limitation of the smaller sampling. The Orage and Pershing schools furnished the second grade pupils and the Kendall school, the fourth grade pupils.

TABLE I

PERSONAL AND EDUCATIONAL DATA OF THE PUPILS
TAKING THE FIRST TRY-OUT TEST

Grade	No. Pupils	Mean C.A.	Mean M.A.	Mean I.Q.	Mean Reading Grade
2	90	8-0	8-6	106.7	3.5
3	287	9-2	9-2	100	4.4
4	84	10-1	10-10	107.4	5.9

Giving the test. Each pupil took the three forms of the test. To neutralize practice effects which might result from giving Form A first in each class, then Form B and finally Form C, the order in which the forms were to be given was scheduled for each class. Thus, following the recommendation of Ruch and Stoddard,[3] the order for one class was to be A, B, C; for another B, C, A; and still another C, A, B.

Two days were required for the three forms. The usual precautions in test administration to secure maximum working efficiency and reliable results were taken.

Teachers were instructed to give ample time for each part of the test and to record the time required for ninety per cent of the pupils to finish.

Results and Interpretations

Scoring and statistical treatment of the results. The tests were scored in the central testing office. The results were tabulated and through statistical treatment, the following information was obtained:

[3] G. M. Ruch and George D. Stoddard, Tests and Measurements in High School Instruction, pp. 330-331.

1. The comparability of the three forms as indicated by the means and standard deviations of the scores on the three tests.
2. The difficulty of the test for third grade pupils as indicated by the arithmetic means on each part of the three forms and on the total test.
3. The discriminative power of the test for third grade pupils as indicated by the distribution of scores and, in particular, by the number of pupils making either zero scores or one hundred per cent scores.
4. Some statistical evidence of validity as indicated by the percentage of success made by the second, third, and fourth grade groups, respectively.
5. The difficulty and discriminative power of each item of the three forms as indicated by the percentage of success made by each grade group.

Third grade achievement. Table II shows the distribution of scores made by the 267 third grade pupils on each of the three forms of the test.

The distributions on the three forms of the test were very similar. In each case, the scores piled up near the upper end of the scale and "tailed off" gradually to almost the lower limit. The means of 100.47, 100.57, and 100.52 were for all practical purposes identical, and the standard deviations differed from the highest to the lowest by less than one score. On the basis of the similarity of means, standard deviations, and forms of distribution it was concluded that the three forms were practically equivalent.

Apparently, the three forms were too easy for third grade pupils as indicated by the means of 100.47, 100.57, and 100.52 out of possible scores of 123, 124, and 124 respectively. The obtained means gave an

average per cent of correctness of 81.7, 81.0 and 81.0, respectively for the three forms.

TABLE II

DISTRIBUTION OF THIRD GRADE SCORES ON THREE FORMS OF THE TEST

Scores	f Form A	f Form B	f Form C
123-127		1	1
118-122	26	28	33
113-117	58	56	52
108-112	53	51	53
103-107	38	42	45
98-102	33	43	35
93-97	26	16	18
88-92	14	16	10
83-87	14	8	10
78-82	4	6	8
73-77	7	5	3
68-72	3	5	3
63-67	2	1	5
58-62	2	1	3
53-57	1	1	
48-52	1	2	1
43-47	1		4
38-42		2	
33-37			
28-32	1		
23-27	2	2	1
18-22		1	1
13-17	1		1
	N 287	N 287	N 287
	A.M. 100.47	A.M. 100.57	A.M. 100.52
	S.D. 16.55	S.D. 16.35	S.D. 17.34

According to Greene[4], most authorities suggest an average difficulty for the entire test of about fifty per cent. In the light of this opinion, the percentage of approximately eighty-one on each form was much too high.

[4] H. A. Greene, Albert N. Jorgensen, and J. Raymond Gerberich, op. cit., pp. 78-79

The constructors of the test agreed, however, that for end-of-the-year testing, the mean might be as high as sixty-five per cent of the number of items, provided no perfect scores were made. This somewhat higher percentage should be permissible since the test would not be used above the third grade, and it was reasoned that a greater average would have a desirable psychological effect on both teachers and pupils.

While only one pupil made a perfect score on any of the three forms, the heavy concentration of scores in the first step from the top of each distribution was undesirable. Two faulty items susceptible to misinterpretation could have kept many pupils from making perfect scores, and thus the test would not have been discriminative among those pupils.

A study of the distribution of scores revealed the lack of discriminative power of the three forms. Approximately sixty per cent of the scores fell within the four steps represented by scores from 103 to 122.

Since the test was organized into three parts, a study of the distribution of scores on each part of the test was considered advisable. Tables III, IV, and V show the distribution of scores on each of the three parts of the test: Part I, concepts; Part II, facts and computation; and Part III, reasoning or problem solving.

From Tables III, IV, and V, it was evident that there was the same consistency among the three forms of each part as there was among the three forms of the entire test. For example, the distributions for the three forms of Part I (Table III) were quite similar; the means were practically identical; and the range of the standard deviations was less than one score. The same was true for Part II (Table IV) and Part III (Table V). These facts were further evidence of the comparability of the three forms.

Each part of the test was too easy as judged by the means, and the discriminative power of each part was faulty as shown by the forms of the distribution. No one part could be said to be responsible for the ease of the entire test, although Part II was somewhat easier than either of the other two parts.

TABLE III
DISTRIBUTION OF THIRD GRADE SCORES ON THE THREE FORMS OF PART I, CONTAINING THIRTY-SIX ITEMS ON CONCEPTS

Scores	f Form A	f Form B	f Form C
36-37	3	1	5
34-35	40	23	31
32-33	54	53	65
30-31	51	64	62
28-29	36	40	41
26-27	34	42	40
24-25	24	23	21
22-23	18	19	7
20-21	11	6	1
18-19	3	6	3
16-17	2	2	2
14-15	4	1	1
12-13	2		2
10-11	1	1	2
8-9	1	2	
6-7	2	1	
4-5	1	2	2
2-3			1
0-1		1	1
	N 287	N 287	N 287
	A.M. 28.46	A.M. 28.32	A.M. 28.77
	S.D. 5.62	S.D. 5.34	S.D. 5.28

TABLE IV

DISTRIBUTION OF THIRD GRADE SCORES
ON THE THREE FORMS OF PART II, CONTAINING FIFTY-NINE ITEMS
ON FACTS AND COMPUTATION

Scores	f Form A	f Form B	f Form C
59-61	9	13	8
56-58	83	88	96
53-55	75	69	72
50-52	42	42	28
47-49	24	30	35
44-46	18	14	16
41-43	12	14	6
38-40	8	7	8
35-37	7	1	4
32-34	1	1	4
29-31	4	2	1
26-28		2	4
23-25	1		1
20-22			1
17-19		1	
14-16		3	2
11-13	1		1
8-10	1		
5-7	1		
	N 287	N 287	N 287
	A.M. 51.13	A.M. 51.24	A.M. 51.10
	S.D. 7.61	S.D. 7.27	S.D. 7.95

TABLE V

DISTRIBUTION OF THIRD GRADE SCORES
ON THE THREE FORMS OF PART III, CONTAINING TWENTY-NINE
ITEMS ON REASONING OR PROBLEM SOLVING

Scores	f Form A	f Form B	f Form C
28-29	16	35	30
26-27	77	79	75
24-25	77	68	57
22-23	50	43	46
20-21	23	27	22
18-19	14	10	11
16-17	6	2	8
14-15	3	3	10
12-13	3	3	3
10-11	6	1	5
8-9	2	2	3
6-7	1	4	4
4-5	4	4	3
2-3	1	2	6
0-1	4	4	4
	N 287	N 287	N 287
	A.M. 22.52	A.M. 22.85	A.M. 22.40
	S.D. 5.33	S.D. 5.62	S.D. 6.34

Achievement of second and fourth grade pupils on the test. Since some idea of the validity of an achievement test may be gained from a comparison of the success of consecutive grade groups on the test, it was given to a sampling from both grades. Table VI gives the second grade results, and Table VII the fourth grade results.

TABLE VI
THE MEANS AND STANDARD DEVIATIONS OF THE SCORES OF NINETY SECOND GRADE PUPILS

Form	Part I		Part II		Part III		Entire Test	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
A	17.02	7.46	20.88	12.39	10.37	7.64	49.67	23.35
B	16.78	7.10	20.36	12.21	10.28	7.72	49.16	22.45
C	17.29	8.18	20.72	12.21	9.62	7.58	49.40	23.35

TABLE VII
THE MEANS AND STANDARD DEVIATION OF THE SCORES OF EIGHTY-FOUR FOURTH GRADE PUPILS

Form	Part I		Part II		Part III		Entire Test	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
A	32.0	2.95	55.56	4.71	25.15	3.32	114.60	9.35
B	32.21	2.91	55.08	5.02	26.38	3.0	114.74	9.35
C	32.9	2.09	55.79	3.82	25.5	3.62	114.74	9.40

The performance of both second and fourth grade groups was consistent on the three forms as indicated by the close correspondence of the means and standard deviations.

Comparison of the percentages of success made by consecutive grade groups. Validity of a test may be judged, according to Greene[5], by the

[5]Henry A. Greene, Albert N. Jorgensen, and J. Raymond Gerberich, op. cit., p.60.

rise in percentage of success from one school grade to the next. A valid test is expected to show significant increases in scores. Figure I shows the rise in percentage of success from the second grade to the fourth. The percentages of success were calculated in terms of the relationship of the means to the total number of items.

A sharp rise in percentage of success from the second grade to the third grade was evident from the graph, while the increase from third to fourth grade was much less; therefore, the test was highly discriminative between second and third grade pupils but much less discriminative between third and fourth grade pupils. It would follow that if the test were used only with third grade pupils, it would discriminate well among pupils of lower ability and poorly among pupils of higher ability. From a study of the graph it was evident that a sharper rise in success from the third to the fourth grade must be accomplished by pushing the third grade percentages down.

The validity of each test item. The validity of the test as a whole depends upon the validity of the various individual items making up the test; therefore, the most effective means of validating a test is to insure validity of each test item. The best procedure for securing valid items, according to most test authorities, is to select those items which show a sharp increase in percentage of success achieved by groups known to possess the abilities in question in varying degrees. This method, in principle, is the same as that applied to the test as a whole which was described in the preceding section. The rise in percentage of success on the test as a whole merely determines whether desirable validity has been obtained. When the method is applied to each test item, a diagnosis of the test in terms of weaknesses in individual items is secured; then through elimination of such items the test can be improved.

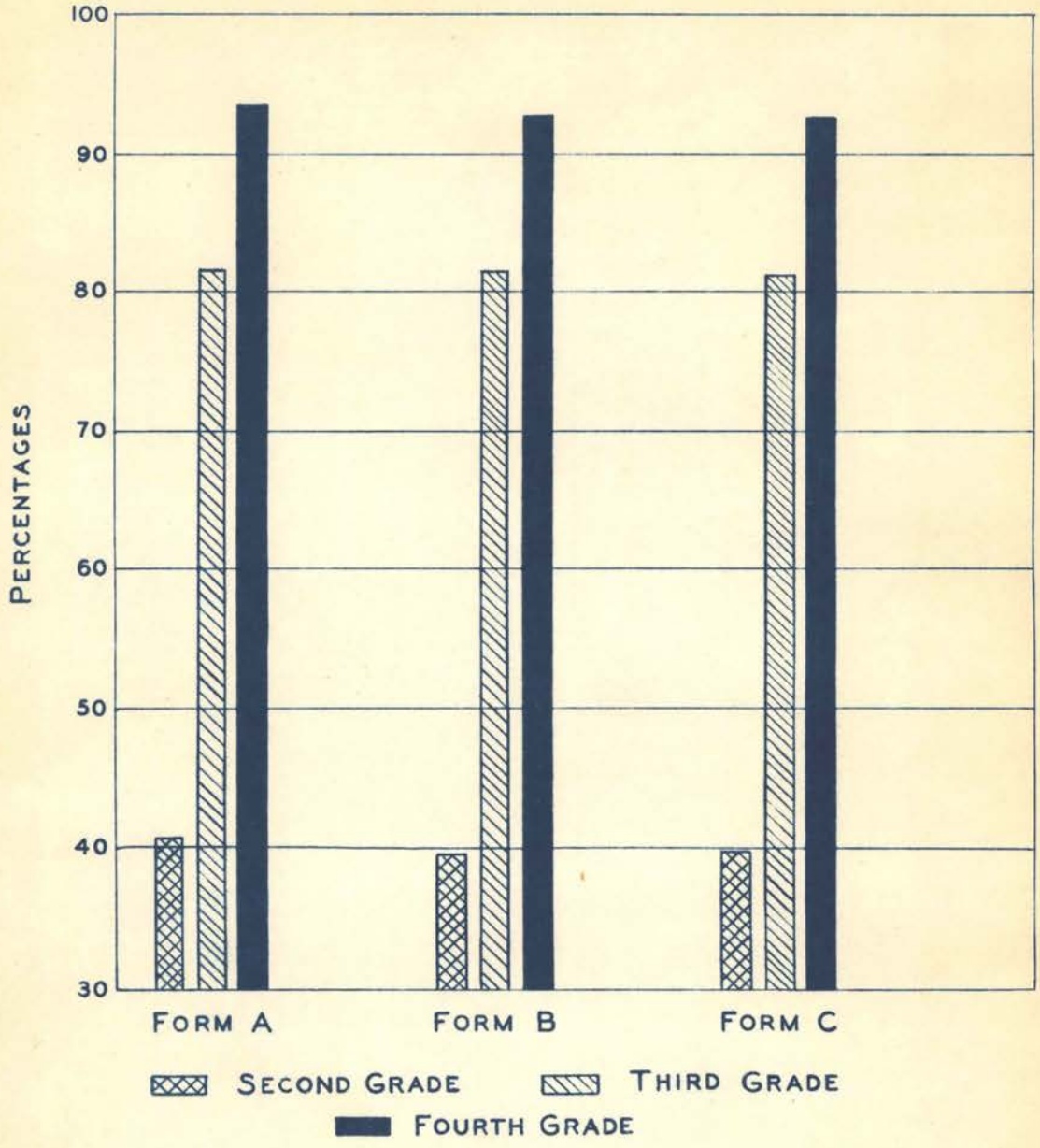

FIGURE 1

THE PERCENTAGE OF SUCCESS BY SECOND, THIRD, AND FOURTH GRADES ON THE THREE FORMS OF THE ORIGINAL TEST.

One method for studying the validity of individual items is suggested by Greene.[6] The pupils taking the test may be divided into two groups on the basis of their scores: those making scores above the median and those making scores below the median of the entire group. The number or percentage of pupils of the superior group succeeding on each item may then be compared with the same data for the inferior group.

Another method suggested by Ruch and Stoddard[7] was used in this study. These authors suggest that the test be given to consecutive grade groups and the percentage of success achieved by each grade group on each item be compared with similar data from the other groups. This procedure is based on the assumption that each successive grade group as a whole possesses the abilities in question to a greater degree than the grade immediately below. According to these authors, this assumption is true except for certain physiological capacities which do not continue over a period of years and for those subjects which are discontinuous over a series of grades.

Items which are most discriminative are those which show a sharp rise in percentage of success from one grade to the next.

In this study, the correct and incorrect responses for each item on the three forms of the test were tabulated for each of the grade groups taking the test. From these tabulations, the percentage of success achieved by each grade on each item was calculated. Table VIII gives these percentages.

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[6]Harry A. Greene, Albert N. Jorgensen, and J. Raymond Gerberich, Op. cit., p. 80.

