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An Experimental Study of the Educational Effects of Grouping in a Fifth-Grade Arithmetic Class

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GROUPING IN A FIFTH-GRADE ARITHMETIC CLASS - HART

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AN EXPERIMENTAL STUDY OF THE EDUCATIONAL EFFECTS OF GROUPING IN A FIFTH-GRADE ARITHMETIC CLASS

By

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

INTRODUCTION

The past two decades have shown a gradual change in the philosophy of the teaching of arithmetic as well as in the general change in the philosophy of education. For many years the instruction of arithmetic was limited to rigid methods, materials, and subject-matter. However, educators have just begun to explore the potential possibilities unfolding in the future for arithmetic.

There is no decisive proof that any particular method of teaching (inductive, deductive, individual, or group) or any particular philosophy of teaching will guarantee better results than any other method or philosophy as far as achievement in arithmetic is concerned. Many variable human factors enter into all research of this kind and make most decisive and positive statements impossible.

John J. Kinsella states in an article in The Mathematics Teacher:

> Although research in mathematics education, in contrast with research in mathematics, cannot yield proof of the degree of rigor and certainty found in modern algebra and set theory, we should, if for no other reason than to be consistent with our ideal of consistency, do all we can to maximize the probability that the content we select and the teaching

methods we use are the best available at any given time.[1]

I. THE PROBLEM

Statement of the problem. It is the purpose of this study (1) to investigate the effects of ability grouping on the achievement growth rate; (2) to present any changes of satisfactions and/or frustrations of the children in the class; and (3) to show ways in which individual differences were met and encouraged in flexible class grouping, as revealed through an experimental study.

Importance of the study. Recent scrutiny of the educational philosophy of the American Public Schools has emphasized the increased importance of each individual to develop intellectually within the limits of his ability. In spite, however, of the rather general recognition by schoolmen of grouping and individual differences in reading, arithmetic is seldom considered in such a light. Especially limited have been experimental studies in arithmetic grouping in the upper elementary grades.

There are several possible ways to teach arithmetic to such an upper elementary class. Perhaps the traditional procedure would be to teach the whole class one lesson for

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[1] John J. Kinsella, "Is Research in Mathematics Education Really Necessary?" The Mathematics Teacher, 50:300, April, 1957.

the same amount of time providing for the same amount of practice. This does not recognize individual differences in present achievement, rate of growth, and intellectual ability in each child. Therefore, such class procedure would not help each individual pupil progress to the best of his ability.

A second possible solution might be to meet individual differences by teaching one lesson or concept at several levels of understanding. This might be plausible if fundamental skills have been mastered. However, a fifth-grader who has not fully mastered the process of subtraction in the abstract or with the use of semi-concrete materials would only be more confused by having to subtract mixed numbers and fractions, or even comprehend more than the concept of the simplest fractions.

The third possible approach would be to group the class on the basis of achievement levels and to teach the different skills and concepts needed by the different groups. This seems to be the most efficient and comprehensive way to meet individual differences. Each child would be working nearer his potential. It must be remembered, however, that individual differences will be present in even the smallest of groups. This study was conceived and developed to explore and test this third approach in teaching arithmetic.

As J. Fred Weaver so aptly writes:

The amount, quality and significance of research

> activity, the extent to which research findings are reported and disseminated; the degree to which the implications of research are implemented in actual classroom situations--all these have a marked influence on the amount of instructional improvement we can hope for in the field of arithmetic.[2]

In this study an attempt will be made to show that many principles of grouping accepted in other subjects are valuable in the teaching of arithmetic.

Delimitation of the problem. This study is limited to the children in one fifth-grade classroom, Room 114, in Aztec School, in Albuquerque, New Mexico, during the months of February, March, April, and May, 1958.

II. DEFINITIONS OF TERMS USED

Flexible groups. Grouping as referred to in this study was flexible. A child from one group could move to a higher group if his ability and progress warranted it, or could move to a lower group if it appeared that the child needed to relearn skills or concepts.

Informal tests. The informal tests were those formulated and duplicated by the teacher to gain an insight into the achievement of each student.

Enrichment materials. Enrichment materials were

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[2] J. Fred Weaver, "Six Years of Research in Arithmetic Instruction: 1951-1956," The Arithmetic Teacher, 4:89, April, 1957.

supplementary books, charts and exercises used to increase depth of understanding for those children who also were increasing their breadth of knowledge beyond their grade level.

Concrete or manipulative materials. Objects or materials which can be touched and handled were considered concrete or manipulative, such as blocks, tongue depressors, and milk bottle caps.

III. ORGANIZATION OF REMAINDER OF THE THESIS

Chapter II reviews the research literature about grouping in arithmetic, especially in the elementary grades.

The design of the study, Chapter III, explains the proposed methods of procedure used in the identification of the groups and the teaching methods to be used in the arithmetic class presented in narrative.

Chapter IV describes the arithmetic groups formed as to number, ability, and individual and group progress, and the actual procedure of the study.

Chapter V discusses conclusions of the study and presents recommendations for classroom methods and further research.

The appendices contain tables of data from the testing program for the children included in the study, some anecdotal records recorded during the study, parent remarks about their children in regard to the study, sample lessons for each

of the groups, the informal and standardized tests given, plates of the children working in groups, and diagrams of teaching materials used in the study.

CHAPTER II

REVIEW OF THE LITERATURE

Many articles have been written about content as well as methods used in teaching arithmetic. Several recent investigations related to grouping and learning in elementary arithmetic classes have been made. A brief summary of the work done on problems very closely related to the one at hand will be given in this chapter.

A study by Holmes and Harvey directly approached the problem by grouping in an elementary arithmetic class when they studied four elementary classes, two of which maintained permanent grouping and two classes which utilized flexible grouping.[3] They reported that generally flexible grouping gained more though there were so many variables that the results were not reliable.[4]

They concluded that the method of grouping made very little difference in promoting subject-matter outcomes, that grouping did not increase already existing differences in knowledge of arithmetic, and that the widening of the gap between the high and the low I.Q. groups tended to occur with respect to their knowledge of arithmetic, irrespective

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[3] Darrell Holmes and Lois Harvey, "An Evaluation of Two Months of Grouping," Educational Research Bulletin, 35: 213, November, 1956.

[4] Ibid., p. 213.

of the method of grouping. They noted that this was a study of two kinds of grouping and not between grouping and non-grouping. Holmes and Harvey reported that:

> It would appear in the judgment of the writers that factors identified in other studies are of primary importance, not the method of grouping. These factors include the personal and professional qualities of the teacher and the teacher's emphasis on meaning and functional practice in his teaching.[5]

Harding and Bryant[6] attempted to compare the attainment gained from formalized methods and from activity-experience methods. They studied two classes of fourth grade children taught by the same teacher. Their study showed the comparative achievements in social adjustment and emotional stability that resulted from the different methods of instruction. The experimental class chose projects, weighed and measured themselves, kept time and weather charts, though there was no systematic teaching or practice from an arithmetic text. The text was used as a reference or for explanations.[7] The controlled group followed the adopted text for the grade with page by page assignments and explanations.

Harding and Bryant concluded that different instruction does result in different learnings. The experience program

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[5] Ibid., p. 222.

[6] Lowry W. Harding and Inez Bryant, "An Experimental Comparison of Drill and Direct Experience in Arithmetic Learning in Fourth Grade," Journal of Educational Research, 37:323, January, 1944.

[7] Ibid., p. 326.

was more effective in developing the ability to solve problems and in developing emotional stability, desirable social behavior, and study habits in children.[8]

Johnson devised a study of four high school classes, two taught by traditional methods and two taught by grouping. Student teachers were utilized for the grouped classes. One unit on new number bases was taught all classes. Achievement was tested after six days of periods divided into twenty-five minutes of instruction and twenty-five minutes of guided supervised study.[9] Johnson concluded that there was no difference in the achievement of students taught in groups compared to students taught by an instructor in a traditional classroom.[10]

Ivie, Gunn, and Holladay, through a curriculum research study in the Meridian Public Schools, Meridian, Mississippi, in 1955, have helped reorganize the mathematics program in grades one through fourteen. The revision centered around the mathematics requirements of general education, an examination of newer content suggested for mathematics today, and a cautious examination of methods for meeting individual differences: homogenous grouping, acceleration

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[8] Ibid., p. 336.

[9] Donovan A. Johnson, "A Study of the Relative Effectiveness of Group Instruction," School Science and Mathematics, 56:609, November, 1956.

[10] Ibid., p. 616.

and/or enrichment, and individualizing instruction within a class.[11]

A survey of the mathematics program provided evidence that the achievement levels of various grades from one to fourteen were at or above the national norm on standardized tests although the range of scores was very narrow, usually one or two grades. The Iowa Algebra Aptitude Test was given a selected group of the top thirty students of the sixth grades of the nine elementary schools in Meridian. Their scores compared to the scores of students on a similar test given at the end of eighth grade with the exception of the very top scores.

Indications from the survey were that the elementary teachers to a greater degree and the high school teachers to a lesser amount used the normal everyday occurrences in arithmetic for extending or enriching abilities of students in mathematics. Most teachers followed a single textbook as a guide with all students in each grade or in each section progressing generally at the same rate.

As a result of the study a group of elementary teachers in 1955-1956 built a course of study in arithmetic in grades one to six. The course of study was examined in a two-week pre-school workshop and faculty study was devoted to it by

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[11] Claude Ivie, Lilybell Gunn, and Ivon Holladay, "Grouping in Arithmetic in the Normal Classroom," The Arithmetic Teacher, 4:219, November, 1957.

all the elementary schools during 1956-1957.

During the summer of 1957 a selected group of twenty-two teachers worked to construct specific action research projects to determine the most effective use collectively of the general activities which should occur in school at each grade level to promote arithmetic understanding, and to find individually specific activities such as drives, post office experiences, or other enrichment practices used normally in a classroom. At the end of 1957 specific reports on activities used to promote arithmetic skills and understandings set up the policy for meeting individual differences.[12]

In the elementary schools, children would be accelerated in the skills areas by at least one grade. Diagnostic tests were to be given and teachers then set up "check list" skills, particularly from third grade upward, which listed everything normally expected in any one year in an elementary grade according to the course of study.

Each child would be allowed to work as rapidly as he could through the check list for his normal grade and through the check list for the grade above or below him. No more than two sessions per week up to an hour in length would be devoted to this skills practice. General use of common mathematical situations arising in a school day was planned for enrichment and development of understandings for the whole

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[12] Ibid.

class. The check list went into the child's folder and the teacher next year would continue the process. It was planned that groups would form in the classroom of their own accord, centered around certain skills.

The teachers participating in the project recommended (1) that enrichment activities should be used for development of the whole group's understandings in arithmetic; (2) as in reading, specific skills should be taught; (3) grouping should be flexible; and (4) child psychology and the effect of peer relationships should be utilized to further learning.

Ivie, Gunn, and Holladay concluded:

> Further, it is assumed that this process of meeting individual differences will occur in the normal classroom. Eventually there may be separation of children who are mentally retarded or definitely superior.[13]

Ben A. Sueltz, editor of The Arithmetic Teacher, commented on this article as follows:

> The new program will seek to develop greater understanding and that calls for modes of teaching and learning that feature discovery and development instead of the memorization of procedures. The pupil who understands the relationships of arithmetic and who can discern a mathematical situation outside a textbook and then knows what to do and how to do it has really mastered arithmetic.[14]

The relationship of certain reading skills to the ability to solve verbal arithmetic problems was studied by

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[13] Ibid., p. 220.

[14] Ibid., pp. 220-21.

John P. Treacy.[15] He tested problem solving, mental ability, and reading ability of the children. Treacy reported that general intelligence, vocabulary, use of quantitative terms and computational ability are positively related to problem solving; that systematic training in a definite procedure for attacking problems results in higher scores though he was not sure of the most effective procedure; and that the relationship of reading to arithmetic problems is contradictory due to different reading skills not being equally important for success in problem solving. However, there is a definite relationship between reading and problem solving ability.[16]

Guiler and Edwards devised a controlled experiment in computational arithmetic with pupils in Grades Seven and Eight in the public schools of Shelby and Lucas Counties, Ohio. This study was to discover the extent to which computational habits of junior high school pupils may be improved by means of a systematic program of individualized instruction; the relative differences of various phases of computation; the relative differences of specific computational skills; the effect of intelligence on achievement in computation; the effect of achievement status on progress in computation; and the influence of time as an element on

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[15] John P. Treacy, "The Relationship of Reading Skills to the Ability to Solve Arithmetic Problems," Journal of Educational Research, 38:86, October, 1944.

[16] Ibid., p. 95.

computational achievement.[17]

The study was twenty-three weeks long, utilizing two periods per week in systematic instruction based on individually diagnosed difficulties; two periods per week on an experimental project; following convention group instruction. The class periods varied from thirty to forty-five minutes. The controlled and experimental groups had paired pupils. The controlled group worked from the text while the experimental classes were organized on individual group instruction basis.

The improvement made by the experimental groups was much greater than that made by control pupils. Lengthened class periods had no noticeable effects.

Guiler and Edwards conclude that individual group instruction based on individual diagnosis is more effective than is conventional group instruction in the improvement of computational skills; some phases of computation are more difficult to improve than others; intelligence exerts a marked effect on improvement in comprehension; and initial status in computational ability has a marked effect on progress in computation.[18]

Stevens lists five major arithmetic trends: an

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[17] W. S. Guiler and Vernon Edwards, "An Experimental Study of Methods of Instruction in Computational Arithmetic," Elementary School Journal, 43:353, February, 1943.

[18] Ibid., p. 360.

increased emphasis to concept building; an emphasis on individual rather than mass instruction; a delay in introducing abstract work; an increase in oral arithmetic; and recognition and acceptance of immature ways of dealing with number situations.[19] She states, "The last trend is a marked leaning toward group and individual teaching as opposed to class and mass teaching."[20]

Ruch states that most pupils master arithmetic combinations by grade five with slight and gradual improvement in accuracy from grades five to eight.[21]

Brownell maintains in his study of two groups that a crutch in arithmetic was not detrimental but that the group using the crutch tended to drop it as soon as the crutch had served its purpose as an aid to learning in early stages of development of the process.[22] Use of the crutch is recommended when it facilitates understanding and computation during the early stages of learning a new arithmetical

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[19] Marion Paine Stevens, "Teaching Arithmetic, Some Important Trends in Our Schools Today," The Grade Teacher, 62:54, April, 1945.

[20] Ibid.

[21] G. M. Ruch, "Relative Difficulty of the One Hundred Multiplication Facts with Special Reference to Textbook Construction," Elementary School Journal, 32:76, January, 1932.

[22] W. A. Brownell, "Borrowing in Subtraction," Journal of Educational Research, 33: 420, February, 1940.

process.

Williams undertook to determine the mathematics learning which took place in nine successive sixth-grades under an experience curriculum. She used the Stanford Achievement Test in Arithmetic and compared the results with the grade norms standardized for an entirely different type of curriculum.[23] Results reveal children in an experience curriculum consistently scored higher in the reasoning test rather than in the abstract examples test although it was effective in developing computational skills.

The study by Ellsworth of 390 children from grades three to six investigated the uses which children find for numbers. He utilized a combination questionnaire-pupil reporting type procedure.[24] The results were tabulated and the percentages of frequencies were computed. Ellsworth ranked the following as the four most common uses of arithmetic: telling time, using United States money, counting, and reading numbers.[25] He found the four fundamental processes of whole numbers are necessary and therefore one hundred per cent efficiency should be required of students. Also he found that the use of fractions was

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[23] Catherine M. Williams, "Arithmetic Learning in an Experience Curriculum," Educational Research Bulletin, 28: 154, September 14, 1949.

[24] Elmer E. Ellsworth, "Number Experiences of 390 Children from Grades Three-Six in an Urban Area," Education, 61: 485, April, 1941.

[25] Ibid., p. 487.

limited.

Plank investigated by observation five children retarded from three to fourteen months in arithmetic. The children appeared to be maladjusted as indicated by school records, interviews with parents, and observations by Plank. A group of tests were given and mathematical materials for elementary schools were used.[26] In conclusion Plank stated that achievement in arithmetic seemed more strongly related with problems of personal adjustment rather than with intelligence or school experiences.[27]

Gibb,[28] Hartung,[29] Pikal,[30] Weaver,[31] and Wrightstone[32]

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[26] Emma N. Plank, "Observations on Attitudes of Young Children Toward Mathematics," The Mathematics Teacher, 43-254, October, 1950.

[27] Ibid., p. 263.

[28] Glenadine E. Gibb, "A Review of a Decade of Experimental Studies Which Compared Methods of Teaching Arithmetic," Journal of Educational Research, 46:603-08, April, 1953.

[29] Maurice L. Hartung, "Selected References on Elementary School Instruction: Arithmetic," The Elementary School Journal, 58:170-72, December, 1957.

[30] Frances Pikal,"Review of Research Related to the Teaching of Arithmetic in the Upper Elementary Grades," School Science and Mathematics, 57:41-47, January, 1957.

[31] J. Fred Weaver, "Research on Arithmetic Instruction-1957," The Arithmetic Teacher, 5:109-18, April, 1958.

[32] J. Wayne Wrightstone, "Influence of Research on Instruction in Arithmetic," The Mathematics Teacher, 45: 187-92, March, 1952.

have compiled useful bibliographies of current research in arithmetic.

CHAPTER III

DESIGN OF THE STUDY

Individual achievement in the class was studied by means of standardized and informal teacher-made tests and observations by the teacher. Intelligence tests and scores were also utilized in the grouping of the children.

I. MATERIALS USED

Tests of achievement. Arithmetic achievement was measured by two scores on the Iowa Every-Pupil Tests of Basic Skills, Test D, Basic Arithmetic Skills, Elementary Battery, Forms L and N given in March and May to all fifth-graders in the class.

Informal teacher-made tests were given to include the major areas of learning previously studied. These twenty-minute tests were given one or two at a time, over a two-week period, preceeding the study in grouping to aid in diagnosis of strengths and weaknesses in arithmetic in each child.

Tests of intelligence. IQ scores from the Otis Quick-Scoring Mental Ability Tests, Beta Form were used for general placement purposes. This test was given to those children who had no IQ scores on their permanent school record cards. Generally previous IQ scores were from Otis Alpha tests given in third and fourth grades.

Teaching materials. Each group in the arithmetic class used different materials as their needs and progress warranted.

The city-wide accepted arithmetic text, Making Sure of Arithmetic Five[33] was used as a guide for Groups I, II, and III. Also the following tests, guides, and materials were used as teaching materials and references for the teacher: Making Sure of Arithmetic Teachers Guide for Grade Five,[34] Making Sure of Arithmetic Six,[35] Study Arithmetics Five,[36] Row-Peterson Arithmetic, Book Five,[37] Row-Peterson Arithmetic,Book Six,[38] Arithmetic for Today,[39] Albuquerque

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[33] Robert Lee Morton and others, Making Sure of Arithmetic Five (Chicago: Silver Burdett Company, 1952), pp. 1-384.

[34] Robert Lee Morton and Others, Making Sure of Arithmetic Teacher's Guide for Grade Five (Chicago: Silver Burdett Company, 1952), pp. 1-209.

[35] Robert Lee Morton and Others, Making Sure of Arithmetic Six (Chicago: Silver Burdett Company, 1952), pp. 1-346.

[36] F. B. Knight, J. W. Studebaker, and G. M. Ruck, Study Arithmetics Book Five (Chicago: Scott Foresman & Co., 1948), pp. 1-352.

[37] Harry Grove Wheat, Geraldine Kauffman, and Harl R. Douglass, Row-Peterson Arithmetic Book Five (Evanston, Illinois: Row,Peterson and Company, 1957), pp. 1-336.

[38] Harry Grove Wheat, Geraldine Kauffman, and Harl R. Douglass, Row-Peterson Arithmetic Book Six (Evanston, Illinois: Row, Peterson and Company, 1957), pp. 1-336.

[39] Thomas J. Durell, Adaline P. Hagaman, and James H. Smith, Arithmetic for Today (New York: Charles E. Merrill Books, 1951), pp. 1-152.

Public Schools Arithmetic Guide Grades One-Six,[40] New Mexico Elementary Curriculum Guide,[41] Outline for Teaching Arithmetic in Grades One to Eight,[42] Self-Teaching Arithmetic Workbook,[43] Addition and Subtraction of Fractions,[44] Using Numbers,[45] Numbers and You,[46] Building in Numberland,[47] Row, Peterson's Enrichment Program for Arithmetic Grade Five,[48] and Row, Peterson's Enrichment Program Grade Six.[49]

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[40] Albuquerque Public Schools Arithmetic Guide Grades One-Six (Albuquerque, New Mexico: Albuquerque Public Schools, 1956), pp. 1-69.

[41] Curriculum Guide for Elementary Schools In New Mexico (Santa Fe, New Mexico: State Department of Education 1950), pp. 1-301.

[42] John R. Clark and Others, Outline for Teaching Arithmetic in Grades One to Eight (Dallas: World Book Company, 1952), pp. 1-29.

[43] Ada R. Polkinghorne, Self-Teaching Arithmetic Workbook (Chicago: The University of Chicago, 1950), pp. 1-32.

[44] Albert G. W. Schlegel, Addition and Subtraction of Fractions (Dallas: The Continental Press, Inc., 1950), pp. 1-30.

[45] Albert G. W. Schlegel, Using Numbers (Dallas: The Continental Press, Inc., 1954), pp. 1-60.

[46] Albert G. W. Schlegel, Numbers and You (Dallas: The Continental Press, Inc., 1955), pp. 1-30.

[47] Albert G. W. Schlegel, Building in Numberland (Dallas: The Continental Press, Inc., 1954), pp. 1-60.

[48] Harold D. Larsen, Enrichment Program for Arithmetic Grade Five (Evanston, Illinois: Row, Peterson and Company, 1956), pp. 1-120.

[49] Harold D. Larsen, Enrichment Program for Arithmetic Grade Six (Evanston, Illinois: Row, Peterson and Company, 1956), pp. 1-120.