G. M. Ruch and George D. Stoddard, op. cit., pp. 319-322.

TABLE VIII

THE PERCENTAGE OF SUCCESS ACHIEVED BY SECOND, THIRD, AND FOURTH GRADE PUPILS ON EACH ITEM OF THE THREE FORMS OF THE TEST

No. of Item	Form A			Form B			Form C		
	Grade 2	Grade 3	Grade 4	Grade 2	Grade 3	Grade 4	Grade 2	Grade 3	Grade 4
Part I									
1	88.9	99.0	98.8	91.1	94.9	94.0	80.0	90.9	83.3
2	86.7	95.1	85.7	86.7	96.9	98.8	80.8	91.6	96.4
3	80.0	85.7	89.3	82.2	90.9	89.3	86.7	97.6	97.6
4	85.6	95.1	94.0	81.1	96.5	97.6	82.2	94.6	97.6
5	61.1	85.4	91.7	43.3	79.4	89.3	77.8	94.1	97.6
6	48.9	83.3	79.8	46.7	80.8	71.4	55.6	84.0	86.9
7	61.1	94.4	97.6	55.6	96.5	98.8	76.7	92.3	94.0
8	85.6	95.6	97.6	74.4	93.7	96.4	87.6	96.2	100.0
9	63.3	90.6	97.6	75.6	96.9	98.8	57.8	86.4	95.2
10	71.1	90.6	92.9	76.7	90.6	92.9	68.9	93.4	96.4
11	36.7	69.7	75.0	42.2	54.7	77.4	41.1	63.4	89.3
12	80.0	92.3	95.2	67.8	93.0	98.8	61.1	87.5	94.0
13	31.1	89.5	96.4	22.2	89.9	100.0	32.2	90.2	100.0
14	13.3	69.0	97.6	12.2	54.0	94.0	18.9	85.4	96.4
15	7.8	62.0	73.8	5.6	65.2	96.4	4.4	30.3	77.4
16	8.9	62.0	90.5	2.2	38.7	85.7	3.3	33.8	71.4
17	65.6	89.9	97.6	56.7	90.9	97.6	66.7	90.2	97.6
18	73.3	89.2	98.8	62.2	90.0	97.6	72.2	91.6	97.6
19	56.7	89.5	98.8	65.6	89.2	95.2	61.1	92.0	97.6
20	28.9	41.5	72.6	71.1	93.4	100.0	37.8	85.4	81.0
21	54.4	77.7	96.4	38.9	91.6	97.6	53.3	88.9	97.6
22	21.1	53.0	84.5	17.8	62.0	71.4	60.0	93.0	98.8
23	76.7	93.0	97.6	70.0	94.1	97.6	73.3	95.8	97.6
24	66.7	94.6	97.6	67.8	92.3	96.4	67.8	94.4	97.6
25	76.7	94.4	96.4	62.2	91.6	97.6	68.9	96.9	98.8
26	75.6	92.0	97.6	74.4	92.7	98.8	71.1	94.6	100.0
27	42.2	78.7	81.0	46.7	77.7	86.9	37.8	88.5	98.8
28	51.1	89.5	97.6	45.6	89.2	92.9	43.3	83.3	96.4
29	25.6	73.2	95.2	33.3	69.0	85.7	46.7	93.0	98.8
30	14.4	47.7	81.0	12.2	77.7	86.9	7.8	31.7	29.8
31	23.3	90.2	100.0	6.7	11.1	26.2	20.0	90.6	98.8
32	7.8	11.8	21.4	0	5.2	69.0	3.3	27.2	96.4
33	25.6	87.8	92.9	36.7	91.6	95.2	36.7	86.4	96.4
34	18.9	62.4	71.4	13.3	63.1	75.0	21.1	62.7	72.6
35	21.1	80.8	91.7	16.7	83.3	95.2	23.3	70.4	92.9
36	14.4	47.0	73.8	8.9	48.1	79.8	17.8	43.6	72.6
Part II									
1	81.1	96.9	98.8	71.1	99.0	97.6	73.3	96.5	100.0
2	84.4	98.3	98.8	80.0	98.3	100.0	76.7	97.9	98.8
3	80.0	98.3	98.8	71.1	98.3	97.6	74.4	98.6	100.0

No. of Item	Form A			Form B			Form C		
	Grade 2	Grade 3	Grade 4	Grade 2	Grade 3	Grade 4	Grade 2	Grade 3	Grade 4
4	62.2	95.8	100.0	73.3	100.0	100.0	73.3	99.3	98.8
5	71.1	99.3	100.0	70.0	98.6	98.8	81.1	98.6	100.0
6	71.1	99.7	98.8	67.8	99.7	98.8	63.3	97.2	97.6
7	68.9	96.5	97.6	67.8	97.6	98.8	70.0	96.9	100.0
8	75.6	96.2	98.8	60.0	96.5	98.8	61.1	96.2	100.0
9	67.8	93.0	100.0	47.8	91.6	98.8	52.2	88.9	100.0
10	63.3	94.4	97.6	56.7	91.6	96.4	44.4	91.3	96.4
11	32.2	90.6	94.0	26.7	20.2	90.5	25.6	96.5	100.0
12	31.1	93.7	91.7	28.9	91.6	89.3	27.8	95.8	98.8
13	33.3	90.6	96.4	27.8	88.5	89.3	18.9	91.6	98.8
14	26.7	87.5	96.4	22.2	87.1	86.9	30.0	94.4	98.8
15	25.6	90.2	95.2	26.7	89.2	90.5	21.1	90.2	98.8
16	20.0	82.9	95.2	17.8	87.8	89.3	10.0	86.8	96.4
17	25.6	86.4	94.0	22.2	92.7	91.7	21.1	93.7	100.0
18	21.1	88.9	91.7	24.4	88.5	90.5	24.4	96.5	100.0
19	11.1	79.4	94.0	15.6	87.1	91.7	5.6	86.8	94.0
20	13.3	85.7	95.2	14.4	83.3	88.1	5.6	84.3	96.4
21	76.7	96.2	94.0	74.4	97.9	98.8	80.0	97.6	100.0
22	18.9	85.0	91.7	14.4	79.4	92.9	16.7	84.3	90.5
23	74.4	97.6	98.8	62.2	96.9	98.8	55.6	95.1	96.4
24	77.8	97.6	97.6	74.4	97.2	100.0	83.3	96.5	100.0
25	15.6	83.3	91.7	16.7	82.2	91.7	13.3	84.3	90.5
26	73.3	95.1	97.6	60.0	97.2	98.8	72.2	96.2	97.6
27	72.2	95.8	97.6	71.1	96.5	98.8	80.0	96.9	100.0
28	16.7	82.9	91.7	12.2	81.2	91.7	15.6	82.2	90.5
29	17.8	70.3	81.0	12.2	73.2	67.9	18.9	70.0	66.7
30	61.1	93.0	97.6	63.3	95.1	98.8	57.8	93.7	98.8
31	10.0	78.0	92.9	8.9	77.0	92.9	7.8	74.6	90.5
32	11.1	77.7	85.7	13.3	75.6	70.2	15.6	68.6	78.6
33	26.7	95.1	95.2	12.2	95.1	95.2	28.9	92.7	92.9
34	26.7	95.8	95.2	13.3	94.2	98.8	26.7	92.0	96.4
35	25.6	94.8	95.2	12.2	93.7	95.2	22.2	87.5	96.4
36	25.6	94.4	95.2	11.1	93.7	96.4	16.7	90.6	95.2
37	36.7	96.2	96.4	23.3	95.5	95.2	35.6	93.4	98.8
38	38.9	95.5	97.6	22.2	95.5	95.2	37.8	90.2	98.8
39	36.7	95.8	97.6	24.4	93.7	96.4	35.6	92.7	98.8
40	28.9	86.1	92.9	18.9	92.0	96.4	31.1	88.9	92.9
41	36.7	88.5	96.4	17.8	79.1	96.4	52.2	92.7	98.8
42	25.6	91.3	95.2	15.6	93.4	94.0	15.6	90.6	96.4
43	27.8	91.3	96.4	11.1	92.0	97.6	14.4	88.9	98.8
44	18.9	92.7	96.2	5.6	91.3	97.6	12.2	91.3	96.4
45	10.0	89.9	94.0	11.1	95.1	97.6	13.3	88.9	96.4
46	11.1	83.3	95.2	12.2	88.2	94.0	17.8	83.6	90.5
47	11.1	71.7	86.9	8.9	78.0	94.0	10.0	91.6	88.1
48	23.3	80.1	91.7	4.4	80.1	92.9	4.4	82.9	88.1
49	4.4	57.8	71.4	1.1	78.0	88.1	2.2	77.0	84.5
50	3.3	15.3	79.8	1.1	13.6	70.2	1.1	16.4	75.0
51	52.2	72.8	91.7	41.1	76.0	84.5	45.6	77.4	85.7

No. of Item	Form A			Form B			Form C		
	Grade 2	Grade 3	Grade 4	Grade 2	Grade 3	Grade 4	Grade 2	Grade 3	Grade 4
52	61.1	81.5	88.1	45.6	78.4	91.7	46.7	80.1	91.7
53	43.3	77.4	91.7	32.2	76.0	86.9	32.2	72.6	79.8
54	27.8	92.0	96.4	44.4	95.1	96.4	41.4	94.1	96.4
55	25.6	86.8	94.0	34.4	88.9	97.6	32.2	95.4	94.0
56	24.4	88.5	97.6	40.0	94.4	97.6	30.0	77.7	91.7
57	26.7	80.8	91.7	27.8	88.9	94.0	28.9	87.5	96.4
58	18.9	91.3	94.0	28.9	81.5	96.4	25.6	88.5	96.4
59	6.6	76.3	95.2	2.2	43.6	95.2	4.4	44.6	91.7
Part III									
1	35.6	92.0	100.0	67.8	93.0	98.8	73.3	96.2	98.8
2	61.1	94.1	95.2	52.2	92.3	98.8	17.8	68.3	73.8
3	41.1	91.6	100.0	32.2	88.9	98.8	21.1	67.6	75.0
4	38.9	91.6	96.4	34.4	92.7	100.0	20.0	66.9	73.8
5	56.7	94.4	96.4	54.4	92.7	95.2	56.7	89.9	95.2
6	42.2	80.1	85.7	61.1	90.2	97.6	44.4	89.9	96.4
7	51.1	92.3	97.6	44.4	86.8	97.6	54.4	92.7	96.4
8	55.6	93.0	96.4	66.7	95.5	100.0	45.6	88.5	97.6
9	73.3	95.5	96.4	53.3	92.0	95.2	28.9	80.8	85.7
10	51.1	91.6	98.8	42.2	91.6	92.9	35.6	81.2	95.2
11	47.8	95.5	97.6	62.2	92.3	96.4	28.9	78.0	90.5
12	18.9	70.0	83.3	21.1	88.9	98.8	25.6	81.2	90.5
13	10.0	83.3	94.0	51.1	95.5	98.8	38.9	86.8	96.4
14	42.2	89.2	91.7	46.7	90.9	96.4	52.2	90.9	97.6
15	38.9	85.4	89.3	32.2	84.7	92.9	18.9	74.2	86.9
16	20.0	77.0	85.7	27.8	80.1	90.5	24.4	85.4	90.5
17	38.9	91.3	98.8	30.0	69.7	88.1	54.4	87.5	90.5
18	46.7	90.2	95.2	37.8	90.2	96.4	30.0	87.5	94.0
19	36.7	77.4	86.9	42.2	91.6	95.2	41.1	85.7	90.5
20	46.7	82.6	88.1	11.1	65.5	88.1	40.0	87.5	92.9
21	41.1	88.2	94.0	35.6	86.4	94.0	22.2	66.9	79.8
22	34.4	82.6	94.0	23.3	86.4	94.0	15.6	69.0	81.0
23	1.1	67.2	79.8	4.4	67.2	86.9	3.3	62.7	77.4
24	35.6	83.3	95.2	1.1	64.1	79.8	35.6	85.4	92.9
25	13.3	73.2	85.7	14.4	76.0	94.0	32.2	81.2	95.2
26	31.1	84.3	91.7	28.9	86.4	95.2	30.0	87.8	90.5
27	0	29.3	72.6	0	44.6	70.2	0	64.5	86.9
28	0	7.3	29.8	0	29.3	65.5	0	29.3	73.8
29				0	11.5	42.9	1.1	10.5	31.0

From Table VIII, each item was carefully studied as to its difficulty and discriminative power. It was immediately evident that a large number of the items was too easy. For example, item I of Part I of Form A was answered correctly by 88.9 per cent of the second grade pupils, 99.0 per cent of the third grade, and 98.8 per cent of the fourth grade. Items of this type failed entirely to discriminate between third and fourth grade pupils and were poor in discrimination between second and third grade pupils.

In general, the most desirable type of item was considered to be that which showed a sharp rise in percentage of success from grade to grade. A good example of such items was item 14, Part I, Form A. Here, the percentages were the following: for the second grade, 13.3; for the third grade, 69.0; and for the fourth grade, 97.6. This item was of strong discriminative power.

Some easy items, for which the correct responses approached but did not reach one hundred per cent, were considered acceptable. For example, while item 7, Part II, Form A, showed little discrimination between third and fourth grade pupils, it did discriminate sharply between second and third grade pupils. Such items were considered desirable for discrimination among the pupils of lower ability. Likewise, some very difficult items were needed which, though they might not discriminate among pupils of low ability, would serve to discriminate among those of high ability.

Analysis of Table VIII revealed the following number of items on each form which was answered correctly by ninety per cent or more of the third grade pupils: Form A, fifty-seven; Form B, sixty-four; and Form C, fifty-six. This high proportion of very easy items was considered to be the chief

defect of the test. While, as pointed out in the preceding paragraph, a few easy items were desirable, the constructors of the test deemed it advisable to eliminate or to reconstruct all items which were answered correctly by ninety per cent or more of the third grade pupils.

One item was found in each of the Forms B and C on which the percentage of response was below ten. It was decided that these two items also be eliminated.

Some items of the test showed erratic response by the pupils of the different grades. For example, on Item 2, Part II, Form A, 88.3 per cent of the third grade pupils responded correctly, while only 79.8 per cent of the fourth grade pupils responded correctly. On the corresponding item on Form B, the percentage correct for the third grade was 80.8 and for the fourth grade 71.4. A study of these items revealed faulty statements which apparently were misinterpreted by more fourth grade pupils than third grade pupils. Obviously, it was necessary to eliminate all such "throwbacks."

Summary of Conclusions and Implications for Revision

The following conclusions and implications for revision were drawn from the results of the first try-out of the test:

1. The three forms of the test were reasonably comparable as indicated by the close correspondence of the arithmetic means and standard deviations.
2. The test was too easy for the third grade as indicated by the means of 100.47, 100.57, and 100.52 for the Forms A, B, and C, respectively. Since there were 123 items in Form A and 124 items in Forms B and C each, the mean on each form was approximately eighty-one per cent of the total number of items.

In light of this defect of the test, it was concluded that the test should be revised to make it more difficult.

3. Careful consideration was given to curricular validity in constructing the test. Some evidence of statistical validity was secured through a comparison of the percentages of success achieved on the test by second, third and fourth grade groups. It was found that on the entire test and each of its parts, there was a very sharp rise from the second to third grade and a low rise from the third to fourth grade. These data indicated a sharp discrimination between second and third grade pupils; consequently, when used on the third grade level the test would discriminate well among pupils of lower ability. However, the test would not be sufficiently discriminative among the pupils of higher ability, and would probably be unreliable. The implication from these conclusions was the same as that drawn from the study of the means and the form of distribution of scores--revision to make the test more difficult.

4. A diagnosis of the test in terms of the weaknesses of individual items was provided through a study of the increase in success by consecutive grade groups on each of the items. As to be expected, in view of conclusions respecting the ease of the test as a whole, a large majority of the items were too easy and did not discriminate sufficiently among pupils of high ability. Approximately half of the items were answered correctly by ninety per cent or more of the third grade pupils. Other items showed erratic response, as indicated by the fact that a lower percentage of fourth grade pupils answered certain items correctly than did third grade pupils.

In revision, all "throwback" items were to be eliminated or reworded. The major need in revision, however, was the elimination of the very easy items to bring the average performance by third grade pupils down to approximately sixty-five per cent.

CHAPTER IV

REVISION OF THE TEST

First Revision and Second Try-Out

Revision and administration of the test. The major weakness of the original test was in its ease for third grade. The first revision aimed primarily to correct this deficiency by eliminating all items which had been answered correctly by ninety per cent or more of the third grade pupils. Analysis of Table VIII revealed the fact that there were fifty-five such items in Form A, sixty-three in Form B, and fifty-six in Form C. Forms B and C each contained one item for which the percentage correct was below ten. These, too, were to be eliminated as poor discriminatory items. Certain other items to which fourth grade pupils responded more poorly than third grade were also to be eliminated or reworded.

It was found that after eliminating the undesirable items, there was not a sufficient number of items left for the test. Three third grade teachers were then asked to submit additional items for each part of the test. These items were to be, according to teacher judgment, somewhat more difficult. Such items were to be selected from the latter part of the third grade curriculum and the first part of the fourth. Inclusion of some items from the fourth grade was justified by the fact that many pupils transferring to the Tulsa Schools had had more arithmetic than the pupils who had spent all their school life in the Tulsa Schools. Form A of the test was completely revised by using the items of the original Form A which proved to be good on the first try-out and by adding new items. The number of items in each part of the revised test was twenty-five, thus, making a total of seventy-five items in the entire test. Forms B and C were then reconstructed with items which paralleled

those of Form A. Thus, Forms B and C differed more radically from the original forms than did Form A.

Many refinements were made in the revised forms. In the original test, certain items required more than one response. In the revised test, each item required only one response. Some attempt was made to scale the items according to difficulty. This could be done objectively with items from the first try-out, but for the new items it was necessary to depend on subjective judgment. Finally, each part of the test was stapled separately to permit ease in administration.

The test was administered at mid-year (January, 1945) to 314 third grade pupils from the Springdale, Sidney Lanier, Longfellow, Osage, and Pershing schools. These schools were the same as those used in the first try-out except for the Pershing School which was added for the second try-out. From Table IX, which gives the mean chronological age, mental age and I.Q. for this sampling of pupils, it is evident that the group was approximately normal.

TABLE IX

THE MEAN CHRONOLOGICAL AGE, MENTAL AGE, AND I.Q. OF 314 THIRD GRADE PUPILS TAKING THE SECOND TRY-OUT TEST

No. Pupils	C.A.	M.A.	I.Q.
314	8-11	8-10	99.2

The test was administered under the same conditions as those specified for the first try-out. The tests were scored in the central testing office and tabulations made.

Results and conclusions. Only two types of studies were made from the data: (1) the distribution of the scores to give an idea of the difficulty of the test as a whole and its discriminative power; and (2) the difficulty of each individual item as determined by the percentage of pupils responding correctly.

Table X shows the distribution of scores on each of the three forms of the test.

TABLE X

THE DISTRIBUTION OF 314 THIRD GRADE SCORES ON THE THREE FORMS OF THE SECOND TRY-OUT TEST

Scores	f Form A	f Form B	f Form C
73-77			
68-72			
63-67	6	6	7
58-62	15	18	16
53-57	29	31	36
48-52	52	49	38
43-47	48	49	46
38-42	52	55	42
33-37	46	44	54
28-32	23	41	25
23-27	18	19	24
18-22	12	12	13
13-17	10	4	10
8-12	1	4	2
3-7	2	2	1
	N 314	N 314	N 314
	A.M. 40.21	A.M. 40.23	A.M. 40.1
	S.D. 11.85	S.D. 11.85	S.D. 12.30

The equivalency of the three forms had apparently been maintained in the revision, as indicated by the means which were almost identical for the three forms, and by the standard deviations which were likewise in close correspondence.

The most significant conclusion, however, in view of the purpose of the revision, was to be found in the nature of the distributions. Little skewness was found in comparison to that of the distributions of the first try-out test. The means of 40.21, 40.23, and 40.1 represented an average per cent of correctness of approximately fifty-three for each of the forms, as compared with approximately eighty-one per cent of the first tests. While the second try-out was a mid-year test and the first try-out was a May test, it was apparent that the difficulty of the test had been considerably increased. The highest score was sixty-six on each form of the test, out of a possible score of seventy-five. The lowest scores were five, seven, and six respectively for the three forms. Apparently, the tests were sufficiently discriminative for mid-year testing of third grade pupils.

The percentage of correct responses for each item was calculated for three reasons. The first was to determine if any items were failing to function on the test by yielding either one hundred per cent or zero per cent correct responses. The second reason was to discover any apparent discrepancies between an expected response and the actual response. Although an expected response would be a subjective matter, any discrepancy between what might be expected and the actual response would serve to bring about a critical examination of the statement of the item concerned. The third reason for calculating the percentages of correct responses was to obtain data for scaling the test.

Table XI gives the percentage of correct responses for each item of the three forms of the test. From the table, it will be noted that corresponding items on the three forms were in most cases of similar difficulty.

TABLE XI

THE PERCENTAGE OF CORRECT RESPONSES
FOR EACH ITEM OF THE SECOND TRY-OUT TEST
GIVEN TO 814 THIRD GRADE PUPILS

No. of Item	Form A			Form B			Form C		
	Part I	Part II	Part III	Part I	Part II	Part III	Part I	Part II	Part III
1	99	87	90	96	85	91	67	82	93
2	97	84	50	58	83	58	97	77	64
3	87	73	77	91	79	89	91	79	73
4	73	53	90	75	55	94	76	59	91
5	57	77	84	70	77	84	60	77	88
6	56	74	65	85	70	70	77	72	65
7	63	22	90	38	21	91	92	24	94
8	30	75	83	34	87	83	30	79	82
9	61	47	92	61	66	91	44	49	86
10	39	80	78	47	81	75	36	78	78
11	29	81	32	33	73	38	44	74	55
12	6	34	80	18	41	85	4	38	86
13	60	51	57	69	45	50	64	56	67
14	71	37	8	75	48	9	71	47	7
15	64	76	75	66	81	73	61	79	73
16	25	44	59	24	40	59	29	43	52
17	70	67	32	70	63	49	63	65	34
18	25	62	29	45	56	23	44	49	18
19	79	11	28	81	11	22	81	10	18
20	60	26	41	81	24	43	34	24	37
21	52	0.6	72	61	0.6	74	34	0	72
22	45	4	62	46	4	58	35	3	61
23	42	2	6	76	5	4	53	2	5
24	64	0.3	54	12	1	52	16	0.3	46
25	47	0	48	58	0	49	56	0.3	48

There were no one hundred per cent items on any form, and only one zero item on each of the forms. The three zero items were apparently the only nonfunctioning items on the test. However, on each form the last five items of Part II had percentages of five or less. These items from the fourth grade curriculum appeared to add little to the effectiveness of the test for third grade pupils as indicated by mid-year testing. The authors of the test reasoned that there was little likelihood that the percentages on these items would be much higher if the test were

given at the end of the third grade. One example involved double borrowing in subtraction and the others were multiplication or division by one digit. For these examples, it was recommended that others more simple but involving the same processes be substituted.

Five items on Form B and six each on Forms B and C gave percentages of ninety or above. These items were considered satisfactory since the test appeared to be of about the correct difficulty, and they would offer encouragement to the pupils of low ability.

From a study of Table XI, all other items appeared to be satisfactory.

Second Revision and Third Try-out

Revision and administration of the test. The major revision for the third try-out was of Part II, which was done in the light of recommendations resulting from a study of the percentages of correct responses on the second try-out. The new items for the most part were division facts with and without remainders, multiplication facts, and two short multiplication examples, one of which involved carrying.

A few items were shifted from one form to another to make the total difficulty of the forms still more closely comparable.

The statement of certain items in Part I and certain problems in Part III were refined. Also, slight changes were made in the numbers involved in a few problems of Part III.

Each part of the test was then scaled on the basis of the difficulty of items as revealed in the study of percentages of correct responses in the second try-out. In Part II, the examples were scaled within the processes involved. For example, all addition examples were grouped together in order of difficulty.

Because the test had been revised after the second try-out, it was necessary to administer it again in a try-out situation. A second reason

was to study the results which would be obtained by giving the revised test at the end of the year. Accordingly, Form A was administered to a sampling of 508 third grade pupils from the Springdale, Lanier, Longfellow, Osage, Pershing, Jefferson, and Lincoln schools. Since in the two previous testings, the three forms had appeared to be practically equivalent, it was considered necessary to give only Form A. Any implications for further revision which might develop from the results of giving Form A would be considered applicable to Forms B and C.

Form A was also given to a sampling of 254 fourth grade pupils from Kendall, Longfellow, and Pershing schools and to 178 second grade pupils from Franklin, Pershing, and Porter schools. The purpose was to obtain tentative grade standards and to study again the rise in percentage of success achieved on each item by consecutive grade groups.

For the sampling of fourth grade pupils, a mean C.A. of 10-2 was obtained and a mean I.Q. of 99.2, both of which were approximately normal. For the sampling of second grade pupils a mean C.A. of 8-2 and a mean I.Q. of 107.9 were obtained. The I.Q.'s of the second grade pupils were from the Detroit First Grade Test, which, from repeated studies made in the Testing Department of the Tulsa Schools, has yielded an average I.Q. of approximately 108. The sampling of second grade pupils was considered, therefore, to constitute an average group. The I.Q.'s were not obtained for the third grade group because it was thought that the size of the sampling and the care in the selection of the schools would insure a normal group. In administering the two previous tests, the third grade pupils from five of the schools were found to have a mean I.Q. of approximately 100. The pupils from Jefferson and Lincoln schools were added because previous data from the Testing Office indicated these pupils to be average in I.Q.

Results of the third try-out. Table XII shows the accomplishment of the three grade groups on each part of the test and on the test as a whole.

TABLE XII

THE ARITHMETIC MEANS OF THE SCORES MADE BY SECOND, THIRD, AND FOURTH GRADE PUPILS ON FORM A IN THE THIRD TRY-OUT

Grade	No. Pupils	Part I	Part II	Part III	Entire Test
2	178	9.85	6.71	9.85	26.41
3	508	17.09	13.59	17.72	48.39
4	234	21.56	22.21	21.61	65.38

The third grade score of 48.39 on the test as a whole is 64.5 per cent of the possible score of seventy-five. This meets the difficulty requirement of the test. As pointed out earlier, even though test authorities recommend a percentage of near fifty, the constructors of this test decided on a percentage of approximately sixty-five for the reasons previously stated.

There was a sharp and reasonably consistent rise in average score from grade to grade, which gives some evidence of the validity of the test. The rise in percentage of success on each part and on the entire test is graphically illustrated in Figure 2.

Parts I and III gave almost identical results, the rise being somewhat greater from the second to the third grade than from the third to the fourth grade. The reverse was true for Part II, the rise being sharper from the third to fourth grade. This was true no doubt because of a few multiplication and division examples that came late in the third grade curriculum and which had been less thoroughly learned, if at all, by third grade pupils.

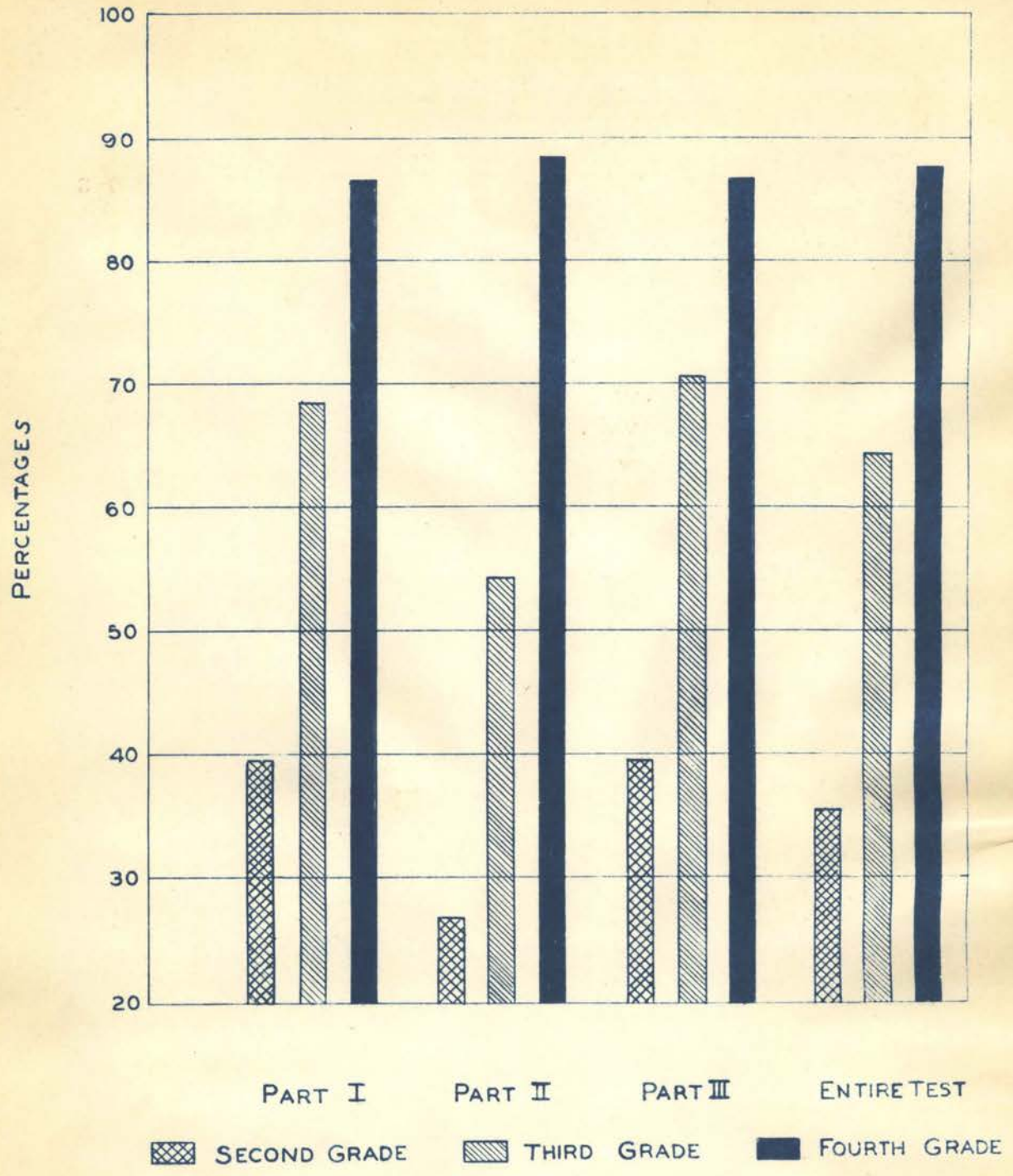

FIGURE 2

THE PERCENTAGE OF SUCCESS BY SECOND, THIRD AND FOURTH GRADE PUPILS ON THE THIRD TRY-OUT OF FORM A

The percentage of correct responses to each item of the test was calculated.

On the third grade level, no item was answered correctly by all pupils and no item failed to be answered correctly by fewer than four pupils. Therefore, all items functioned on the test.

Two items on the test received a larger percentage of correct answers by the third grade than by the fourth grade. Both of these were addition combinations, $\frac{8}{6}$ and $\frac{9}{6}$, which apparently were misinterpreted by a number of fourth grade pupils as subtraction facts. Since there was no apparent reason other than carelessness for such misinterpretation both items were considered valid. However, it was recommended that an example of single column addition of three digits be substituted for the second addition combination.

On Part III, four problems were answered correctly by more than ninety per cent of the third grade pupils. It was recommended that two of these problems be made more difficult. One involving addition of three digits with a sum less than ten (4+2+3) was to be replaced by one whose sum would exceed ten and involve a higher decade addition fact (4+7+3). The other involving addition of 10+5+10 was to be replaced by a problem involving addition of 15+5+10, which was presumed to be slightly more difficult.

Revisions comparable to those suggested for Form A were to be made also in Forms B and C. With these minor revisions and with some further refinement of the statements of certain problems in Part III, the three forms of the test were considered to be ready for final try-out and standardization.

CHAPTER V

FINAL TRY-OUT AND STANDARDIZATION

Administration of the test. Minor revisions which had been suggested by the results of the third try-out were made, and the tests were prepared for administration to the entire third grade of the Tulsa schools in January, 1946.[1] The purpose was to gather final data on the tests and to establish tentative mid-year norms.

Each of the three forms was given to one third of the third grade enrollment. To secure equivalent groups for each form, each teacher passed out the tests to the pupils in the order, A, B, C, A, B, C. Thus, the group taking each form was composed of one third of the pupils of every classroom, selected by choosing every third pupil.

Results and conclusions. Results in terms of the means and standard deviations of the scores are given in Table XIII.

TABLE XIII

MEANS AND STANDARD DEVIATIONS
OF THIRD GRADE SCORES ON THE THREE FORMS
OF THE FINAL TEST

Form	No. Pupils	Part I		Part II		Part III		Entire Test	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
A	709	13.7	5.3	11.2	4.3	13.8	5.9	38.6	13.9
B	703	12.8	4.7	11.3	4.1	13.9	5.5	37.7	12.5
C	691	13.1	5.1	11.0	4.4	13.8	5.8	37.8	13.7

[1] The reader is referred to the Appendix for a copy of the three forms of the final test.