Other visual and concrete materials included: felt board and felt cut-outs, circles, and squares; tag board fractional charts; counting blocks; dominoes; gallon, half-gallon, quart, pint, and cup containers; rulers; yardsticks; tape measures; chalkboards; bulletin boards; pictures; newspaper articles; weather reports; graph paper; flash cards; addition, subtraction, multiplication, and division Quizmo games, teacher-made circles to improve addition and subtraction of one and two digit combinations; charts; posters; and individual torn paper fraction kits.

It was hoped that from the above mentioned materials, the gifted children would construct original puzzles and games, the average groups would find arithmetic more meaningful, and the slow-learners would begin to grasp understanding of the work they were doing.

II. CHILDREN STUDIED

The fifth-grade class in Room 114, at Aztec School, Albuquerque, New Mexico, was selected for the study. At the beginning of the study there were forty-one children in the class and at the conclusion of the study the class enrollment was forty with five changes in the class roll.

III. METHODS OF PROCEDURE

This study was planned with the basic assumption that

in order to meet individual differences it would be necessary to plan different group assignments most of the time.

A two-week period of testing and diagnostic study was to provide information necessary for group placement and for unit material background. Teacher-made informal tests were planned to cover units of material and information which had been included in past arithmetic experiences. The Iowa Every-Pupil Tests of Basic Skills, Basic Arithmetic Skills were to be given at the beginning and again at the conclusion of the study.

Otis B Intelligence tests were to be administered to children with no IQ scores recorded in their permanent record cards. The previous scores were generally from Otis A tests given during the third or fourth grades.

Using test scores and knowledge of each child attained from home visits and experiences in teaching them over five months, each of the forty-one children was to be placed in one of five groups. The pupil and teacher discussion of the purpose and plans for the following months was planned to answer questions and prepare the children for this new experience in arithmetic.

Group I was to be a small group of superior or gifted children in arithmetic who were capable of working faster and absorbing more complex arithmetical concepts than an average fifth-grader. They were to complete the textbook,

study two sixth-grade units, and have an enrichment program planned for two periods each week.

Group II was to include a larger group of above average children capable of mastering all of the fifth-grade arithmetic concepts. As many enriching and practical experiences as possible were to be fitted into their program.

The largest group of average fifth-graders was to be Group III. Most of the fifth-grade units were to be covered with as many practical experiences included as would be possible.

Group IV was to be a smaller group who needed additional experience in previous units studied and many experiences with thought or story problems.

Group V was to be a small group of children with remedial difficulties in arithmetic, some of whom counted fingers to add and subtract. Their program was planned to be full of concrete and manipulative materials and experiences. Thus many short, easy lessons were planned to ease the tensions built up through the years that arithmetic was a frustrating experience. They would not use the textbook but would work with study sheets from workbooks planned and selected by the teacher.

After two months of study a different form of the Iowa Every-Pupil Tests of Basic Skills, Basic Arithmetic Skills would be given to gauge the increase of ability in vocabulary and fundamental knowledge, fundamental operations,

and thought problems. Also the first general informal teacher-selected test was repeated.

An inventory about the arithmetic groups was to be given to the children to gain their reaction to the study. A sample of parents was to be contacted for their reaction and comments about the study. The principal, consulting-teacher, and teacher-visitors during the study were to be asked for their opinions.

The three parts of the problem (1) to investigate the effects of ability grouping on the achievement growth rate, (2) to present any changes of satisfactions and/or frustrations of the children in the class; and (3) to show ways in which individual differences were met and encouraged in flexible class grouping, as stated in Chapter I, were to be studied by these proposed procedures.

CHAPTER IV

COMPILATION OF DATA

Contrary to traditional approaches or methods of teaching arithmetic, this study has been made to discover and investigate the possibilities of grouping in arithmetic. In order to meet individual differences it seems obvious that instruction must begin where the individual is and continue from there. Since a fifth-grade class has as many achievement levels as it has pupils, it seems practical to group the children who have similar abilities or difficulties. This will facilitate teaching a large class and yet partially meet individual differences.

Some authorities feel individual differences can be well met by teaching each unit at various levels of learning. It seems contradictory to expect a child without a basic fundamental knowledge of arithmetic to achieve successfully in more complicated and difficult arithmetic when he has consistently failed to comprehend much simpler processes. An analogy to this would be the child who took swimming lessons for a year but did not learn to swim. However, when the class began to receive instructions in diving this child was expected to learn to dive regardless of the fact that he did not know how to swim. This situation sometimes exists in arithmetic classes when everyone studies the same lesson with the

same assignment for the same length of time. Slow learners of arithmetic find themselves trying to learn to "dive" before they can "swim."

This study was introduced to the class by preparing the forty-one children who were to participate in the study. Previously they had been taught as one group with some flexible grouping during each unit for those children not achieving or grasping the meaning of the process or unit being studied. The scope of the study was described generally and grouping was explained in regard to the new ways they would be studying. The testing program was mentioned, especially the introductory teacher-made tests which were to indicate some of the things they knew. The class expressed enthusiasm and an eagerness to try something new in arithmetic.

Informal teacher-made tests were duplicated and constructed to require twenty minutes or less to complete. Eight of these tests were given during the following two weeks. They were not considered difficult by most of the class. The tests covered addition, subtraction, multiplication, and division problems as well as arithmetic terms, measurements, and one and two-step thought problems. Copies of these tests are found in Appendix D. The scores by groups are given in Table I. Table I is read as follows: G.C.7 in Group I scored fifteen correct answers in test one with a total number of possible correct answers of fifteen on February 24, 1958. G.C.7 scored

TABLE I

SCORES MADE BY CHILDREN FROM FEBRUARY 24, 1958 TO MARCH 5, 1958 ON A SERIES OF INFORMAL TEACHER-MADE TESTS DESIGNED TO SHOW INDIVIDUAL DIFFERENCES ON ACHIEVEMENT OF SPECIFIC SKILLS WITHIN A CLASS

Date test was given	2/24	2/25	2/27	2/27	2/28	3/3	3/4	3/5
Total number of possible correct answers	15	5	20	29	9	5	15	12
Test numbers	1	2	3	4	5	6	7	8
Group I								
GC7	15	5	17	27	9	5	13	8
JJ17	14	4	14	23	7	5	14	5
JK19	11	4	15	29	9	4	15	10
RL23	13	5	15	25	9	4	14	12
SM26	10	5	15	25	6	4	14	10
JS32	12	5	12	26	8	4	14	7
GROUP II								
CB2	9	4	17	22	9	5	12	11
JJ16	11	5	17	28	9	4	12	5
JJ18	7	5	18	25	8	2	13	9
TL21	10	5	13	29	9	4	14	8
LM24			17	25		2	4	4
TM25	13	4	12	25	7	3	10	5
JR30	13	5	16	27	8	5	15	4
GT35	14	5	14	27	9	3	13	10
Group III								
MB1	12	4	12	26	9	2	11	4
SB3	9	5	11	24	8	3	13	5
MB4	9	5	14	26	9	4	8	0
SD9	10	5	12	28	8	2	14	9
MG13	11	5	9	24	8	2	11	4
GL20	12	5	13	26	7	2	9	2
SP29	11	5	14	25	9	2	11	7
JS33	9	5	15	24	9	3	12	5
BS34	9	5	13	27	8	3	7	6
CU36	14	5	13	22	9			6
KW38	7	5	10	21	7	3	11	2
JW39	10	5	16	29	2	1	5	6
KW40	11	5	13	23	8	1	12	7
BS42								
KC43								

TABLE I Con't.

Date test was given	2/24	2/25	2/27	2/27	2/28	3/3	3/4	3/5
Total number of possible correct answers	15	5	20	29	9	5	15	12
Test numbers	1	2	3	4	5	6	7	8
Group IV								
SB6	7	3	6	21	6	2	4	5
RD10	12	4	9	23	8	4	4	3
CE11	9	5	11	21	3	4	4	0
PG12		5	11	20	8	3	12	5
BH14	7	2	11	21	7	0	8	0
JL22	12	5	13	20	7	0	9	5
DS31	9	5	13	23	9	4	7	3
Group V								
WD8	6	4	1	19	4	3	7	1
MJ15	2	3	8	24	3	0	5	2
GN27	9	5	3	22	3	2	6	0
JV37	7	1	11	12	6	0	4	0

five correct answers out of five possible answers on test two on February 25, 1958. C.B. 2 in Group II answered nine problems correctly on test one from fifteen possible correct answers on February 24, 1958. The remainder of the table is read in the same way.

The Iowa Every-Pupil Tests of Basic Skill, Test D, Basic Arithmetic Skills, Form L, Elementary Battery, Grades Three, Four, and Five was given to the class March 6, 1958. The scores were recorded and are included in Table II. The test was given in one sitting with a ten-minute rest period near the middle of the test.

The Otis Quick-scoring Mental Ability Tests, Beta Test was given the following week to those children who did not have IQ scores recorded in their permanent record cards. Recorded scores were generally from Otis Alpha tests given during the third or fourth grades.

The combined information obtained from the above tests and a personal knowledge of each child was utilized in grouping the children into five groups.

The physical arrangement of Room 114, Aztec School, was conducive to good grouping even though forty-one children was considered a large class. The room is 27 feet square with completely moveable furniture and shelves. Two rectangular reading tables were utilized by Groups I and IV. The chair-desks were arranged in such a way that both small and large groups were well placed, with opportunities for

TABLE II

IQ, Z SCORES, AND GRADE PLACEMENT OF THE FIFTH-GRADERS GROUPED IN THIS STUDY BY THE IOWA EVERY-PUPIL TESTS OF BASIC SKILLS: BASIC ARITHMETIC SKILLS, FORMS L AND N GIVEN MARCH 16, 1958, AND MAY 23, 1958

		Form L March 16, 1958				Form N May 23, 1958					Z scores		Z score means	
	IQ	I	II	III	Total	I	II	III	Total	Diff.	Z_L	Z_N	Z_L	Z_N
Group 1														
GC7	121	83	65	82	74	58	63	72	62	-12	1.77	1.05		
JJ17	115	74	57	73	63	73	60	88	65	2	.87	1.50		
JK19	115	74	67	82	72	63	59	72	62	- 1	1.66	.92		
RL23	124	78	65	82	72	85	60	80	65	-.6	1.66	1.60		
SM26	144	78	62	57	63	66	59	65	62	-.1	.87	1.05		
JS32	119	74	68	73	70	70	62	72	64	-.5	1.54	1.31	1.395	1.239
								Mean diff. -.44						
Group II														
CB2	108	47	63	63	58	59	55	59	57	-.1	.19	-.14		
JJ16	108	78	58	52	59	59	63	64	61	.1	.30	-.82		
JJ18	128	69	57	47	55	73	60	48	59	-.4	-.38	.24		
TL21	108	83	60	57	63	85	59	80	65	.2	.75	1.60		
LM24	116	69	63	68	64	63	62	59	61	-.3	.98	.82		
TM25	127	78	65	68	67	63	58	80	62	-.5	1.32	.92		
JR30	109	47	57	52	53	53	62	57	58	-.5	-.72	.05		
GT35	94	74	63	63	66	66	69	70	65	-.1	.98	1.50	.428	.726
								Mean diff. +.08						

TABLE II Con't.