From the data of Table XIII, the three forms appear to be reasonably comparable. The three means and the three standard deviations for Part II and Part III vary no more than four tenths of a score point. A greater variation is seen in these measures for Part I and for the test as a whole. Apparently, some further shifting of certain items of Part I from one form to another may be advisable if the same set of norms or standards is to be used for the three forms. However, in view of the fact that separate norms are being established, the three forms may be considered comparable for all practical purposes.

No pupil made a perfect score on any form. The highest score was sixty-nine, which was made on Form C by two pupils. Sixty-eight was the highest score on Forms A and B. One score of zero was made on Form B; this score was the only zero score on any form. Thus, the test appears to be discriminative among pupils at both extremes of the range of ability.

The mean of Form A is 51.5 per cent of the possible score; of Form B, 50.4 per cent; and of Form C, 50.3 per cent. The difficulty of the test, as indicated by these percentages for mid-year testing, is quite satisfactory. Since the percentage of correct responses on Form A given at the end of the year in 1945 was 64.5, it may be concluded that the normal mean of the test will fall between fifty and sixty-five per cent when the test is given at any time during the second semester of the third grade.

From Table XIV, which gives the percentage of correct responses, to each item, it may be seen that every item functions for mid-year testing. There were no zero items and no one hundred per cent items.

TABLE XIV

THE PERCENTAGE OF CORRECT RESPONSES TO EACH ITEM
OF THE FINAL TEST GIVEN TO THIRD GRADE PUPILS AT MID-YEAR

No. of Item	Form A			Form B			Form C		
	Part I	Part II	Part III	Part I	Part II	Part III	Part I	Part II	Part III
1	97	87	89	95	89	88	94	83	87
2	91	79	77	85	81	61	87	79	77
3	82	73	88	88	75	90	90	81	87
4	63	70	76	76	72	91	79	78	75
5	72	79	81	74	83	84	80	74	82
6	72	76	75	68	75	79	68	69	84
7	74	19	75	73	16	75	69	18	71
8	74	71	67	69	74	67	59	72	81
9	61	52	79	58	67	78	57	73	64
10	61	73	73	58	73	74	59	68	68
11	68	74	69	66	71	73	62	50	67
12	54	50	57	54	54	61	43	48	69
13	38	54	55	46	48	61	46	44	60
14	45	28	58	51	25	56	51	23	41
15	47	74	51	57	76	60	27	75	51
16	57	75	56	42	69	51	53	73	58
17	59	53	54	35	52	45	39	55	29
18	40	6	43	34	7	41	56	5	35
19	38	6	32	67	6	35	51	4	57
20	46	0.3	45	13	0.4	25	36	0.1	29
21	35	3	20	36	2	37	37	4	43
22	15	7	18	7	9	15	12	10	21
23	42	4	21	18	3	19	26	6	20
24	26	4	20	2	3	17	10	3	18
25	11	1	8	11	1	9	14	1	8

Reliability of the test. An estimate of the reliability of the test was secured through computation of the "Chance-Half" coefficient and by "stepping up" this correlation by means of the Spearman-Brown Prophecy Formula.

To secure a sampling for this correlation, all test papers were stacked alphabetically according to forms. Then, every fifth test paper was selected. This method secured 119 cases for Form A, 117 cases for Form B, and 115 cases for Form C.

For each pupil, two half-scores were obtained by tabulating his responses to odd and even numbered items. The correlation coefficient was then computed between the two sets of half-scores for the group of pupils. Correlations obtained were .90, .91, and .91 for Forms A, B, and C, respectively. When these correlations were "stepped up" by means of the Spearman-Brown Prophecy Formula, the following estimates of reliability were secured for each form of the entire test: Form A, .95-; Form B, .95+; and Form C, .95+.

Standardization. Two types of norms were contemplated in constructing the test--grade norms and percentile norms. For the purposes for which the test was designed, percentile norms were considered to be equally as satisfactory as grade norms. At the same time, they would involve samplings only from third grade pupils, while grade norms would require large samplings from the second, third, and fourth grades.

To establish reliable norms, data are required from larger and more extensive samplings, than have been used in the development of the test to this point. However, on the basis of approximately seven hundred scores, tentative percentile norms for each form of the test have been established. Table XV gives the scores made on each form of the test and the corresponding percentile ranks for each score.

Figure 3 presents a graphic representation of the percentile ranks of the scores on the three forms of the final test. The curves for the three forms offer graphic evidence of the near comparability of the forms. If smoothed, the curves would be almost identical.

TABLE XV

PERCENTILE RANKS OF THE SCORES ON
THE THREE FORMS OF THE TEST

Score	Form A	Form B	Form C
1		.1	
2		.2	.1
3	.3		.2
4	.6	.5	.7
5	1.1	.8	1.1
6	1.4	1.0	1.3
7	2.2		1.7
8	2.5	1.5	3.0
9	3.2		3.4
10	3.6	2.2	4.0
11	4.2	2.5	4.6
12	4.6	3.5	5.3
13	5.3	4.2	5.3
14	5.9	4.6	6.8
15	6.7	5.5	7.6
16	7.6	6.5	8.1
17	9.0	7.1	8.9
18	10.0	7.8	10.2
19	10.4	8.8	11.4
20	11.5	10.3	12.0
21	12.8	11.5	13.8
22	14.1	12.2	15.2
23	16.0	13.8	16.5
24	17.3	15.0	17.5
25	18.7	16.7	19.3
26	20.1	18.2	20.5
27	21.7	19.7	22.1
28	22.9	22.0	24.4
29	24.6	25.1	26.6
30	27.6	27.7	27.9
31	28.9	30.4	29.6
32	31.7	33.2	32.2
33	33.1	35.8	35.4
34	35.5	38.1	37.0
35	38.0	40.6	39.2
36	39.4	42.9	42.8
37	42.3	44.3	45.1
38	45.7	46.5	48.7
39	48.9	49.7	51.3
40	51.6	52.2	53.5
41	54.8	55.1	58.1
42	58.1	58.6	61.0
43	60.5	62.1	62.6
44	62.9	65.0	66.8
45	65.4	68.5	69.0
46	67.2	72.4	70.9

PERCENTILE RANKS OF THE SCORES ON
THE THREE FORMS OF THE TEST
(Continued)

Score	Form A	Form B	Form C
47	69.9	75.3	74.3
48	72.9	78.2	77.8
49	75.3	80.9	79.3
50	77.7	83.3	81.1
51	80.3	86.0	83.5
52	82.5	88.0	85.5
53	84.2	90.0	87.5
54	86.7	91.8	89.5
55	89.2	93.3	90.5
56	91.2	94.4	92.0
57	93.3	95.4	92.9
58	95.0	96.5	94.7
59	96.6	97.0	95.9
60	97.6	98.0	96.9
61	98.0	98.5	97.8
62	98.5	99.1	98.4
63	99.0	99.4	98.9
64	99.5	99.5	99.4
65	99.7	99.7	99.5
66	99.8	99.8	
67			99.7
68	100.0	100.0	
69			100.0

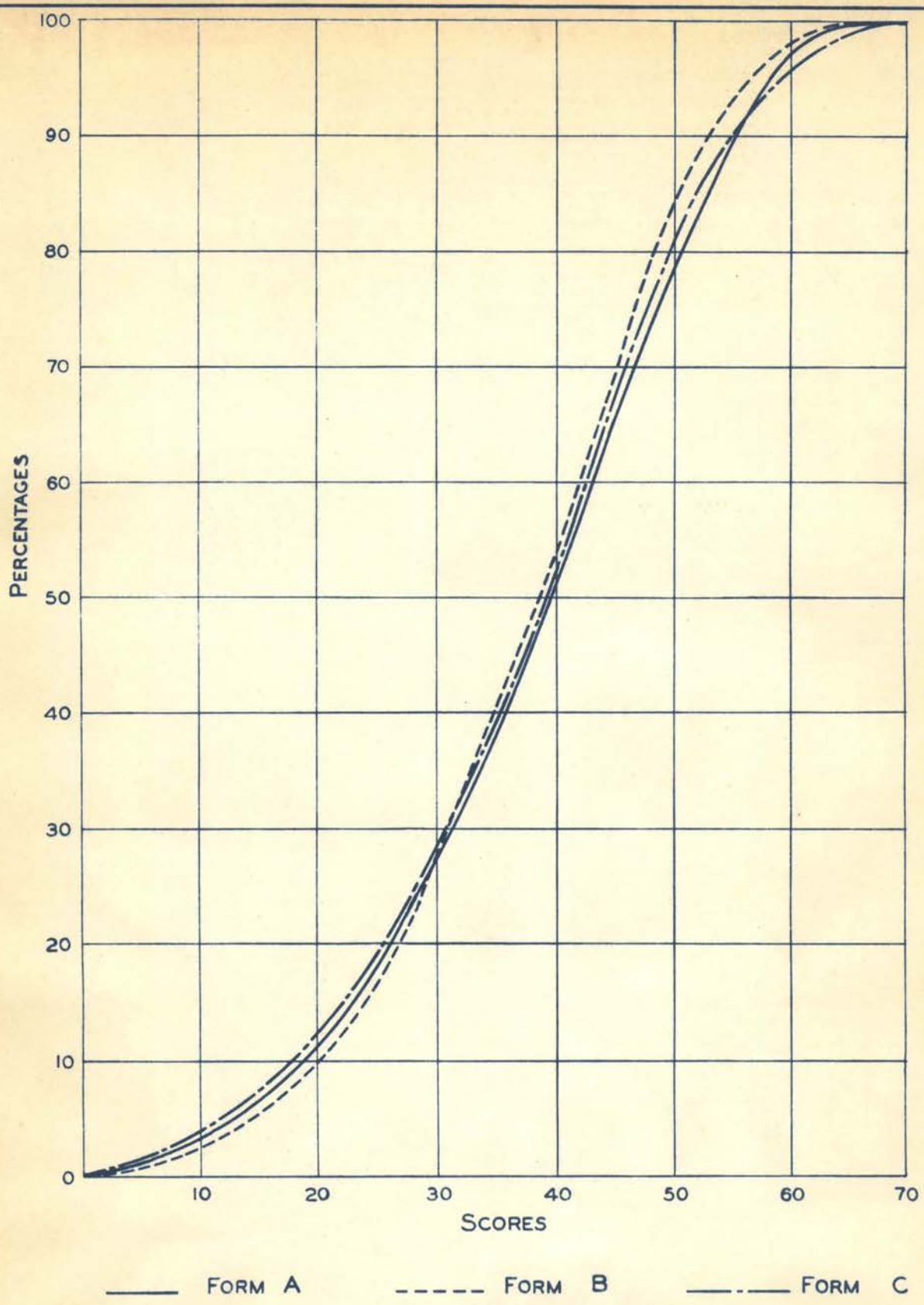

FIGURE 3

THE PERCENTILE RANKS OF THE SCORES ON THE THREE FORMS OF THE FINAL TEST.

For diagnostic purposes, the percentile ranks of the scores on each part of the three forms were also computed. Table XVI presents these data.

TABLE XVI

PERCENTILE RANKS OF THE SCORES ON EACH PART OF THE TEST

Score	Form A			Form B			Form C		
	Part I	Part II	Part III	Part I	Part II	Part III	Part I	Part II	Part III
0	.3	1.1	1.4	.1	1.3	.7	.4	1.3	1.0
1	1.1	2.2	2.5	.7	2.7	1.8	1.1	2.7	2.6
2	2.6	3.2	4.6	1.2	4.2	2.8	2.1	4.2	3.4
3	3.6	5.6	7.1	2.8	6.0	4.1	4.3	6.0	5.5
4	4.6	8.1	9.7	5.1	8.5	5.9	6.0	8.5	8.5
5	6.4	11.8	11.5	8.5	12.8	8.1	9.1	12.88	10.8
6	9.8	16.0	13.8	10.3	17.6	10.2	11.8	17.6	13.4
7	13.6	20.7	17.3	15.3	22.2	14.7	15.7	22.2	16.5
8	17.9	26.9	20.0	20.0	29.5	17.6	19.9	29.5	19.9
9	23.1	32.6	22.7	25.2	35.8	23.4	25.6	35.8	23.4
10	29.0	40.2	27.6	31.2	41.9	26.8	30.9	41.9	27.9
11	35.1	47.6	31.8	38.6	48.6	31.7	36.6	48.6	31.5
12	42.1	54.4	35.6	44.3	58.3	37.7	44.1	58.3	36.1
13	47.3	66.1	42.1	52.4	68.1	43.2	51.5	68.1	42.6
14	53.8	75.8	50.3	59.8	78.1	49.3	59.0	78.1	48.7
15	60.5	85.9	55.0	66.8	86.9	57.0	65.8	86.9	56.7
16	66.8	93.0	62.3	74.9	91.9	65.0	72.3	91.9	63.8
17	73.3	97.0	68.4	82.0	95.5	71.4	79.8	95.5	69.4
18	78.7	98.3	75.1	89.1	97.4	77.5	84.0	97.4	76.9
19	83.9	98.8	81.2	94.3	98.9	83.7	88.1	98.7	84.0
20	89.8	99.2	87.5	96.4	99.5	89.6	92.6	98.9	88.2
21	92.6	99.7	93.5	98.0	99.8	93.7	96.0	99.5	92.7
22	97.0		96.9	99.5	100.0	96.1	97.6	99.8	96.0
23	98.8	99.8	98.8	99.8		98.7	98.9	100.0	98.2
24	99.5		99.7	100.0		99.4	99.7		99.4
25	100.0	100.0	100.0			100.0	100.0		100.0

Establishment of time limits. Beginning with the first try-out and continuing through the third try-out, teachers were asked to record the time when all but approximately ten per cent of the pupils had completed the test. On the basis of the information thus received, time limits were set for the final test given in January, 1946. The following time

limits were observed: Part I, eighteen minutes; Part II, fifteen minutes; and Part III, thirty minutes.

Each teacher was asked to record the time required if the entire class finished the test in less time than that allotted. If the entire time was used, they were to report the number of pupils who failed to finish. On the basis of returns, it was found that only nine classes of a total of sixty-five completed Part I; ten classes completed Part II; and seven classes completed Part III. For the classes that did not finish, incomplete information was received concerning the number not finishing. However, a number of teachers commented that while several pupils were still working when time was called, apparently most progress had ceased.

On the basis of somewhat inadequate information, the constructors of the test believe that the time limits set for the final test were adequate. Further verification, however, will be sought in the next use of the test.

Directions for giving the test. A copy of the directions for administering the test may be found in Appendix B. These directions appeared to be adequate for the final test. With some amplification, the directions and the tentative percentile norms will be incorporated in a manual to accompany the tests.

Final conclusions. The constructors of the test believe that the major criteria for a good achievement test have been met. Curricular validity has been assured through the method of selecting the content. Evidence of validity was found in the test norms which consistently showed higher average scores with advancement in grade placement. Further evidence of validity was secured through the careful study of individual test items. Only those items were used which showed an increasing

percentage of correct responses from one grade level to the next higher level.

The coefficient of reliability of .95 for each form was sufficient evidence of the reliability of the test.

Other criteria such as objectivity and adequacy have been taken care of through establishing reliability.

On three points, the test perhaps needs further refinement. As previously indicated, some shifting of the items of Part I from one form to another may be desirable in order to bring the difficulty of the three forms into a little closer correspondence. The second need is for some rearrangement of the items in each form in terms of difficulty to provide better scaling of the test. Finally, additional data to be secured from subsequent use of the test are needed for developing more reliable norms.

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APPENDIX

SPELLING QUESTIONNAIRE

The following questionnaire was presented to the teachers of grades four, five, and six on April 4, 1944 and again on May 14, 1945.

TULSA PUBLIC SCHOOLS

To Teachers of Grades Four, Five, and Six:

The following questionnaire is presented to you as a part of an evaluation study which is being made of our spelling program. Please answer each question carefully and accurately on the basis of what you actually do with respect to the practices indicated. Under each question, check your answers by writing in the margins and the blank spaces. Answer this questionnaire for your highest grade. You need not sign your name. Return to the Assistant Superintendent's Office.

1. For what grade is this report made? _____

2. How many minutes per week on the average do you allot to spelling in this grade? _____

3. Does your spelling instruction include words other than those of the lists?
   a. Yes _____ b. No _____

4. How are these additional words taught?
   a. Added to the regular spelling list for the week
   b. Incidentally taught only (attention of pupils called to correct spelling, misspelled words rewritten correctly etc.)