		Form L March 16, 1958				Form N May 23, 1958					Z scores		Z score means	
	IQ	I	II	III	Total	I	II	III	Total	Diff.	Z_L	Z_N	Z_L	Z_N
Group III														
MB1	111	61	53	68	57	61	60	50	58	.1	.07	.05		
SB3	121	52	62	52	56	61	58	59	59	.3	-.26	.24		
MB4	99	52	57	59	56	47	56	55	53	-.3	-.26	-.72		
SD9	123	61	58	57	57	56	53	64	56	-.1	-.04	-.34		
MG13	123	57	57	54	56	53	59	50	56		-.26	-.24		
GL20	118	52	65	54	58	51	58	50	54	-.4	.19	-.53		
SP29	92	69	53	59	57	61	56	59	58	.1	.07	.05		
JS33	105	61	60	68	61	63	67	61	62	.1	.53	1.05		
BS34	87	49	60	63	57	56	53	59	55	-.2	-.04	-.43		
CU36	93	61	58	63	59	53	57	64	58	-.1	.30	.15		
KW38	106	57	58	57	57	53	52	55	53	-.4	.07	-.72		
JW39	110	57	58	57	57	53	57	50	54	-.3	-.04	-.53		
KW40	105	57	58	53	57	59	56	50	56	-.1	.07	-.24		
BS42						40	53	56	48			-1.59		
KC43						73	54	64	60			.53	.031	-.218
								Mean diff.	-.11					
Group IV														
SB6	103	47	57	50	52	51	53	57	53	.1	-.83	-.82		
RD10	101	52	57	54	55	61	67	52	57	.2	-.38	-.05		
CE11	96	47	50	57	52	50	53	50	52		-.94	-.92		
PG12	112	49	54	52	53	50	58	59	56	.3	-.72	-.34		
BH14	101	65	62	38	50	56	56	45	53	.3	-1.51	-.72		
JL22	89	47	53	54	52	47	55	46	51	-.1	-.83	-1.21		
DS31	85	49	54	59	55	63	57	72	61	.6	-.38	.82	-.799	-.463
								Mean diff.	.22					

TABLE II CONT'D.

TABLE II Con't.

		Form L March 16, 1958				Form N May 23, 1958					Z scores		Z score means	
	IQ	I	II	III	Total	I	II	III	Total	Diff.	Z_L	Z_N	Z_L	Z_N
Group V														
WD8	95	57	63	54	58	58	46	52	51	-.7	.19	-1.11		
MI15	90	42	47	38	43	38	44	43	43		-2.52	-2.66		
GN27	80	45	60	59	56	47	53	70	55	-.1	-.26	-.43		
JV37	88	40	43	41	42	38	51	40	44	-.2	-2.86	-2.46	-1.362	-1.666
								Mean diff.		-.27				

different group activities without interfering with the work of others. The diagram, Figure I, shows Group I at the right table and Group IV at the center table. Three rows of desks in the back of the room were well-suited for the largest group, Group III. Group II was seated in two rows of chairs on the left side of the room and small Group V was placed between the two tables on the right side of the room. The movable chairs made circles and various grouping patterns possible for all the groups. Figure 2 shows the placement of the groups during the arithmetic study. Part of Group II is in the foreground and on the left side, Group III extends across the three back rows, Group I works at the table near the windows and part of Group IV is shown in the right foreground of the photograph.

After moving the children to their new arithmetic seats, each group spent a portion of the forty-five minute period discussing with the writer the immediate, specific, and overall plans for them as a group and as individuals. They were encouraged to ask questions and make suggestions. Because many new experiences were introduced at the same time, a review assignment was completed in their new arithmetic seats.

To utilize space and time efficiently all groups changed to arithmetic seats at the beginning of each arithmetic period. Assignments for each group were on the chalkboard and the special materials needed for each group were placed on the

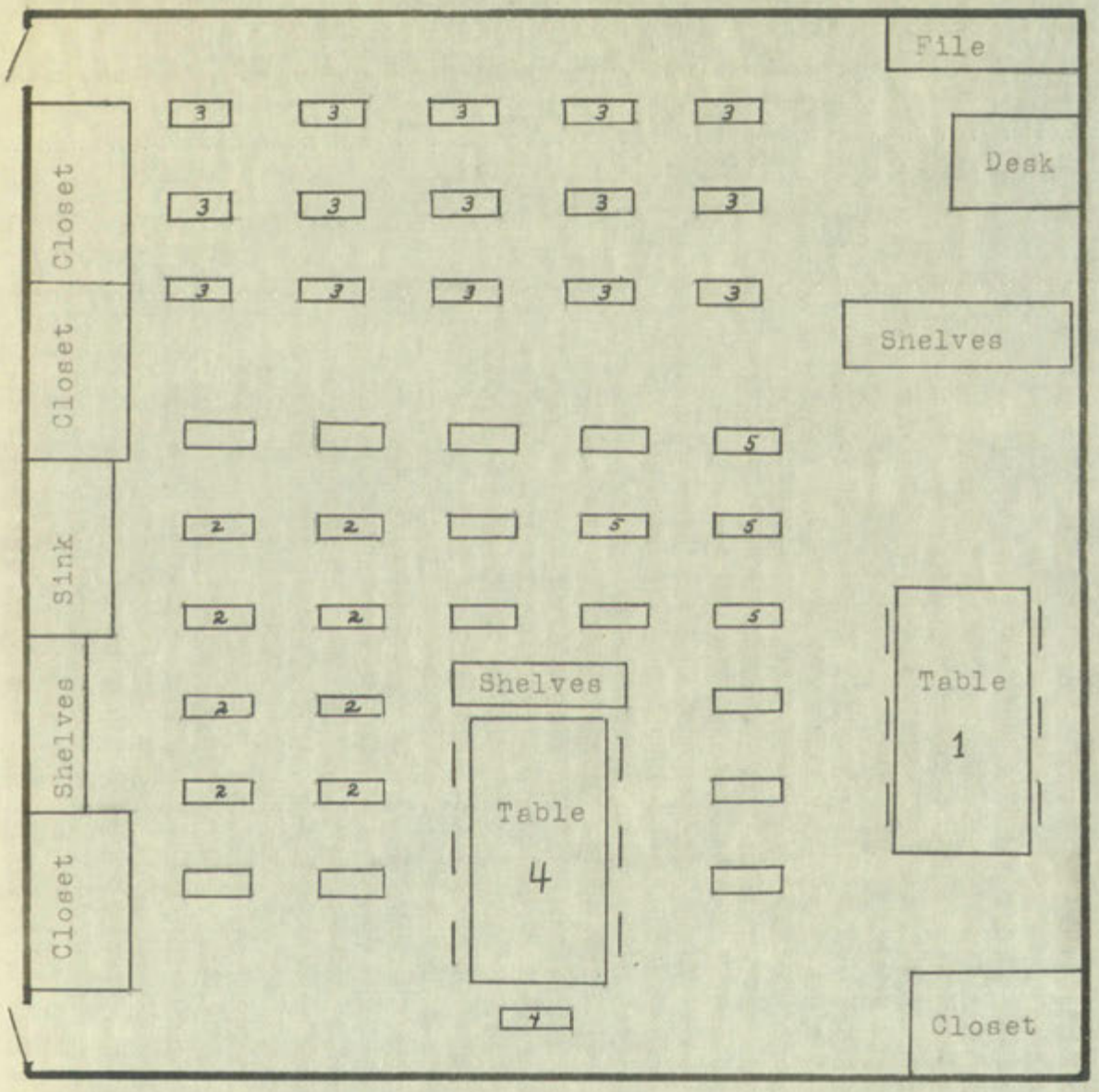

FIGURE 1

Seating Arrangement of Room 114, Aztec School,

Showing the Placement of the Five Arithmetic Groups

FIGURE 1

Seating Arrangement at Penn Ave. Junior School,
Showing the Placement of the Five Art Tables Groups

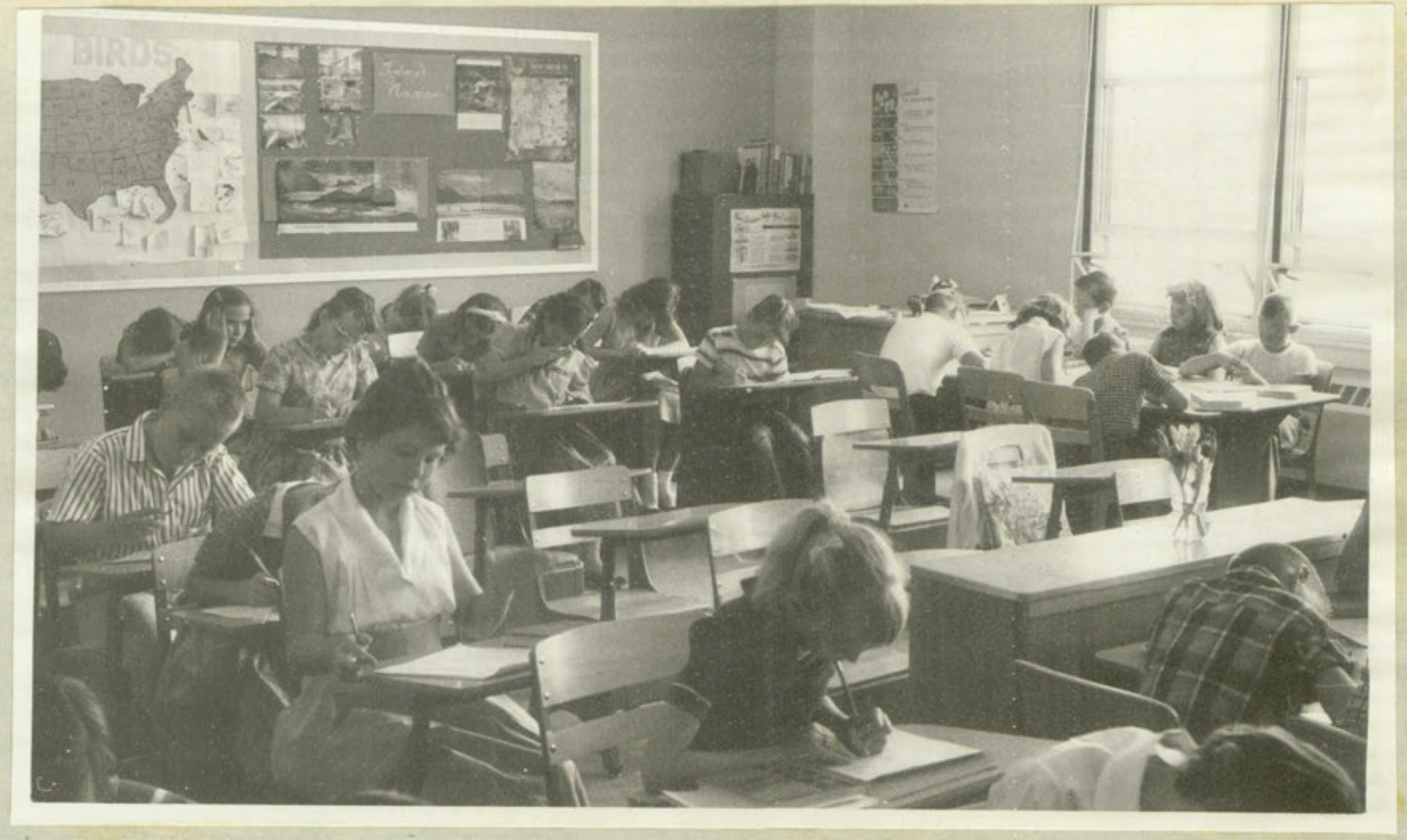

FIGURE 2

Children in Groups II, III, I, and IV (Left to Right) Are Working During This Arithmetic Project

tables and desks before class each day. From the assignments and materials most groups were able to begin work immediately. Each group received daily instruction from the teacher, although the introduction of a new unit in a group might require more than usual directly supervised instruction. The teaching units were planned so that each group received ample teaching and guided supervised study each day. The normal forty-five minute arithmetic period was not lengthened for this study.

A chart was constructed using the Outline for Teaching Arithmetic in Grades One to Eight by John R. Clark and others,[50] to show the skills needed to be learned in each group. Even in the top group "area" was not mentioned since neither the textbook nor city guide include this as a fifth-grade skill. Likewise multiplication of fractions is considered a sixth-grade skill in both text and city guide.

With the knowledge of the computational abilities of the children and the aid of the outline of basic skills to be learned in the arithmetic program, certain needed basic skills and abilities were defined for each of the five groups. These are presented in Table III.

Table III is to read as follows: Group V was still in need of recognizing without counting the number of objects in patterns usually assigned to second grade level. Group V lacked the ability to read and write Roman numerals usually

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[50] Clark, op. cit.

TABLE III

SKILLS NEEDED TO BE LEARNED BY THE FIFTH-GRADERS IN THE STUDY CONSTRUCTED FROM THE OUTLINE FOR TEACHING ARITHMETIC IN GRADES ONE TO EIGHT BY JOHN R. CLARK AND OTHERS

	Skills usually assigned to grade 2	Skills usually assigned to grade 3	Skills usually assigned to grade 4	Skills usually assigned to grade 5
GROUP V	Recognizing without counting the number of objects in patterns Telling time Symbols and language of addition and subtraction	Roman numerals Weight oz., lbs. Temperature and thermometer Money - to show value Geometric figures Adding and subtracting with carrying and borrowing (Time AM & PM) Adding by endings zeroe in subt. Division facts Estimating Problem solving	Skills listed	Skills listed
GROUP IV		Weight-oz.,lb. Geometric figures Adding by endings	Multiplying by zeros, small number by large	Roman numerals Terminology of fract.

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	Skills usually assigned to Grade 2	Skills usually assigned to Grade 3	Skills usually assigned to Grade 4	Skills usually assigned to Grade 5
GROUP V	Recognizing without counting the number of objects in patterns Telling time Symbols and language of addition and subtraction	Roman numerals Weights on . . . lbs. Temperature and thermometer Money - to show value Geometric figures Adding and subtracting with carrying and borrowing (Time AM & PM) Adding by endings zeros in sums. Division Facts Estimating Problem solving	Skills listed	Skills listed
GROUP IV	Weights--lb. Geometric figures Adding by endings	Multiplying by zeros, small number by large		Roman numerals Terminology of fract.

TABLE III Con't.

	Skills usually assigned to grade 2	Skills usually assigned to grade 3	Skills usually assigned to grade 4	Skills usually assigned to grade 5
GROUP IV con't.		Zeros in subt. Division facts Estimating ans. Problem solving	numbers Equivalents of simple fractions Problem solving Mental arithmetic Checking	Meaning, reading, writing and uses of decimals (introduction) Dividing with two-figure divisors Dividing a number by a larger number Meaning of fract. Adding and subtracting like fractions Changing improper fractions to mixed numbers Adding and subtracting mixed numbers Adding and subtracting fract. when necessary to find common denominator Changing fract. to higher or lower terms

TABLE III CON'T.

TABLE III Con't.

	Skills usually assigned to grade 2	Skills usually assigned to grade 3	Skills usually assigned to grade 4	Skills usually assigned to grade 5
GROUP IV con't.				Subt. fractions from whole numbers Subt. fractions and mixed numbers with borrowing Multiplication of fract. Measurement - area perimeter - scale drawings Problem solving
GROUPS III, II AND I				Terminology of fractions Meaning, reading, writing and uses of decimals (introd). Dividing a number by larger number Changing improper fractions to whole and mixed numbers Adding and subtracting when necessary to find common denominator Changing fractions to higher or lower terms Subtracting fract. from whole numbers and fractions and mixed numbers with borrowing Multiplication of fractions, whole numbers, and mixed numbers Area of rectangular figures Perimeter of rectangular figures Scale drawings Graphs Problem solving

TABLE III Con't.

Skills usually assigned to Grade 2	Skills usually assigned to Grade 3	Skills usually assigned to Grade 4	Skills usually assigned to Grade 5
GROUP IV con't.			Subt. Fractions from whole numbers Subt. Fractions and mixed numbers with borrowing Multiplication of fract. Measurement - area perimeter - scale drawings Problem solving
GROUP III, II AND I			Terminology of fractions Meaning, reading, writing and uses of decimals (introd). Dividing a number by larger number Changing improper fractions to whole and mixed numbers Adding and subtracting when necessary to find common denominator Changing fractions to higher or lower terms Subtracting fract. from whole numbers and fractions and mixed numbers with borrowing Multiplication of fractions, whole numbers, and mixed numbers Area of rectangular figures Perimeter of rectangular figures Scale drawings Graphs Problem solving

assigned to third grade. Group IV did not know the units of ounces in a pound usually assigned to the third-grade level. The remainder of this table will be read in the same way.

Groups I, II, and III showed comparable ability in arithmetical skills at the fifth-grade level altnough they demonstrated a wide range of reasoning ability on the Iowa Every-Pupil Arithmetic test. This might be explained because their previous learning experiences had not allowed for individual differences. The discrepancy between reasoning ability and computational skills shows a need for a different type of arithmetic program.

In the elementary school studied fifth graders had little or no opportunity to study arithmetic skills and knowledge considered above fifth-grade level. Materials above fifth grade level were not available for student use. The writer feels that enrichment and acceleration are merited if the ability of the child warrants it. This arrangement makes possible, by extending skills and abilities of the above average child, a normal curve of distribution of attainment that will correspond nearer to the extent of lack of achievement in the below average child.

Group I consisted of six children with superior or gifted abilities in arithmetic who required less practice time and worked accurately, efficiently, and swiftly. During this study they studied the following units: addition and subtraction of like and unlike fractions, multiplication and

divisions of fractions and mixed numbers, measurements including perimeters, decimals, and a general review of whole numbers.

Their program provided for study of the above units on Monday, Wednesday, and Friday. Tuesday and Thursday were spent working with enrichment materials. They read articles in encyclopedias related to mathematics, arithmetic, number puzzles, the metric system, the United States census, United States money and foreign currency. The Row Peterson Enrichment for Arithmetic Grade Five,[51] included pamphlets entitled "Numbers Do Strange Things," "Magic Squares, Circles, and Stars," "Cross-number Puzzles," "Number Magic," "Ways to Multiply," "Story to Measures," and "Jokes and Riddles" which they used. The Enrichment for Arithmetic Grade Six[52] pamphlets from that series are entitled "Brain Teasers," "Some Curious Numbers," "Amusing Problems," "Short Cuts to Multiplying," "Faster and Faster" (speeds from the turtle to the auto), "Excursions in Arithmetic," "Arithmetic of Long Ago," and "The Story of Money."

They constructed fractional parts charts and original puzzles. Short written reports were assigned and each child located the material, read the reference, and wrote a report during one enrichment period.

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[51] Harold D. Larsen, Enrichment Program for Arithmetic Grade Five (Evanston, Illinois: Row, Peterson and Company, 1956).

[52] Harold D. Larsen, Enrichment Program for Arithmetic Grade Six (Evanston, Illinois: Row, Peterson and Company, 1956).

They worked well as individuals and as a group. Previously they had finished their work so quickly they always had extra time. During this project they found there was always something to be done. They found arithmetic was more of a challenge to them. Some of their comments may be noted in Appendix B. Figure 3 shows a member of the group using the sixth-grade Row Peterson "Crossnumber Puzzles."

The eight children in Group II were of above average ability who were capable of working and learning with few relearning situations required. They completed all of the work planned for them very successfully They were an ambitious group and utilized the knowledge they learned in practical ways. Several of their arithmetic experiences that will be mentioned later clearly indicate this.

Units of study for Group II would include the addition and subtraction of like and unlike fractions, measurements, the addition and subtraction of decimals, and a general review of whole numbers.

A sample of the practical experiences of Group II would include the scale drawing of their living room, the charted and graphed temperature in Albuquerque for a week, measurements of desks, doors, and the floor of the classroom, making estimations of lengths and checking by measuring. They used the felt board and felt objects as well as the fractional charts. Generally this group worked harder than under traditional methods, although they enjoyed it and seemed challenged