5. If other words are included, is this
   a. A regular weekly practice?
   b. An occasional practice?

6. From what subjects or periods are these words selected?
   a. reading
   b. language
   c. arithmetic
   d. Weekly Reader
   e. other subjects _____

7. How do you decide on what words to select?
   a. words misspelled in written work
   b. words from reading material which you think should be learned
   c. other bases _____

8. If words are selected from misspellings in written work, for whom are these words used?
   a. only for those individuals who misspelled the words
   b. for all members of the class

9. In selecting misspellings from written work do you include
   a. all misspellings
   b. certain selected misspellings

10. Are the words which you select to include in your spelling program, checked against any standard list for frequency of usage, to determine their importance?
   a. Yes - if so, what list?
   b. No

11. What general method do you use?
   a. test-study method (pre-test on Monday, study on Tuesday, test on Wednesday, study on Thursday, test on Friday)
   b. study-test method (study four days and test on fifth day)
   c. other general method _____

_____

12. In the weekly tests how are the words presented to the pupils and written by them on the test?
   a. In column or list form
   b. In context, either in phrases or complete sentences

13. How are the words of the list distributed through the week?
   a. all the words included in each day's spelling activities
   b. the list broken up into two or more units presented on different days

14. If you teach the meanings of the word in the list, check the item that applies.
   a. all the words each week
   b. certain selected words each week
   c. certain words occasionally

15. How do you determine the words, for which the meaning should be taught?

_____

_____

16. How do you teach the meanings? _____

_____

17. Before the pupils begin the study of the words, do you have a pronunciation exercise in which all pupils pronounce all the words?

   a. yes _____ b. no _____

18. As a regular practice do the pupils use the words in written sentence or written stories during the week's spelling activities?
   a. yes _____ b. no _____

19. Do you teach any spelling rules?
   a. yes _____ b. no _____

20. If your answer was "yes" to No. 17 what rules do you teach? (Be specific.)

_____

_____

_____

21. Do you regularly emphasize syllabication during the pronunciation exercise?
a. yes _____ b. no _____

22. Do you regularly emphasize phonetic-elements and other means of word analysis?
a. yes _____ b. no _____

23. What procedure or steps do you have the pupils use in learning to spell a word?

_____

_____

_____

24. Outline your week's spelling program; for example, after "Monday", list all the activities in which you engage, such as writing the words on the board, using a pronunciation exercise, developing meanings, pretesting words, etc.

Monday:

Tuesday:

Wednesday:

Thursday:

Friday:

25. Do all achievement levels within a given class study the same number of words?
a. yes _____ b. no _____

26. If you have two classes of unequal ability, do you give the same number of words to each group?
a. yes _____ b. no _____

Jess S. Hudson
Chairman of Spelling Committee

Charles C. Mason
Assistant Superintendent

TULSA PUBLIC SCHOOLS

IMPROVEMENT OF INSTRUCTION IN SPELLING

Bulletin No. 1

I. Aims in the Teaching of Spelling[1]

A. To develop sound purposes for the study of spelling

1. Through knowledge that the words the pupil studies are those most commonly and crucially needed in writing

2. Through knowledge that the words he studies are those he needs to study (those he cannot already spell)

3. Through a desire to spell correctly all the words he uses in written work

4. Through the knowledge that a premium is placed on correct spelling in all writing

B. To develop self-direction in learning how to spell a new word

1. Through an effective method of study in learning to spell new words

2. Through the use of the dictionary as a means of learning the meaning, the pronunciation, and the spelling of a word

3. Through the ability to make certain generalizations in forming the derivatives of base words, possessives, and contractions

4. Through the ability to relate the sounds of words or parts of words to their spelling

C. To develop mastery of the spelling of a minimum list of words

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[1]The aims in this list have been compiled from three major sources:
(a) J. Murray Lee and Dorris M. Lee, The Child and his Curriculum, New York: D. Appleton-Century, 1940.
(b) T. G. Foran, The Psychology and Teaching of Spelling, Washington, D. C.: The Catholic Education Press, 1934.
(c) Ernest Horn and Ernest J. Ashbaugh, Progress in Spelling, New York: J. B. Lippincott, 1941.

D. To enlarge the writing vocabulary

1. Through development of the meanings of all words in the basic list

2. Through provision for the use of the words in writing

II. Principles of Method

A. Developing sound purposes and motivation for the study of spelling

1. Give a straightforward explanation to the pupils of how the words of their spelling list were selected. In a study of over 5,000,000 words of writing, each different word was listed and the number of times it was used was counted. The words which were used the greatest number of times, and therefore, the most important words in writing are those included in the spelling list.

Select a child's letter and analyze it to illustrate this means of discovering the most important words to be learned.

The program of spelling as now set up through the eighth grade in the Tulsa Schools will include the words which will take care of approximately ninety-nine per cent of the written needs of the average person. For detailed discussion, see T. G. Foran, The Psychology and Teaching of Spelling, Chapter II.

2. Through the use of the pre-test and frequent reminders of its purposes, develop the idea that the words the pupil studies each week are those he needs to study. He has already learned to spell a large percentage of the words for the week through incidental means. The pre-test discovers those words which he already knows and on which he does not need to waste time. At the same time, it points out his needs for further study. No other subject offers a means, so definite and so objective, of pointing out pupils' needs as does spelling through the pre-test.

3. Consciousness that spelling is one of the means of written expression should be emphasized.

a. Emphasize the fact that without words one cannot express ideas; and without knowing how to spell, one cannot use words.

b. Point out the fact that poor spelling is inconsiderate of the reader.

c. Give examples of the cruciality of spelling in certain types of writing; also point out that people are often judged by their spelling in letters.

d. Insist on careful and exact spelling in all written work. Carelessness should not be tolerated.

e. Encourage other teachers to whom the child goes to be exact in their requirements of spelling.

f. Insist that the pupil not guess at the spelling of a word when he is writing. He always has some means at hand for getting the correct spelling.

g. Have pupils form the habit of checking spelling at all times. Studies have shown that over fifty per cent of spelling errors are due to carelessness or to demands of other processes involved in writing, such as developing ideas, finding words to express ideas, and formation of letters in handwriting.

B. Development of self-direction in learning how to spell a new word

1. One of the fundamental weakness in many spelling programs is the failure to develop an effective method of independent study of a new word. A systematic and effective method of study is necessary, not only for learning the words of the list, but also for the other words which pupils may need in their writing. The following steps compiled from various sources are recommended. Pupils should be directed in these steps until they become habitual.

Step 1. Pronounce the word correctly. Say each syllable distinctly, and look at each syllable as you say it.

Step 2. Look at the word and spell it softly. Notice any double letters or hard spots.

Step 3. Close your eyes and think how the word looks. See every letter. Then spell the word softly.

Step 4. Look at the word to find whether your spelling is right. If you make a mistake, repeat steps one, two and three.

Step 5. Without looking at the word list, write the word. See if you spelled it correctly. If you misspelled it, repeat the first four steps and try writing it again.

Step 6. With the word covered write it a second time. Check, and if it is correct write it a third time.

2. The use of the dictionary should be taught as a means os securing the meaning, the pronunciation, and the spelling of a new word. The mastery of 4000 words of a list will enable the pupil to spell approximately 99 per cent of the words used in everyday writing. For the other one or two per cent and for these words

the pupil has forgotten, he must rely on the dictionary. The following exercises may be used:

a. Give practice in alphabetizing words.

b. Use the dictionary for making the vowels of three or four words of the list; for crossing out silent vowels.

c. Use the dictionary for writing words by syllables and for putting in accents. Writing a word by syllables should be followed by writing it as a whole to insure correct visual perception of the word.

d. Find the plurals of words.

e. Find the meanings of words.

3. As a means of self-direction, have the pupils develop certain generalizations with respect to the formation of derivatives of base words.

a. Most nouns form their plurals by adding s to the singular. Es is sometimes added to make the word easier to pronounce.

b. Drop the final e before adding a suffix beginning with a vowel. This rule may be applied particularly to ing, ed, and er.

c. Abbreviations are always followed by a period.

d. The apostrophe is used in contractions.

e. The apostrophe is used to form possessives.

These rules should be taught inductibely rather than deductively. The pupils should discover, with the help of the teacher, the similarity in the spelling of several words covered by the rule. They should then formulate the rule and write many other words which are covered by it. Teach only one rule at a time.

4. Self-direction may be further developed by causing pupils to relate the sound of words or parts of words to the spelling.

The steps in this process have been suggested by Dolch.(1) Before the following suggestions can be applied, it is assumed that the pupil knows the basic sounds of consonants, vowels, and important letter combinations. In meeting any new word the

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(1) Edward W. Dolch, Better Spelling, pp. 74-80. Champaign, Illinois: The Garrard Press, 1942.

pupil should be taught to analyze the word by the following steps.

a. What is the right sound of the word?
The pupil must have the correct ear image of the word. If he hears the teacher's pronunciation, it is essential that the teacher's pronunciation be exact. If he cannot ask for the pronunciation he must rely on the dictionary and, therefore, must have the techniques for getting the exact pronunciation. Wrong sounding or wrong pronunciation causes a high percentage of errors in spelling.

b. After getting the correct pronunciation, the pupil should ask, "Is the word spelled as it is sounded?" The answer to this question will tell him whether the pronouncing will automatically take care of the spelling. The pupil should pronounce the word slowly by syllables to see if the sound agrees exactly with the letters. If not, the differences should be carefully noted.

The tendency is for one to think the sound of a word as a whole and the printed word as a whole. Dolch gives examples: "Most persons are surprised to learn that the "i" in friend is silent, and that "iron" is pronounced "iorn". Pupils should form the habit of making such analyses .

c. If any part of a word does not sound as spelled, "How may the spelling of these different parts be remembered?" The following techniques are suggested by Dolch.

(1) Associate the unusual sound of these parts with known words which involve the same letters and sounds. For example, the ou in "fought" is sounded as the ou in "ought", which may be a known word.

(2) Sound the word exactly as it is spelled as a device for remembering troublesome spots. For example, "colonel" is spelled as if it were pronounced "col-o-nel".

(3) Try to form a clear mental image of the letters of the troublesome spot so that the mental picture can be used for correct spelling. For example, the troublesome spot in "separate" is the first a.

C. Mastery of the words of the spelling list.

1. The general plan
The test-study plan should be used. This means that a pre-test should be given before the words are studied. This plan provides motivation by showing the child exactly what he needs to do; moreover, it individualizes the spelling lesson.

2. Presentation of the new words

   a. A pronunciation exercise should precede the pre-test. The teacher should write each word on the blackboard and pronounce the word carefully by syllables, as she directs the pupils' attention to the word. While looking at the word, the pupils should pronounce the word. This step is important, not only to give the correct sound of the word but also to help the pupils associate the sound image with the visual image.

   b. During the pronunciation exercise, the meaning of each word should be illustrated in a sentence. If the word is unknown, its meaning should be discussed. There is little value in learning to spell a word, if it will not be used in writing because the meaning is not known.

   c. Strong appeal should be made to visual imagery during the presentation.

3. The pre-test (Monday)
   The pupils should understand the purpose of the pre-test: that it points out his needs for study during the week. No penalty should be attached to the number of words missed, in order that pupils will be honest with themselves; likewise, no comparisons with other pupils should be made.

   For the pre-test, the word should be pronounced, used in a sentence and then pronounced again. It is preferable that the pupils write the words in column form rather than in context.

4. Studying the words (Tuesday)
   Pupils should study only those words missed on the pre-test. The pupils who missed no words on the pre-test should be free to do other work.

   The greatest fundamental weakness is, perhaps, the failure of the pupil to use effective study techniques for learning to spell the words he missed. The teacher should see that he acquires a definite plan which will involve all types of imagery and recall. He should hear the word, see the word, pronounce the word, spell the word, and write the word. The six steps listed in B, 1 above should become habitual with all pupils.

5. Further testing and study
   On Wednesday, the pupils should be tested on all words. Again, the words missed should be checked, for further study on Thursday. On Friday the final test should be given. Words missed on Friday should be written in the pupil's notebook of troublesome words for further study.

D. Enlarging the Writing Vocabulary
   The only purpose in learning to spell is to be able to use the

words in writing: thus, spelling becomes a tool of written expression. Learning to spell a word, that the pupil cannot use in writing for lack of its meaning, has no value. Spelling, therefore, should not be divorced from actual usage. In addition to the development of meanings during the presentation of the words, other suggestions which may be used are the following:

1. Try to develop an attitude on the part of the pupils toward making new words of the reading vocabulary and of the speaking vocabulary a part also of their writing vocabulary. The technique suggested under B in this outline "Development of self-direction in learning how to spell a new word" are applicable for this purpose. Success in this respect, however, will be attained only to the degree that an attitude of caring about learning to spell new words can be developed.

2. Give pupils extensive and varied opportunities in written composition, which utilizes not only the words of the list but also new words, with emphasis on the correct spelling of all words.

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TULSA PUBLIC SCHOOLS

IMPROVEMENT OF INSTRUCTION IN SPELLING

Bulletin No. 2

In no other area of education, have the principles of method been so thoroughly investigated as in that of spelling. Dr. Ernest Horn in concluding the article on spelling in the Encyclopedia of Educational Research points out that certain problems in spelling need further investigation and then says, "Perhaps the greatest need during the next few years, however, is the skillful incorporation of present knowledge into classroom practice."

The following important principles of method appear to have been definitely established through research or authoritative opinion:[1]

1. A direct systematic program in spelling is superior to an incidental or opportunistic program. This means that the regular use of a list of words, scientifically determined, produces better results than does mere dependence upon incidental spelling in connection with other work. Since we are committed in Tulsa to the use of a spelling list, this principle is of little concern in our efforts to improve instruction.

2. Much learning of spelling does actually take place in an incidental manner. Various studies show that practically all pupils can spell a large percentage of the words before they are formally presented in spelling lessons. All teachers are familiar with this fact through the use of pre-tests. This incidental learning takes place in the various situations in which pupils meet the words both in reading and in writing. The implication for teaching spelling is that we should utilize the factors which produce incidental learning. While all the factors are not known, the following suggestions should be helpful:

   a. A definite emphasis should be placed on vocabulary development by calling attention in all classes to new words: to their meanings, their use, and their spelling. Words commonly used and frequently misspelled should be added to the weekly list.

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[1]The teacher is referred to the following secondary sources which review the scientific investigations on which the principles listed in this bulletin have been established:

T. G. Foran, The Psychology and Teaching of Spelling, Washington, D. C.: The Catholic Education Press, 1934.

Paul McKee, Language in the Elementary School, pp. 366-429. New York: Houghton Mifflin Co., 1939.

b. Emphasis should be placed on developing self-direction in learning to spell a new word the pupil meets: through an effective method of studying words which emphasizes visual perception; through use of the dictionary; through use of generalizations; and through the relating of the sounds of words to their spelling. See bulletin number 1, Improvement of Instruction in Spelling.

c. Emphasis should be placed on the development of an attitude of caring about correct spelling in all written work. Pupils should not guess at the spelling of words but look them up or ask for the spelling; moreover, they should form the habit of checking their spelling after writing.

3. The test-study method is superior to the study-test method in the middle grades. According to the survey made last Spring, Tulsa teachers are not fully in accord with this principle; nevertheless, scientific research is in complete agreement as to the superiority of the test-study method. This means that a pre-test should be given to determine those words the pupil has already learned through incidental means. The pupil may then focus his attention on those he needs to study. Economy of time and motivation, through a sense of need, are both thus provided.

4. A pronunciation exercise should precede the pre-test. The ability to pronounce a word correctly is an important factor in learning to spell it. The teacher should write the word on the blackboard, to direct the pupils' attention to it and pronounce it carefully by syllables. The pupils should then pronounce the word carefully by syllables while looking at the word. Teachers should check their own pronunciation of words before pronouncing them for pupils. Pronouncing words slowly by syllables often shows up glaring mispronunciation of certain vowels. Example: "pu puls" for "pu pils", " a magine" for "i magine", "state munt" for "state ment", etc.

5. There is doubt about the advisability of writing words by syllables in presenting them on the board. If this practice is followed, the word should then be written as a whole to avoid a distortion of the appearance of the word.