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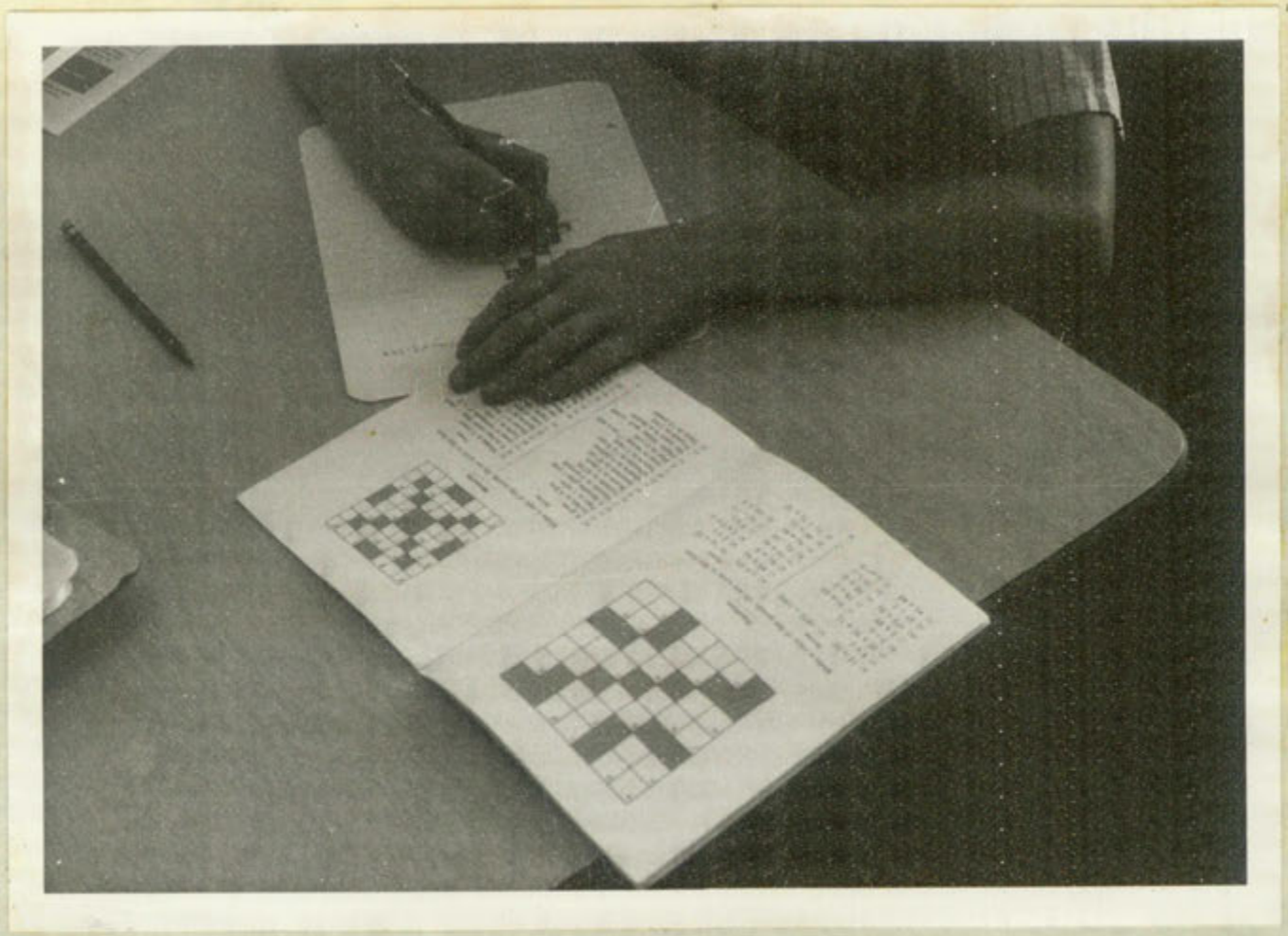


FIGURE 3

A Member of Group II Is Using a Crossnumber Puzzle

During an Enrichment Period

to accomplish even more. Figure 4 illustrates Group II's activities from measuring the room to reviewing long division.

The largest middle group, Group III, consisted of fourteen fifth-graders with average achievement in arithmetic. They did not complete all of the material and activities experienced by the second group; however, the most important units were completed. They needed more discussions and practice during each unit studied than did Groups I and II.

Group III studied the addition and subtraction of like and unlike fractions, measurements, and arithmetic terms. They measured the room and many of the objects in the room. Quarts, pints, and gallons were measured with water by the children themselves. Figure 5 illustrates part of their work in actually measuring to see the answers to the problems. This group moved along just as the whole class had been proceeding from September to March. They used the felt board and felt objects, fraction charts, rulers, yardsticks, quarts, pints, gallons, and cups. They drew pictures to answer story problems and fractional problems. Original story problems were written and exchanged within the group. The room and most objects in it were measured by the children grouped in pairs. Figure 5 shows Group III measuring pints and half gallons.

The seven children who worked in Group IV reviewed needed skills during the first part of the study. Arithmetic reasoning and practical computations were difficult for the members of this group for different reasons. Some were not

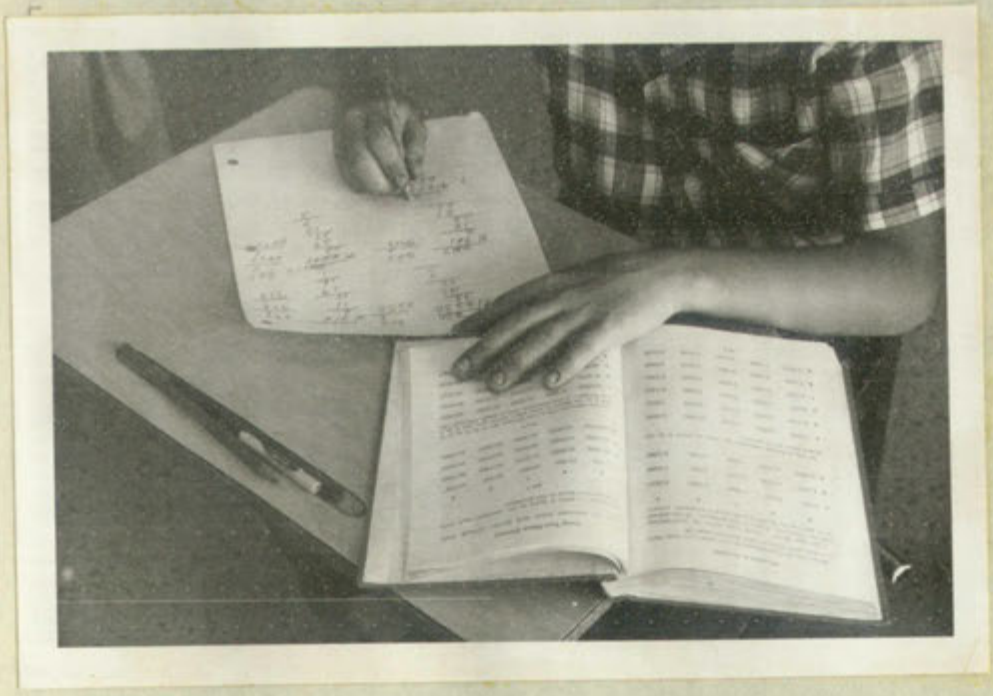


FIGURE 4

Children in Group II Measure the Room With a Yardstick.
They Also Spend Time Reviewing and Practicing Long Division

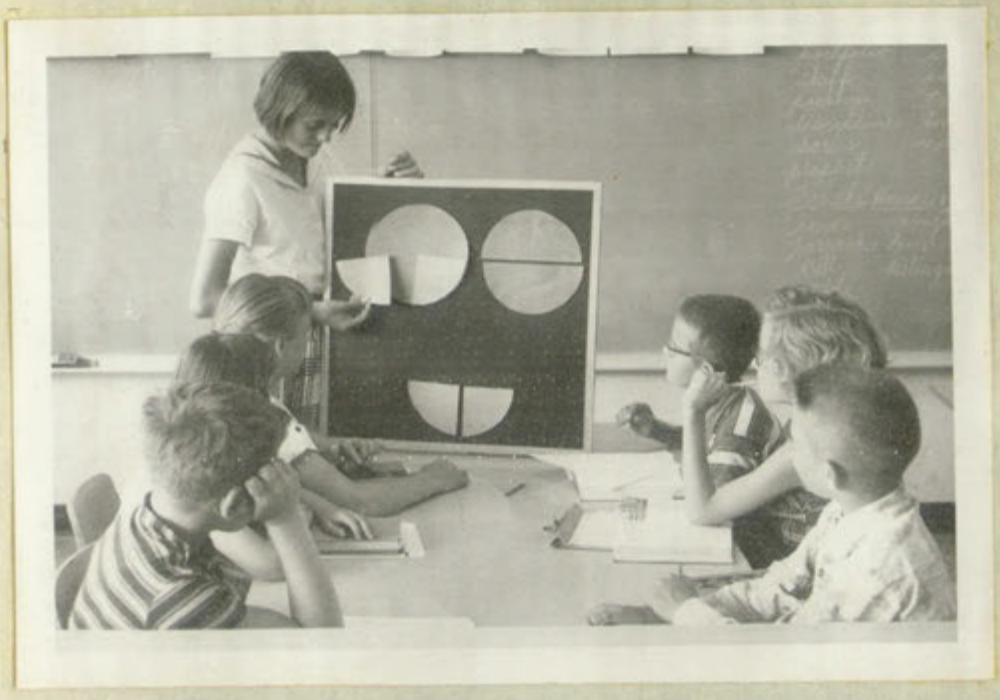
FIGURE 5

Two Members of Group III Measure Water to Show How Many Pints Are Equal to One-Half Gallon

sure of basic arithmetic facts, poor reading ability prevented successful computation of story problems for others, and for some arithmetic held little practical possibilities. They reviewed addition, subtraction, multiplication, and divisaion completely. Also addition and subtraction of like fractions were studied with many experiences related to this. Figure 6 illustrates their study of fractions by using the felt board.

These children used the felt board and felt objects, the number circles to practice adding by endings, flash cards to review number facts, and fraction charts. They drew picture to show answers to study problems, and they wrote many of their own story problems and solved them. Arithmetic terms were used as often as possible and they gained practical experience in actually measuring with rulers and yardsticks among other things.

Some of these children became aware of meaning in arithmetic for the first time. Some of them are still very slow in comprehending; however, they have shown some progress. Others have shown more interest in arithmetic problems and projects. They were rather disappointed as a group when they did not use a textbook for awhile; however, they were better prepared to understand later work after the concentrated review. It helped some of the children to know that it is possible to use arithmetic without a book. Assignments were easily completed.



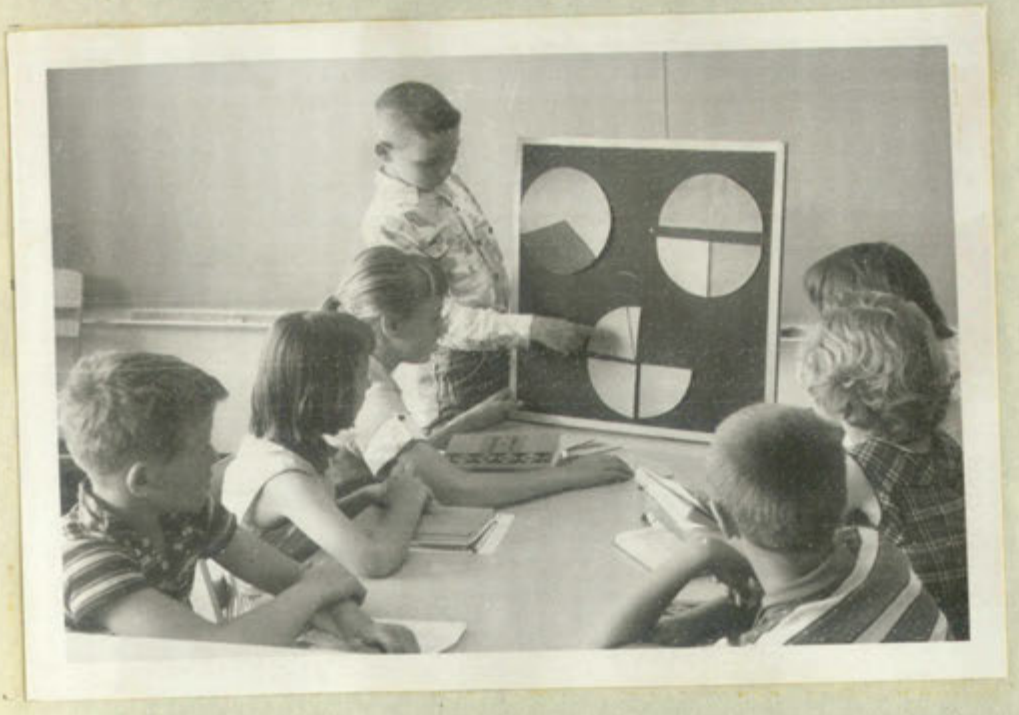


FIGURE 6

Members of Group IV Study Fractions With a Felt Board

The fifth group started with seven children and completed the year with only four members. Two children were placed in other groups during the study and one child moved out of the city.