6. Studies show conclusively that words for which the pupils have the meaning are more readily learned and retained longer. The implication is that the meanings of those words unknown to pupils should be developed as they are presented - perhaps during the pronunciation exercise.

7. In presenting words an appeal should be made to as many senses as possible. Studies in types of imagery have shown elementary school children to be strongly visual. Emphasis, therefore, should be placed on precise visual perception of the letters of the word. Other forms of imagery, however, whould not be neglected. Children should see the word, hear the word, say the word, spell the word, and write the word. Emphasis on visual imagery is

provided when the teacher writes the word on the board and directs the pupils' attention to it. Auditory imagery is provided as the pupils hear the pronunciation of the word. Speech imagery is provided by the pupils' pronunciation of the word. In the later study of words, further emphasis is placed on speech imagery as the pupils spell the words, and on hand-motor imagery as they write the words.

8. Research evidence indicates that better results are produced when words are presented in column form rather than in sentence form. The probability is that visual perception is more precise when full attention is directed to the single word. This principle refers to the written presentation of the word which the teacher makes on the blackboard. Certainly, the pupils should know the meaning and the teacher or pupils should give a sentence using the word.

9. The evidence on the teaching of rules in incomplete. Present practice tends to place little emphasis on the use of rules. Only the most simple rules which have wide application and few exceptions should be taught. See bulletin number 1, Improvement of Instruction in Spelling on the use of certain generalizations.

10. There is agreement among authorities that pupils must be taught an effective method of study. One study indicated "that pupils who are deficient in spelling have no fixed habits in perceiving words but allow their gaze to wander backwards and forwards over the word as a whole instead of attacking it letter by letter." An effective method of study provides that the pupil pronounce the word; get a visual impression of the word; recall the image and compare with the correct form in the book; spell the word softly and check; and write the word and check. See the steps in learning how to spell a new word in "Developing Self-direction in Learning to Spell a New Word" in the bulletin number 1, Improvement of Instruction in Spelling.

11. Authorities agree that means should be provided for the pupil to make use in writing of the words he learns to spell and that the teacher should insist upon correct spelling in all written work.

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TULSA PUBLIC SCHOOLS

IMPROVEMENT OF INSTRUCTION IN SPELLING

Bulletin No. 3

Methods of Presenting and of Learning Words[1]

Educational psychologists have long agreed that as many senses as possible should be appealed to when material is presented for learning. This principle is particularly applicable to spelling. A brief summary of the research on this point follows:

Lay, quoted by Breed (1), found that a method of presenting non-sense words or syllables which combined hearing the words, seeing the words, saying the words, saying the letters, and writing the words was more effective than any single method of presenting words.

Baird (3), reported by Pryor and Pittman, used words rather than non-sense syllables and arrived at the same conclusions. The percentages of misspelled words according to different methods of presentation are given in the following table.

PERCENTAGE OF WORDS MISSPELLED ACCORDING TO METHOD OF PRESENTATION

Method of Presenting Words	Percentage Misspelled
Pronounced only	6.43
Heard and spelled aloud by pupil	4.66
Seen only	2.60
Seen and spelled aloud by pupil	2.27
Seen, used, spelled and written by pupil	1.00

Other studies by Gilbert (2), Winch (4) and Zyve (5), have emphasized the value of visual presentation.

The conclusion that may be drawn from these studies is that instruction in spelling should utilize as many forms of presentation as possible but special emphasis should be placed on visual perception. The word should be seen by the pupils as the teacher writes it on the blackboard, and directs the pupil's attention to it; it should be heard as it is pronounced by the teacher; it should be pronounced by the pupil. In studying the word, the pupils should see the word; pronounce the word; spell the word; write the word.

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[1]This bulletin is an adaptation of a discussion by Foran. See T. G. Foran, The Psychology and Teaching of Spelling, Washington, D. C.: The Catholic Education Press, 1934.

Improvement in spelling will depend to a large degree on the pupil's fixation of the habit of systematically utilizing the various senses in studying a new word. It is not likely that this will occur if pupils are not directed and guided in their study. The admonition of "Study your spelling after you have finished your arithmetic" will not procure effective results with many pupils unless they have previously learned self-direction in studying words under teacher guidance.

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4. Winch, W. H. "Further Experimental Researches of Learning to Spell." Journal of Educational Psychology, V (1914), 449-460.

5. Zyve, C. T. An Experimental Study of Spelling Methods. Teachers College Contributions to Education, No. 466. New York: Teachers College, Columbia University, 1931.

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TULSA PUBLIC SCHOOLS

IMPROVEMENT OF INSTRUCTION IN SPELLING

Bulletin No. 4

Presentation of Words

1. Does the pupil get the correct visual impression of the word by having his attention directed to it?

2. Does the pupil get the correct sound of the word (by syllables) by hearing the teacher pronounce the word and by pronouncing it himself?

3. Does the pupil form the correct association of the sound and the visual impression of the word?
   a. Is the word spelled as it sounds?
   b. Can the word be associated with a known word which has a similar sound?
   c. Is a clear mental image formed of the troublesome parts?

4. Does the pupil know the meaning of the word?

Testing

1. Is the purpose of the pre-test understood?

2. Are the words about which the pupil is hesitant checked for further study?

3. Does the pupil proof read his words on Friday for accuracy of spelling as soon as he has written them?

Studying the Words

1. Is a definite period provided for study for those pupils who missed words on the pre-test?

2. Is the pupil's attention focused for study on those words which he missed on the pre-test?

3. Is specific guidance given in the development of a technique for studying words?

4. Are the various types of imagery utilized in the study technique; that is, are the words seen, pronounced, spelled, and written with opportunity given for recall and checking?

Application in Writing

1. Are varied opportunities provided for the use of words in writing?

2. Is emphasis placed on correct spelling in all written work?

3. Are pupils encouraged to form the habit of not guessing at the spelling of words?

4. Are pupils encouraged to form the habit of proof reading their written work for misspellings?

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TULSA PUBLIC SCHOOLS

IMPROVEMENT OF INSTRUCTION IN SPELLING

Bulletin No. 5

Errors in Spelling

Book and Harter,[1] in a study of spelling errors, involving a total of 18,840 mistakes, classified 49.46 per cent of the mistakes as due to pupils' lack of knowledge of the correct spelling. The remaining 50.53 per cent were classified as mistakes of expression. In the latter case, the pupils really know how to spell the words but made mistakes in the writing. While the authors' interpretation of their data is open to some question, the importance of their classification deserves consideration.

Foran[2] makes the following statement:

> A tremendous improvement in spelling could be produced through greater emphasis on care and on reviewing (proof reading) the writing of words ..... Perhaps many of the difficulties attributed to spelling are produced by such interference as poorly developed writing habits contribute. The tendency to minimize the importance of handwriting may be creating difficulties in other subjects.....
>
> The remedy lies in better control of the writing process, and this can be achieved only through practice which renders the writing of the word easy enough to permit the even distribution of attention over all parts of the word. Mistakes can also be prevented through cultivating the habit of reviewing what has been written.

The implications for reducing the large percentage of errors due to carelessness or to the competition of other factors in the process of writing are three-fold:

1. Greater emphasis on the improvement of handwriting itself, so that it will not interefere with the thinking process.

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1. William F. Book and Richard S. Harter, "Mistakes Which Pupils make in Spelling," Journal of Educational Research, XIX (February 1929), 106-118.

2. T. G. Foran, The Psychology and Teaching of Spelling. pp. 102-103. Washington, D. C.: The Catholic Education Press, 1934.

2. Provision for motivation of a direct nature which makes correct spelling satisfying and errors unsatisfying. An attitude of intolerance toward carelessness in writing should be developed. Incentives should be used that place a premium on accuracy and penalize errors and carelessness.

3. The development of a habit of reviewing or proof reading all written work, including the writing of spelling words in the regular lesson. Checking of arithmetic problems is an accepted practice; likewise checking of spelling should become a habitual practice.

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TULSA PUBLIC SCHOOLS

IMPROVEMENT OF INSTRUCTION IN SPELLING

Bulletin No. 6

The following steps in the presentation of words were illustrated in the demonstration spelling lessons on January 16, 17, 18, and 22. These steps are presented here as they were formulated by the teachers as a guide for their use in these demonstrations.

I. Pronunciation exercise

A. Pronounce the word. "The next word is _____".
(The word should be pronounced as a whole as the pupils hear it in conversation.)

B. Write the word on the blackboard, pronouncing the word again by syllables during the writing.
(The pupils should watch the blackboard rather than their lists. The word should be written as a whole though the syllables are stressed in the pronunciation. The teacher should have previously familiarized herself with the exact pronunciation and the syllabication of the word in order that her pronunciation by syllables may follow exactly her progress in writing. Previous preparation will also correct many inexact and slurring vowel sounds which become noticable when syllables are stressed. Example: "imagine" in conversation is often pronounced "amagine"; "statement" is often "statemunt".)

C. Have the pupils pronounce the word, stressing it by syllables.

II. Development of meanings

A. Through teacher judgment or through questioning, determine whether the meaning of a word should be developed or enriched.

B. If the meaning is not clear, explain the word and use it in a sentence. Have various pupils use the word in sentences.

III. Peculiarities in the spelling of the word.

A. Is the word spelled as it is pronounced?

B. What part of the word is not spelled as it sounds?

C. Point out such peculiarities as the following:

1. Distinction between the word and a homonym that may be already known. (write, peace, too, you're)

2. Double letters in words (parallel, planning)

3. Silent letters (coast, know)

4. Base or root words (friendly, joyful)

5. Compound words (birthday, baseball)

6. Two words often misspelled as one word (all right, basket ball)

7. Hyphenated words (twenty-five)

8. Use of apostrophe in contractions and possessives (we'll, Mary's)

9. How suffixes are added (dropped, dancing)

10. Words misspelled frequently because they are mispronounced (height, not heighth; separate, not seperate; government, not goverment)

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TULSA PUBLIC SCHOOLS

IMPROVEMENT OF INSTRUCTION IN SPELLING

Bulletin No. 7

Bulletin Number 6 discussed errors in spelling due to carelessness or to lack of control of the writing process. This bulletin deals with errors due to ignorance of the correct spelling.

Misspellings Phonetically Justified

Booker and Harter[1] found that twenty-six per cent of the mistakes in spelling were phonetically justified. Pupils not knowing how to spell the words endeavored to spell them according to their sound. Mendenhall[2] classified seventy-five per cent of all misspellings as reasonably phonetic. (The large difference between the results of Book and Harter and of Mendenhall was largely due to their methods of classification. Book and Harter did not include in the phonetic misspellings those words misspelled through carelessness even though they were phonetically misspelled.) Masters[3] found that over sixty-four per cent of the misspellings at the eighth grade level were phonetic. Carroll[4] observed that the mistakes of bright children were very often phonetic spellings while the mistakes of dull children were random spellings which neither looked like nor sounded like the words attempted. The writer of this bulletin in an unpublished study found more than fifty per cent of the misspellings of the fifth grade pupils were phonetic; also that the mistakes of the better spellers were more frequently phonetic than those of the poor spellers, regardless of the brightness of the pupils.

The following conclusions may be drawn from these studies:

1. Phonetic ability certainly has a positive relationship to good spelling. This conclusion is justified by the partially phonetic nature of the English language, and by the fact that poor spellers show less phonetic ability and attempt fewer phonetic renditions when they do not know the words, than do good spellers. Therefore, some emphasis on

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[1]William F. Book and Richard S. Harter, "Mistakes Which Pupils Make in Spelling," Journal of Educational Research, XIX (February 1929), 106-118.

[2]James E. Mendenhall, "The Characteristics of Spelling Errors," Journal of Educational Psychology, XXI (1930), 648-656

[3]Harry V. Masters, "A Study of Spelling Errors," University of Iowa, Studies in Education, 4, Number 4, (September 1927), 113-116.

[4]Herbert A. Carroll, "Generalization of Bright and Dull Children," Journal of Educational Psychology, XXI (1930), 489-499

phonetic analysis should be continued in the middle grades. The habit of having pupils relate the sound of the word or its parts to the spelling should be emphasized. Pupils should be taught to ask themselves: "What is the right sound of the word?" "Is the word spelled as it is sounded?" "In what part of the word is the difficulty?"

2. The second conclusion is that dependence on phonetic ability alone in spelling will not produce good spellers. This conclusion is based on the fact as shown by the previous studies that a large percentage of all misspellings are phonetically justified. Pupils with good phonetic ability will misspell many words unless they have the correct image of those words. Correct presentation of the words and an effective method of study of the words which emphasize all types of imagery must be cultivated. The words must be seen, heard, pronounced, spelled, and written. Strong emphasis should be placed particularly on accurate visual perception of the word.

Where Errors in Spelling Occur Most Frequently

Mendenhall found that one form of misspelling accounts for approximately one third of the mistakes but a great variety of misspellings account for the remainder of the mistakes. For example, the word "trouble" was misspelled twenty-nine times. Eleven of the errors were of one form; however, there were fifteen different ways of misspelling "trouble". Foran points out that the stressing of one particular syllable or the marking of some hard spot is of limited value; however, since there is considerable concentration of errors one might expect some improvement in spelling by giving special attention to the cause of the most frequent misspelling. Misspellings are most common in the middle of words or slightly to the right. In words of three syllables, there are twice as many misspellings in the third syllable as in the first but more in the second syllable than in either.

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TULSA PUBLIC SCHOOLS
Primary Arithmetic Test

FORM A

Scores

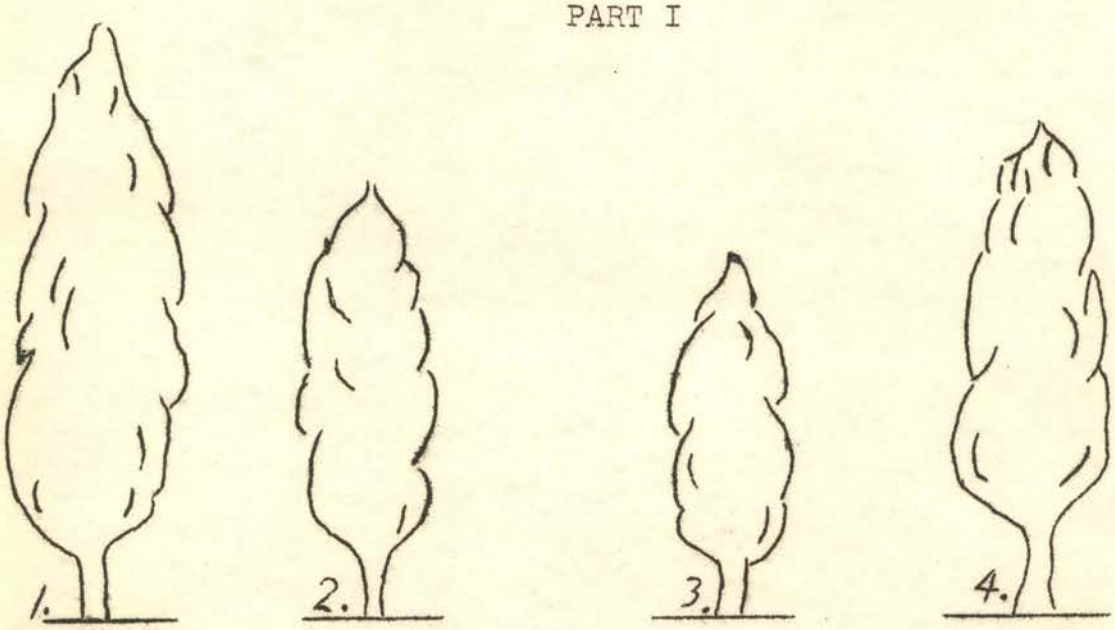
Name_____ Concepts_____

School_____ Computation_____

Age_____ Birthdate_____ Reasoning_____

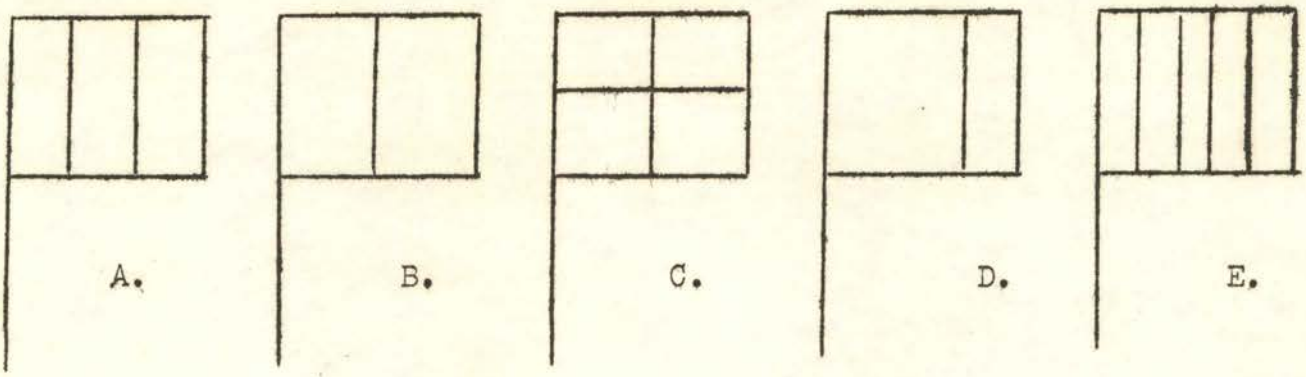
Date of Test_____ Total_____

PART I



1. Is the third tree as tall as the first tree?.....
2. Is the fourth tree as short as the second tree?... unfair question no shorter
3. Is the second tree shorter than the first tree?...
4. Which is the smallest number: 647, 621, or 617?..
5. How many cents are there in 3 dimes?.....
6. Does a bird have fewer legs than a dog?.....
7. Which number is in the upper right corner? 4 5 8 6 7
8. How many months are there in a year?.....
9. Make the sign for dollars.....
10. Which will buy more: 3 dimes or 1 quarter?.....

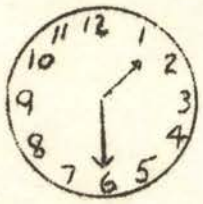
 GO ON TO THE NEXT PAGE.



11. Write the letter of the flag which shows fifths..._____

12. Write the letter of the fourth flag from the left._____

13. Write the letter of the flag which shows halves..._____

14. What time does this clock show?  _____

15. Which is the largest number: 168, 219 or 180?....._____

16. Which is less money: 2 dimes or 3 nickles?....._____

17. Which is the smaller: 3821 or 1099?....._____

18. Write four hundred seven in figures....._____

19. How many pints are there in 2 quarts?....._____

20. Write the number that comes just before 200....._____

21. Which is shortest: 2 feet, 20 inches, or 1 yard?._____

22. Write two dollars and ninety-eight cents in figures_____

23. Write the minus sign....._____

24. How many feet are there in a yard?....._____

25. Write the Roman number for 18....._____

STOP
DO NOT TURN THE PAGE.

PART II

Add these numbers:

(1)	(2)	(3)	(4)	(5)	(6)	(7)
				4	6	
	2		21	6	9	62
9	9	43	6	5	2	170
6	7	5	42	2	3	194

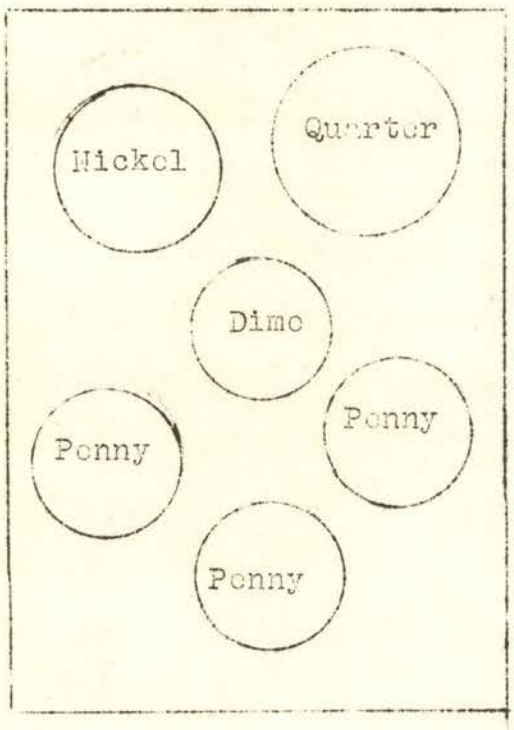
Subtract these numbers:

(8)	(9)	(10)	(11)	(12)	(13)	(14)
9	14	7	10	16	15	105
3	6	5	5	9	4	13

(15) 4 boxes from 9 boxes are_____boxes.

(16) 8 birds and 7 brids are_____birds.

(17) Write under the box how much money there is in the box.



_____cents.

Work these examples:

(18) $7\overline{)21}$

(19) $6\overline{)18}$

(20) $3\overline{)23}$

(21) $5\overline{)45}$

(22) 3×7

(23) 8×4

(24) 40×3

(25) 131×6

STOP
DO NOT TURN THE PAGE.

PART III

1. One day Bobby saw 3 black rabbits, 2 brown ones, and 5 white ones. How many rabbits did he see that day?_____

2. Ned bought 3 red balls and 2 blue ones. How many more red balls than blue ones did Ned buy?.....

3. Joe had a pencil box with 2 red pencils, 4 blue pencils, and 5 yellow pencils. How many pencils in all did Joe have?.....

4. Ann had 3 tables and 6 chairs in her new doll house. How many fewer tables than chairs did she have in it?_____

5. On the playground 4 boys are playing ball, 7 are flying kites, and 3 are playing marbles. How many boys are there?.....

6. Mrs. Brown went away from the city for 5 days. Mrs. Smith was gone for 8 days. How many more days was Mrs. Smith gone than Mrs. Brown?.....

7. Will 2 nickels buy more than 7 pennies?.....

8. Betty spent 15 cents for a ride on a train, 5 cents for a balloon, and 10 cents for ice cream. How much did she spend?.....

9. A cage with six squirrels was beside a cage with nine foxes. How many animals were in both cages?.....

10. Harry had 9 marbles. He gave 3 to John and 2 to Ned. How many marbles did Harry have left?.....

11. Jack has 20 cents. How many apples can he buy if each apple costs 5 cents?.....

12. Twelve chickens are how many more than 7 chickens?..

13. Sally bought 6 pictures at the store. Each one cost 10 cents. How much money did she spend?.....

14. Mary and Sue each had 32 paper dolls. How many paper dolls do both girls have together?.....

15. There are 38 children in Bobby's class. One day 7 were absent. How many came to school that day?.....

16. In one book there were 16 stories about children and 8 other stories about toys. There were how many more stories about children than about toys?.....

GO ON TO THE NEXT PAGE.

17. Jack and Betty and Tom were playing the bean-bag game. Here are their scores:

Jack	Betty	Tom
62	22	31
4	71	40
40	25	53

Who won the game?....._____

18. Bill, Bob, and Joe made a swing. It was strong enough to hold only 200 lb. Bill weighed 72 lb.; Bob weighed 80 lb., and Joe weighed 75 lb. Was the swing strong enough to hold the three boys at one time?....._____

19. Mother gave Jane 2 dolls and 4 dresses for each of the dolls. How many doll dresses did Mother give Jane?....._____

20. Grandfather got 96 ears of corn from his garden. He fed 52 of them to his pigs. How many ears of corn did he have left?....._____

21. There were 18 children in the class. Six could sit at a table. How many tables were needed?....._____

22. Jim had 9 marbles in 3 little bags. He had the same number in each bag. How many marbles were in each bag?....._____

23. Betty had 12 doll dresses. She had 2 times as many as Sue. How many doll dresses did Sue have?....._____

24. Tom weighs 40 pounds, Bill weighs 112 pounds, and Jack weighs 67 pounds. How much do all three weigh?_____

25. Jack is saving his money for a trip to Grandmother's. His ticket costs $1.68. He has saved 72 cents. He needs how much more money for his ticket?....._____

STOP
CLOSE YOUR BOOKLET

TULSA PUBLIC SCHOOLS
Primary Arithmetic Test

FORM B

Scores

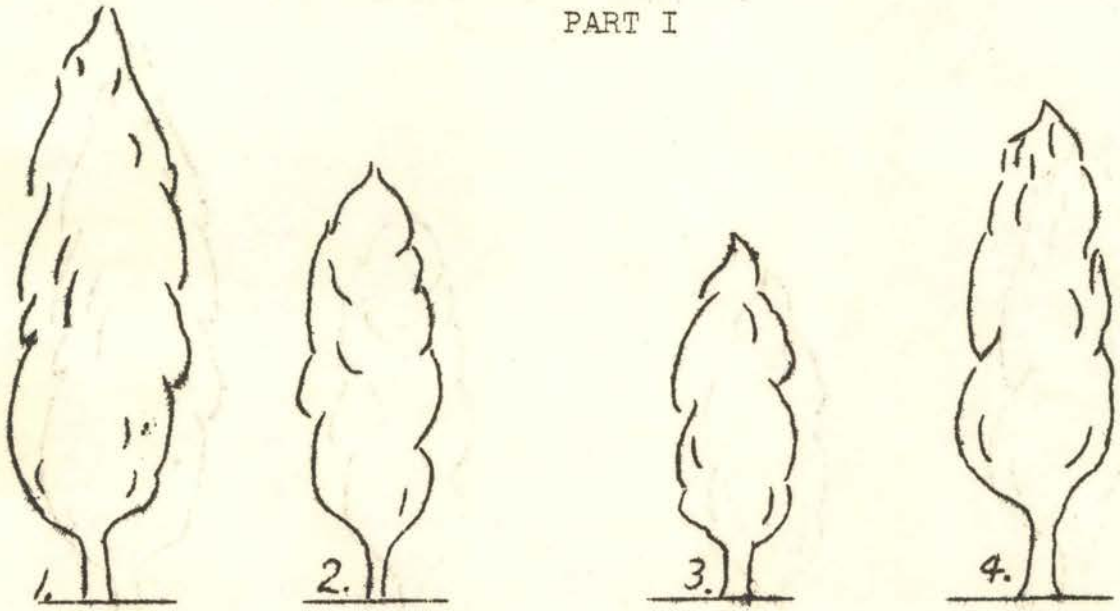
Name_____ Concepts_____

School_____ Computation_____

Age_____ Birthdate_____ Reasoning_____

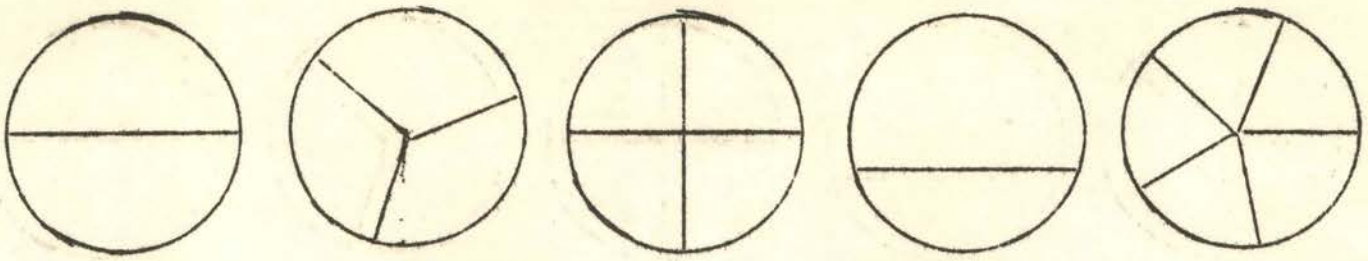
Date of Test_____ Total_____

PART I



1. Is the third tree as tall as the second tree?.....
2. Is the third tree shorter than the first tree?.....
3. Is the fourth tree taller than the third tree?.....
4. Which will buy more: 4 dimes or 2 quarters?.....
5. Does a dog have fewer legs than a bird?.....
6. Which is the smallest number: 714, 721, or 712?...
7. Which is the largest number: 590, 878, or 929?....
8. Which number is in the upper left corner? | 4 5 / 8 / 6 7 |
9. Which is less money: 3 dimes or 4 nickels?.....
10. How many things are there in a pair?.....

GO ON TO THE NEXT PAGE.

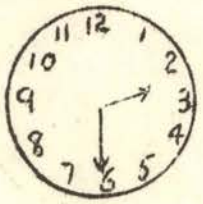


A. B. C. D. E.

11. Write the letter of the pie which shows fifths..._____

12. Write the letter of the pie which shows halves..._____

13. Write the letter of the fourth pie from the left._____

14. What time does this clock show?  _____

15. Which is the larger: 6017 or 4129?....._____

16. Write five hundred six in figures....._____

17. Which is shortest: 3 feet, 30 inches, or 1 yard?_____

18. Write the number that comes just before 500....._____

19. How many cents are there in 4 nickels?....._____

20. Write two dollars and eighty-nine cents in figures_____

21. Write the equals sign....._____

22. How many pints are there in a gallon?....._____

23. How many inches are there in a yard?....._____

24. Make the sign for divide....._____

25. Write the Roman number for 17....._____

STOP
DO NOT TURN THE PAGE.

PART II

Add these numbers:

(1)	(2)	(3)	(4)	(5)	(6)	(7)
6	3	34	31	6	3	194
9	6	5	6	4	2	62
	8		52	2	9	170
				5	6	

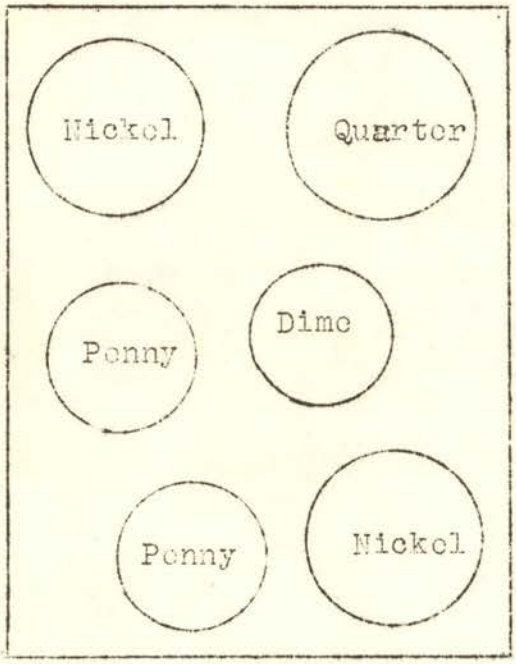
Subtract these numbers:

(8)	(9)	(10)	(11)	(12)	(13)	(14)
8	14	8	12	16	17	105
3	7	6	6	4	6	14

(15) 5 boxes from 9 boxes are_____boxes.

(16) 7 birds and 8 birds are_____birds.

(17) Write under the box how much money there is in the box.



_____cents.

Work these examples:

(18) $9\overline{)18}$

(19) $3\overline{)27}$

(20) $3\overline{)26}$

(21) $4\overline{)32}$

(22) 2×9

(23) 6×6

(24) 20×6

(25) 121×7

STOP
DO NOT TURN THE PAGE.

PART III

1. Joe had a pencil box with 2 red pencils, 3 blue pencils, and 1 yellow pencil. How many pencils in all did Joe have?....._____

2. There are 36 children in Bobby's class. One day 6 were absent. How many came to school that day?...._____

3. On the playground 3 boys are playing ball, 2 are flying kites, and 6 are playing marbles. How many boys are there?....._____

4. One day Bobby saw 4 black rabbits, 2 brown ones, and 5 white ones. How many rabbits did he see that day?....._____

5. Betty spent 10 cents for a ride on a train, 10 cents for a balloon, and 5 cents for ice cream. How much did she spend?....._____

6. Mrs. Brown went away from the city for 5 days. Mrs. Smith was gone for 7 days. How many more days was Mrs. Smith gone than Mrs. Brown?....._____

7. Will 2 nickels buy more than 8 pennies?....._____

8. Ann had 3 tables and 7 chairs in her new doll house. How many fewer tables than chairs did she have in it?_____

9. A cage with seven squirrels was beside a cage with nine foxes. How many animals were in both cages?....._____

10. Jack has 15 cents. How many apples can he buy if each apple costs 5 cents?....._____

11. Harry had 9 marbles. He gave 4 to John and 2 to Ned. How many marbles did Harry have left?....._____

12. Twelve chickens are how many more than 8 chickens?._____

13. Mary and Sue each has 33 paper dolls. How many paper dolls do both girls have together?....._____

14. Sally bought 7 pictures at the store. Each one cost 10 cents. How much money did she spend?....._____

15. Jack, Betty, and Tom were playing the bean-bag game. Here are their scores:

Jack	Betty	Tom
73	32	32
4	71	40
40	25	53

Who won the game?....._____

GO ON TO THE NEXT PAGE.