This group did not use the textbook for the remainder of the year. Their materials and exercises were selected from textbooks and workbooks and were duplicated for their use.

Special emphasis was placed on meaningful addition and subtraction. All but one child in this group used their fingers to add and/or subtract. The group discussed the situation and decided it would be better if they could add and subtract without their fingers. This was achieved by all of the children in this group by the end of the year. Multiplication and division were reviewed and one-step thought problems were utilized in each of the four arithmetical processes.

These children were taught to play dominoes and to keep score. This gave them much meaningful practice in recognizing without counting the number of objects in patterns. Figure 7 shows them enjoying a lesson in arithmetic. They used counting blocks in adding, subtracting, multiplying and dividing. They drew patterns on the chalkboard to help explain their work. Quizmo, a game similar to Bingo, provided additional practice in all of the number processes, They used flash cards and studied in pairs with the counting blocks. Rulers and yardsticks, the clock, and the felt board

FIGURE 7

Group V Play Dominoes to Learn to Recognize the Number of Objects in a Pattern and to Gain Practice in Addition

with its cutouts were used frequently to present arithmetic in its various phases.

They drew pictures to solve problems and gradually experienced more and more success with thought problems. Their assignments were very short to give them repeated experience with success. These children were always the few who never finished, who seldom or never understood, who found arithmetic impossibly difficult and who generally disliked it. If their achievement were a general feeling that arithmetic wasn't so bad after all, their future will be much brighter in arithmetic. One boy in Group V expressed his appreciation for this opportunity to find out what arithmetic means. In Appendix B he is quoted as saying that he was finally beginning to understand.

These five groups were able to study and actively experience arithmetic situations during the same period each day. They were thoughtful of others and conscientious about their work. The arithmetic period as recommended by the Albuquerque elementary curriculum committee was forty-five minutes in length throughout the year.

This study was a pleasure for the teacher as well as the pupils. The Aztec School principal, Mr. Michael White, and Consulting Teacher, Miss Velma Whipple, commented as follows about the study:

> My general impression of this arithmetic project has been very good. I believe it has stimulated the pupils

and certainly the teacher has [been] bubbling with enthusiasm. Each time I have gone into the room, I have noticed an attitude of sincerity and willingness for improvement on the part of the children. (You can't ask for much more.)

The grouping set up has afforded the teacher a chance to better prepare the children for next year's work. I have noticed one group in particular working way ahead of the ordinary fifth grader. It has given all groups a chance to get a more solid foundation of facts according to their ability. This has worked well in relation to our plans for next year in putting the very strong into a 7th grade text about mid year.

Academically we have been able to know what each student is doing and can therefore fit him into his niche just a little better, not only this year but it has helped in making room assignments for next year.

Miss Hart has been very conscientious about this project.

(Signed) Michael White
Principal

As a Consulting Teacher in the Albuquerque Public Schools I had occasion to visit Miss Patricia Hart's class twice during the period in which she was conducting her experimental arithmetic program.

I was particularly impressed with the interest in the program shown by the children. The variety of activities, the small groups in which each child worked with children at a similar stage of learning, and the physical moving to work with a new group of classmates no doubt contributed to this interest.

It appears to me that with a large class, (35 or more students) this type of program approaches as near to the ideal of individual attention as is possible.

I should like to add that Miss Hart handled the program with a great deal of maturity, and there was evidence of considerable careful planning, which resulted in fine teaching.

(Signed) Velma D. Whipple

Several individuals and groups of teachers visited during the project. These fifth and sixth-grade teachers expressed a definite interest in the program and inquired into possibilities of trying a similar project with their

children the following year. Materials, routine, and planning were discussed with them.

Parent comments about arithmetic were sought at the end of the school year. Twelve parents were contacted by telephone as a sample of each group. Some parents stated that they really had not heard about arithmetic lately. Previously arithmetic had been an everyday problem. Others said their child had shown improvement and that he liked the subject. Another parent did not know that arithmetic had been different during the year, while others mentioned the challenge experineced by their child. The parents of the children were always cooperative in every way. Parent comments are quoted in Appendix B.

Form N of the Iowa Every-Pupil Tests of Basic Skills, Test D: Basic Arithmetic Skills was given Friday morning, May 23,1958. The testing situation was very poor. This was an unusually hot morning, too hot to attempt to close the doors. The adjoining class was singing for an unusually long period, which was distracting to the children. The test scores showed improvement for sixteen children, no change in five children, and lower scores for nineteen children. The teacher's observation is that the test results were poor because of the adverse testing conditions. Table I shows the scores for Part I: Vocabulary and Fundamental Knowledge, Part II: Fundamental Operations, Part III: Problems, and the total scores for both Forms L and N. The children's scores

are listed by groups. The child's initials and number were used instead of the child's name. The ninth column shows the increase or decrease by grade level achievement as measured by the two tests.

The tenth column shows the Z score for Form L and column eleven shows the Z score for Form N. The group mean Z scores for Forms L and N are in columns twelve and thirteen. The scores for Groups II and III increased while the scores of Groups I, III, and V decreased.

The results of the achievement test show that more than half of the class decreased in achievement during the last two months of school. This does not seem reliable for several reasons. Some of the largest differences occurred with high scoring children. The Elementary Battery for Grades Three, Four, and Five was used for the test to provide opportunities for achievement for most of the children. However, the intermediate battery of the test for grades five to nine would have provided a more reliable score for those children in the top range. However, Groups I and II had little range because they were already near a perfect score. Their scope of improvement was limited because the test did not include enough harder problems to measure their growth accurately. The high scores were not as reliable as the middle scores because one problem might represent four months difference in the grade score. The conversion tables of the two forms

were different. Form L, the test given in March, extends to a higher grade equivalents than Form N, the test given May 23. A raw score of 84 if Form L is equivalent to a grade score of 8 years 7 months; however, the raw score of 84 in Form N is equivalent to a grade score of 6 years 9 months. The ceiling of Form L is 8 years 7 months while the Form N ceiling is 7 years 6 months.

The difference in the two conversion tables suggested that the two forms were not equivalent. Therefore, the raw scores were converted to Z scores so that a possibly more adequate comparison of the results would be possible. Inspection of Table I shows substantial agreement with the data obtained from the grade-equivalent scores. Assuming interform equivalence the explanation for the anamolies may be found in the adverse conditions of the testing situation and/or other unknown factors.

Figure 8 compares standards for the scores of the informal Arithmetic Test 1 given in February and in May. The standards are rated as excellent, good, average, fair and poor. Four children in Group I on the first test scored in the excellent range and two scored in the good range. However, the second graph for Group I shows four excellent scores, one good score, and one average score.

Three excellent scores, one good score, two average scores, and one fair score are measured on the first graph

for Group II. The second test shows improvement with five excellent scores, two good scores, and one average score.

Of the thirteen scores in Group III, one score was excellent, five were good, and seven were average. The second test measured seven excellent scores, four good, three average, and one fair.

Group IV had two good and three average scores on the first test. Two excellent scores, three good, one average, and one fair were illustrated on the second graph.

Group V measured two average scores and two fair scores on the first test and three average scores and one poor score on the second test.

Testing conditions were quiet even though the weather was very warm.

The enrichment program for Group I was not measured in any way. These children spent two-fifths of the study involved in enrichment. Group V reaped additional results in courage and self-confidence in arithmetic yet this was not measured by the tests either.

The children were observed throughout the study for emotional adjustments. The children in Group I expressed more satisfaction in actually having a challenge in arithmetic. Groups II and III seemed to work along with few changes in their emotional adjustment. Perhaps this was because they continued studying in similar ways to the previous method. The children in Groups IV and V showed the most changes.

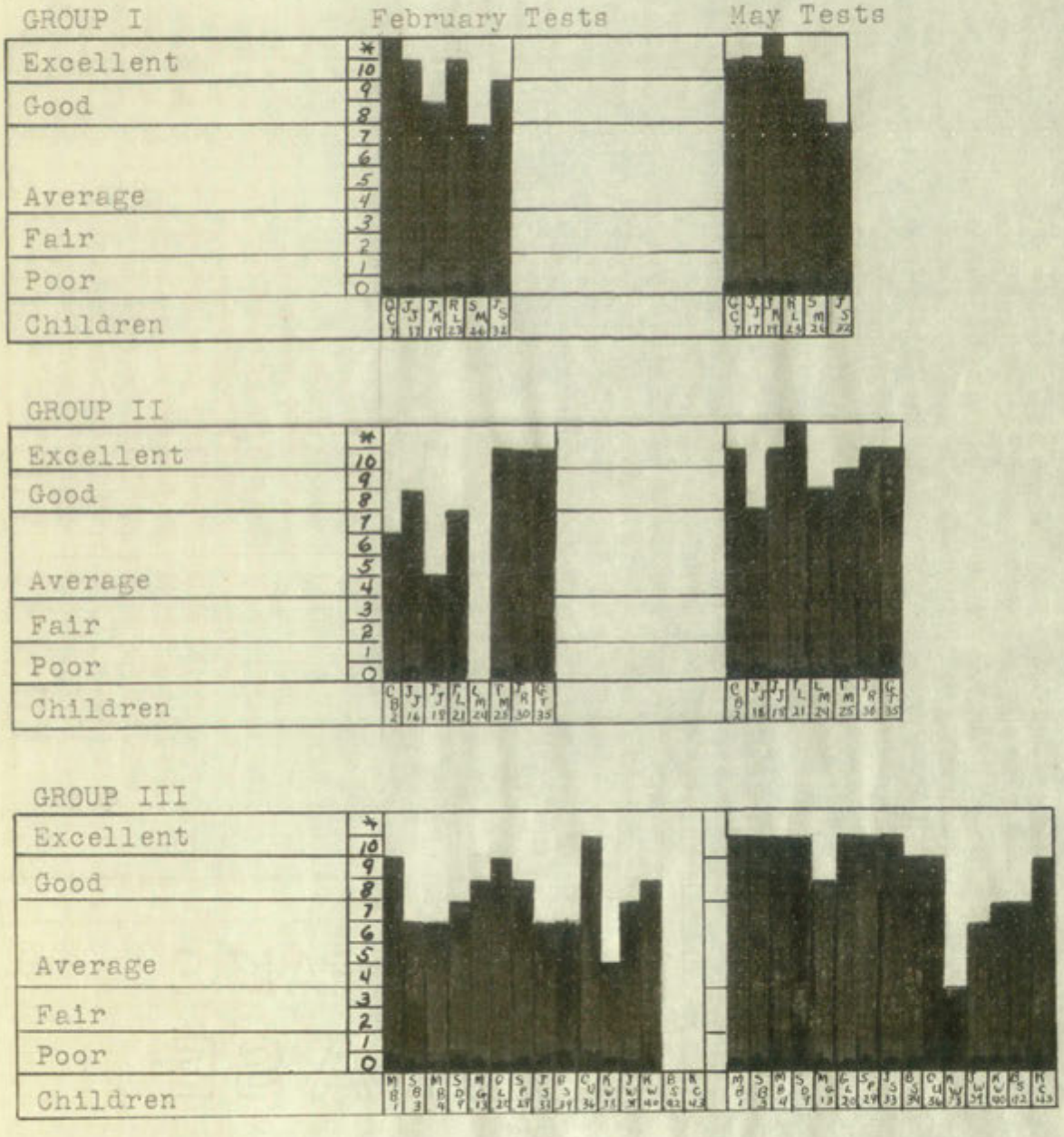


FIGURE 8

Standard Scores of the Informal Arithmetic Test One Given in February and May, 1958, and the Individual and Group Differences in Achievement