16. There are 38 children in Bobby's class. One day 6 were absent. How many came to school that day?....._____

17. In one book there were 16 stories about children and 6 other stories about toys. How many more stories were there about children than about toys?....._____

18. Dick, Joe, and Bobby made a swing. It was strong enough to hold only 200 lb. Dick weighed 71 lb.; Joe weighed 87 lb., and Bobby weighed 75 lb. Was the swing strong enough to hold the three boys at the same time?....._____

19. Mother gave Jane 3 dolls and 2 dresses for each of the dolls. How many doll dresses did Mother give Jane?....._____

20. There were 16 children in the library. Only 4 could sit at a table. How many tables were needed?....._____

21. Grandfather got 97 ears of corn from his garden. He fed 52 of them to his pigs. How many ears of corn did he have left?....._____

22. Jim had 12 marbles in 3 little bags. He had the same number in each bag. How many marbles were in each bag?....._____

23. Betty had 14 doll dresses. She had 2 times as many as Sue. How many doll dresses did Sue have?....._____

24. Jack weighs 42 pounds; Harry weighs 110 pounds, and Tom weighs 67 pounds. How much do all three weigh?_____

25. Jack is saving his money for a trip to Grandmother's. His ticket costs $1.58. He has saved 72 cents. He needs how much more money for his ticket?....._____

STOP
CLOSE YOUR BOOKLET

TULSA PUBLIC SCHOOLS
Primary Arithmetic Test

FORM C

Scores

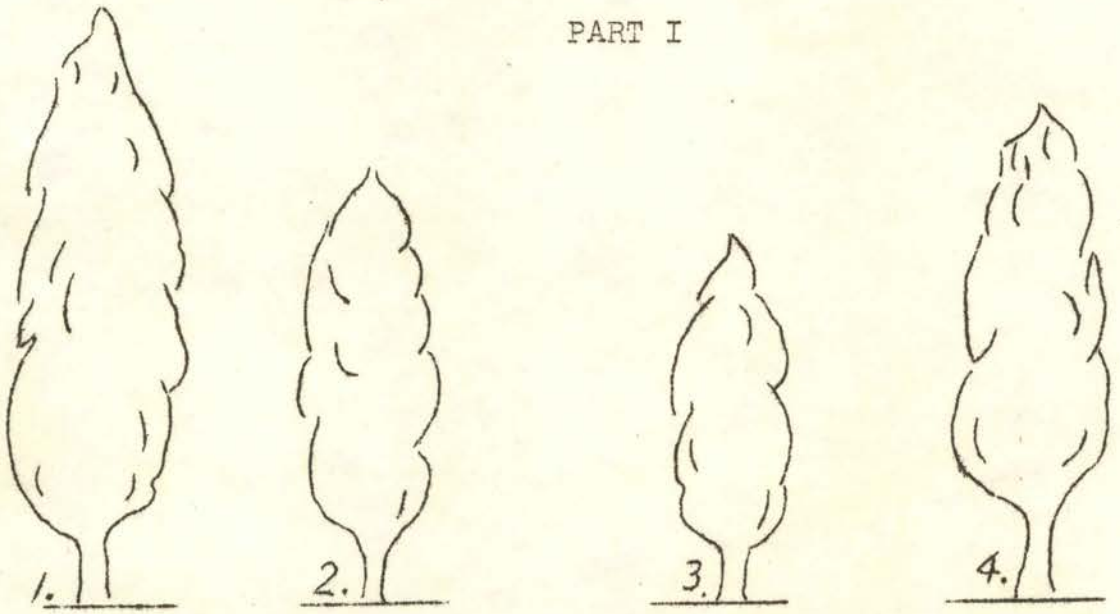
Name_____ Concepts_____

School_____ Computation_____

Age_____ Birthdate_____ Reasoning_____

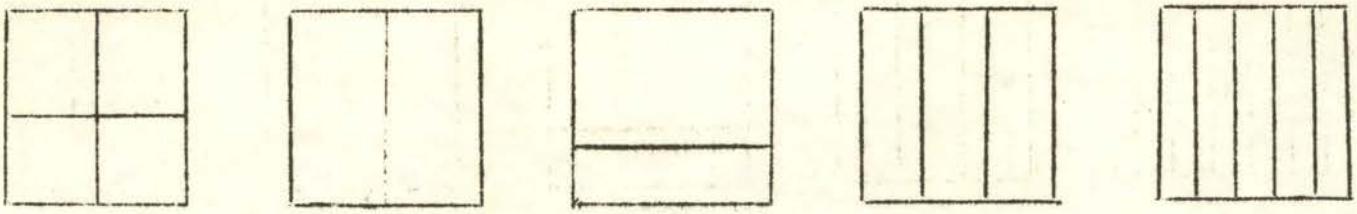
Date of Test_____ Total_____

PART I



1. Is the fourth tree as short as the third tree?....._____
2. Is the second tree shorter than the third tree?...._____
3. Is the fourth tree taller than the second tree?...._____
4. Which will buy more: 2 dimes or 1 quarter?....._____
5. Does a bird have fewer eyes than a dog?....._____
6. Which number is in the lower right corner? | 4 5 / 8 / 6 7 | _____
7. Which is the largest number: 438, 470, 549?....._____
8. Which is the larger: 7030 or 3079?....._____
9. How many minutes are there in one hour?....._____
10. Which is the smallest number: 108, 166, or 192?..._____

GO ON TO THE NEXT PAGE.



A. B. C. D. E.

11. Write the letter of the square which shows fifths._____

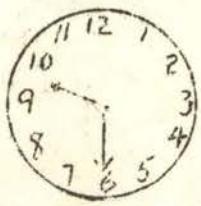
12. Write the letter of the square which shows halves._____

13. Write the letter of the fourth square from the left._____

14. Which is less money: 3 dimes or 5 nickels?....._____

15. Write three hundred one in figures....._____

16. How many cents are there in 2 quarters?....._____

17. What time does this clock show?  _____

18. Write the plus sign....._____

19. How many things are there in 2 dozen?....._____

20. Which is shortest: 2 feet, 30 inches or 1 yard?.._____

21. Write the number that comes just before 300....._____

22. Write two dollars and sixty-seven cents in figures_____

23. How many pints are there in 3 quarts?....._____

24. Write the Roman number for 16....._____

25. Make the sign for multiply....._____

STOP
DO NOT TURN THE PAGE.

PART II

Add these numbers:

(1)	(2)	(3)	(4)	(5)	(6)	(7)
7 8	45 3	5 4 9	2 5 6 4	9 6 3 2	42 5 32	170 196 62

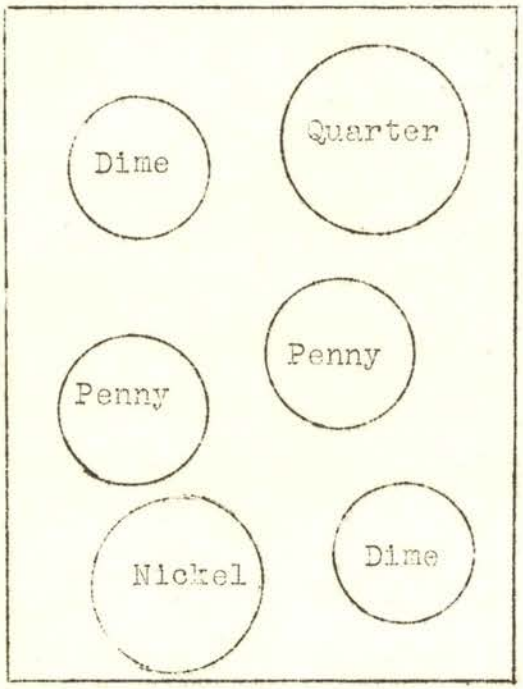
Subtract these numbers:

(8)	(9)	(10)	(11)	(12)	(13)	(14)
9 4	8 5	10 6	16 5	15 7	17 6	105 12

(15) 5 boxes from 8 boxes are_____boxes.

(16) 9 birds and 6 birds are_____birds.

(17) Write under the box how much money there is in the box.



_____cents.

Work these examples:

(18) $8\overline{)24}$

(19) $3\overline{)21}$

(20) $3\overline{)25}$

(21) $5\overline{)40}$

(22)

$$\begin{array}{r} 2 \\ \times 8 \\ \hline \end{array}$$

(23)

$$\begin{array}{r} 4 \\ \times 6 \\ \hline \end{array}$$

(24)

$$\begin{array}{r} 30 \\ \times 4 \\ \hline \end{array}$$

(25)

$$\begin{array}{r} 142 \\ \times\ 4 \\ \hline \end{array}$$

STOP
DO NOT TURN THE PAGE.

PART III

1. On the play ground 4 boys are playing ball, 2 are flying kites, and 2 are playing marbles. How many boys are there?....._____

2. Ned bought 5 red balls and 4 blue ones. How many more red balls than blue ones did Ned buy?....._____

3. Joe had a pencil box with 2 red pencils, 4 blue pencils and 6 yellow pencils. How many pencils in all did Joe have?....._____

4. Mrs. Brown went away from the city for 6 days. Mrs. Smith was gone for 8 days. How many more days was Mrs. Smith gone than Mrs. Brown?....._____

5. Betty spent 10 cents for a ride on a train, 5 cents for a balloon, and 5 cents for ice cream. How much did she spend?....._____

6. One day Bobby saw 3 black rabbits, 4 brown ones, and 5 white ones. How many rabbits did he see that day?_____

7. Will 2 nickels buy more than 9 pennies?....._____

8. A cage with six squirrels was beside a cage with seven foxes. How many animals were in both cages?_____

9. Ann had 4 tables and 7 chairs in her new doll house. How many fewer tables than chairs did she have in it?_____

10. Harry had 9 marbles. He gave 3 to John and 4 to Ned. How many marbles did Harry have left?....._____

11. Jack has 25 cents. How many apples can he buy if each apple costs 5 cents?....._____

12. In one book there were 12 stories about children and 8 other stories about toys. There were how many more stories about children than about toys?....._____

13. Twelve chickens are how many more than 5 chickens?_____

14. There are 39 children in Bobby's class. One day 7 were absent. How many came to school that day?..._____

15. Sally bought 8 pictures at the store. Each one cost 10 cents. How much money did she spend?....._____

GO ON TO THE NEXT PAGE.

16. Mary and Sue each has 34 paper dolls. How many paper dolls do both girls have together?....._____

17. There were 15 children to sit at the reading tables in the library. Five could sit at a table. How many tables were needed?....._____

18. Tom, Jack, and Jim made a swing. It was strong enough to hold only 200 lb. Tom weighed 72 lb.; Jack weighed 84 lb., and Jim weighed 74 lb. Was the swing strong enough to hold the three boys at the same time?....._____

19. Jack and Betty and Tom were playing the bean-bag game. Here are their scores:

Jack	Betty	Tom
63	22	31
4	70	40
40	25	54

Who won the game?....._____

20. Mother gave Jane 2 dolls and 3 dresses for each of the dolls. How many doll dresses did Mother give Jane?....._____

21. Grandfather got 97 ears of corn from his garden. He fed 53 of them to his pigs. How many ears of corn did he have left?....._____

22. Jim had 15 marbles in 3 little bags. He had the same number in each bag. How many marbles were in each bag?....._____

23. Betty had 10 doll dresses. She had 2 times as many as Sue. How many doll dresses did Sue have?....._____

24. Bill weighs 41 pounds, Bob weighs 120 pounds, and Jim weighs 67 pounds. How much do all three weigh?_____

25. Jack is saving his money for a trip to Grandmother's. His ticket costs $1.68. He has saved 74 cents. He needs how much more money for his ticket?....._____

STOP
CLOSE YOUR BOOKLET

January 8, 1946

TULSA PRIMARY ARITHMETIC TESTS

Forms of the Tulsa Primary Arithmetic Tests are being sent out to each building. These are scheduled for January 10-16. These tests should be given to all pupils classified as third grade. The number of tests sent to each building is the number indicated in the last special membership report plus three to six extra booklets.

The purpose of administering the tests at this time is to provide material for a final mid-year revision. Standards for these tests have not been established and they are being given on a city-wide basis in order that norms may be provided.

No help should be given as preparation for the test and no help on the examples should be given during the test. Any practice or familiarity with the material spoils the purpose of the tests. Please remember that some material is included that will not be taught until fourth grade, but this is necessary to provide a higher ceiling for those pupils whose ability goes beyond the third grade arithmetic curriculum.

In order to equate the three forms, tests are packaged so that each package is stacked with Form A on top, then Form B, and then Form C--in the manner A B C A B C A B C, etc., throughout the package. Tests are to be distributed to pupils as stacked, in order to eliminate any selection. For example, pupil 1 takes the test on the top of the package which is Form A, pupil 2 the next, which is Form B, and pupil 3 the next which is Form C. Thus, approximately one third of the pupils of every class will be working on each form. Instructions are identical for all three forms.

A sheet of instructions for administering the test is attached. Further instructions are being given at Principals' Meeting, January 9.

Educational Research Council
Amanda Herring
L. W. Levengood
Earl Denney
Frank Pauly
Jess S. Hudson, Chairman

Approved:

C. C. Griggs, Assistant
Superintendent in charge
of Elementary Education

January 8, 1946

TULSA PRIMARY ARITHMETIC TESTS
Third Grade
Directions for Administering

There are three forms of this arithmetic test in the package. Beginning with Form A they are stacked A B C A B C A B C, etc., throughout the package. Work from the top of the stack and distribute the tests as stacked. Thus, pupil 1 takes Form A, pupil 2 Form B, and pupil 3 Form C, etc.

Before the test is given, be sure that each child has his name on the face sheet. Other information requested may be filled in by the child or by the teacher, but all birthdates should be checked with the cumulative records.

See that children put the answers in the spaces provided. It will be necessary for the person giving the test to walk around the room to see that this is being done throughout the testing period.

At the beginning of each of the three parts of the test, ask the children to read the directions at the bottom of the page and do what it tells them to do. Some pages say "Stop. Do not turn the page", other pages say "Go on to the next page."

A child should not be permitted to waste time on any item that is too difficult for him, but should be encouraged to go on with the rest of the test, doing the items that he can do. Give no help on the items.

The time limits for the parts are as follows:

Part I	18 minutes
Part II	15 minutes
Part III	30 minutes

The time allotments are quite liberal and should not be exceeded in any case. Many groups will finish in considerably less time. If your group finishes in less time, please record in the blanks on the attached sheet the time required to finish each part. If your class does not finish in the required time limits, stop them anyway and write in the blanks "time-up." Return the time blanks properly filled in when you send in the tests.

Be sure that children are not tested when fatigued. Part I and Part II may be given with a short rest period between. Part III should be given at a new sitting. Tests should not be given in periods immediately preceding lunch or dismissal.

Directions to Pupils.

Part I - When pupils are ready to begin Part I, say to them--"You are to put your answers in the blank spaces (point). When you have finished a page read what it tells you to do at the bottom of the page. If you are not sure how to write a word, do the best you can. You are to answer all of the questions without help. Ready--Go." At the end of 18 minutes say "Stop", even though all pupils have not finished.

Part II - When pupils are ready to begin Part II say--"Get the answers to these examples as quickly as you can without making mistakes. Look carefully at each example and do what it tells you to do. When you finish this page, close your booklet. Ready--Go." At the end of 15 minutes, say "Stop", even though all pupils have not finished.

Part III - When pupils are ready to begin Part III say--"Here are some problems. Get the answers as quickly as you can. Write the answers in the blank spaces (point). Use the sides of the pages to figure on if you need to. Ready--Go." At the end of 30 minutes say "Stop", even though all pupils have not finished.

Please return all used and unused booklets to the Testing Office as soon as tests have been given.

- -

Please fill in and return the blanks to the Testing Office. Write in the actual time required to finish each part of the test. In no case should the time limits be exceeded. If all pupils have not finished in the time allotted, write in "Time up". It would be helpful to indicate the number of pupils who had not finished when you called time.

SCHOOL ______________________________

Section	No. pupils taking test	Time used		
__________	__________	Part I ______	Part II ______	Part III ______
__________	__________	Part I ______	Part II ______	Part III ______
__________	__________	Part I ______	Part II ______	Part III ______

Typists:

Norma Duncan
Willene Paris