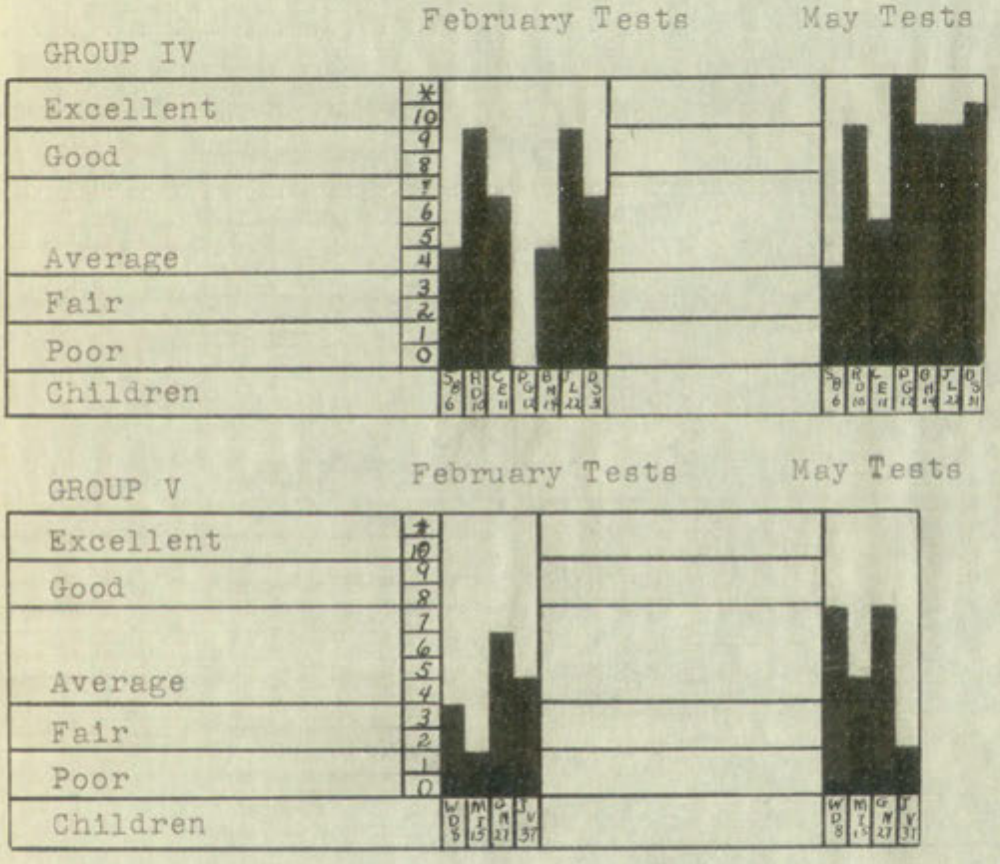


FIGURE 8 Con't.

Their outlooks improved and several expressed actual interest in a subject that had seemed hopeless previously. They began to look forward to new activities of the group and were able to complete assignments. Success experienced when their work was well done gave added confidence and courage to ask for additional work in arithmetic. One boy in Group IV gained confidence which carried over in other subjects as well.

The study certainly has recognized and provided for individual differences in the forty-one children involved in the study. In a small group it is easier to watch individual growth and difficulties or problems.

An inventory completed by the children May 29, 1958, indicated the attitudes of the children. All answers indicated that the children approved of grouping. Every child, except one who preferred the traditional method, chose grouping as the best way of teaching arithmetic in the fifth-grade if he were the teacher. Table IV is the inventory. Samples of the children's comments about question seven (Think carefully about all the boys and girls in the room and see if you can tell why you would teach arithmetic the way you chose) follows:

> (1) Because some of them are not very good in arithmetic and some are ahead, and together we couldn't learn much. This way we all learn what we are capeble of learning. I think they were a very good idea. SM26, Group I.
>
> (2) I think I would teach the last way because it teaches those who are behind in a certain thing,

TABLE IV

ARITHMETIC GROUPS INVENTORY COMPLETED BY THE CHILDREN IN THE STUDY AND SOME OF THEIR COMMENTS

1. Do you think arithmetic groups was a good idea?

   Very good Good Bad Very bad

2. Was arithmetic more interesting for you?

   Very much Much Less Much less

3. Were you able to complete your work more easily?

   Very often Often Less often Much less often

4. Were you able to understand your problems?

   Very much Much Less Much less

5. Did you get to do more things in arithmetic that you could do well?

   Very many Many Less Much less

6. If you were the fifth grade teacher, do you think you would teach arithmetic the way you had it first or since March 6?

7. Think carefully about all the boys and girls in the room and see if you can tell why you would teach arithmetic the way you chose.

the think or things they need. It also advances those who can use more advancement according to their ability.
TL 21, Group II.

(3) I think there are some children in here that can't do some of the arithmetic things. And they learn what they don't know in the different groops. They will learn what they don't know rather than what they do know.
SB3, Group III.

(4) Some might not understand what we did first. And the review might helep them. It heleped me, and I thank I can do better then first. I did not know how to do fractions.
PG 12, Group IV.

(5) because they can learn much more. Then by there salf.
JV37, Group V.

The results of the testing program given at the end of this study do not demonstrate that the first of the original objectives was met but certainly additional research along this topic will be of benefit to elementary teachers.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The following general conclusions were drawn from this study.

This study (1) failed to show the effects of ability grouping on the achievement growth rate as measured by one selected test: (2) did present changes of satisfactions and/or frustrations of the children in the class as subjectively determined through observation of (a) principal, (b) consulting teacher, (c) pupils, (d) selected parents; and (3) did show ways in which individual differences were met and encouraged in flexible class grouping.

The results of this study are inconclusive because of the influence of the testing conditions upon the test results. However, generally, individual differences were more appropriately recognized and accommodated when the study was evaluated by the consulting teacher, the principal and the teacher.

Frustrations and satisfactions changed favorably even in the short time of the study. Attitudes about arithmetic were changed in individual children as well as in some of their parents.

The area of knowledge of the above average children was lengthened as well as deepened and arithmetic became an interesting challenge to them as a group.

The concrete materials and meaningful arithmetic experiences and games were beneficial to those children who experienced difficulty in understanding arithmetic.

The study was too short in length to show long range or time differences.

Many different kinds of teaching materials should be readily available to the teacher of a class grouped in arithmetic.

Social interaction of peer groups was evident and beneficial. The best student in some groups seldom had the opportunity to exercise leadership and offer a challenge to classmates of similar ability in other situations as he did in arithmetic. Self confidence was beginning to develop in arithmetic and results were evidenced in other situations in the classroom.

The children understood the reasons for grouping in arithmetic and felt this was a better way for each to learn as much arithmetic as possible.

II. RECOMMENDATIONS

The following recommendations are made from an analysis of previous studies and of this investigation.

There is a need for additional similar studies of a longer time duration to gain conclusive evidence of the value of grouping in elementary arithmetic groups.

Further analysis of the problems of some children whose mental ability records indicate a higher level than the achievement level of the child should be made, causes should be identified, and ways of eliminating the difficulties need to be developed.

Teaching materials, including textbooks, should be studied and provided so that the teacher of arithmetic groups will have a plentiful supply of materials of various teaching levels in each grade.

The importance of meeting individual differences should be stressed as much in arithmetic as in reading or any other subject and teachers should be encouraged to utilize as many methods or materials as is needed to achieve this goal successfully.

BIBLIOGRAPHY

BIBLIOGRAPHY

A. BOOKS

Albuquerque Public Schools Arithmetic Guide Grades One-Six. Albuquerque, New Mexico: Albuquerque Public Schools, 1956. 69 pp.

Clark, John R. and others, Outline for Teaching Arithmetic in Grades One to Eight. Dallas: World Book Company, 1952. 29 pp.

Durell, Thomas J., Adaline P. Hagaman, and James H. Smith, Arithmetic for Today. New York: Charles E. Merrill Books, 1951. 152 pp.

Glennon, Vincent J. and C. W. Hunnicutt, What Does Research Say About Arithmetic? Washington, D.C.: National Education Association, 1952. 45 pp.

Knight, F. B., J. W. Studebaker, and G. M. Ruch, Study Arithmetics Book Five. Chicago: Scott, Foresman and Company, 1948. 352 pp.

Larsen, Harold D., Enrichment Program for Arithmetic Grade Five. Evanston, Illinois: Row, Peterson and Company, 1956. 120 pp.

_____, Enrichment Program for Arithmetic Grade Six. Evanston, Illinois: Row, Peterson and Company, 1956. 120 pp.

Morton, R. L., Teaching Arithmetic. Washington, D.C.: National Education Association, 1953. 33 pp.

Morton, Robert Lee and others, Making Sure of Arithmetic Five. Chicago: Silver Burdett Company, 1952. 348 pp.

_____, Making Sure of Arithmetic Teacher's Guide for Grade Five. Chicago: Silver Burdett Company, 1952. 209 pp.

_____, Making Sure of Arithmetic Six. Chicago: Silver Burdett Company, 1952. 346 pp.

Polkinghorne, Ada R., Self-teaching Arithmetic Workbook. Chicago: The University of Chicago, 1950. 32 pp.

Schlegel, Albert G. W., Addition and Subtraction of Fractions. Dallas: The Continental Press, Inc., 1950. 30 pp.

_____, Using Numbers. Dallas: The Continental Press, Inc., 1954. 60 pp.

_____, Numbers and You. Dallas: The Continental Press, Inc., 1955. 30 pp.

_____, Building in Numberland. Dallas: The Continental Press, 1954. 60 pp.

Wheat, Harry Grove, Geraldine Kauffman, and Harl R. Douglass, Row-Peterson Arithmetic Book Five. Evanston, Illinois: Row, Peterson and Company, 1957. 336 pp.

_____, Row-Peterson Arithmetic Book Six. Evanston, Illinois: Row, Peterson and Company, 1957. 336 pp.

B. PERIODICAL ARTICLES

"A Selected Bibliography of Research in the Teaching of Arithmetic," The Arithmetic Teacher, 1:20-22, April, 1954.

Brownell, W. A., "Borrowing in Subtraction," Journal of Educational Research, 33:415-24, February, 1940.

_____, "Readiness and the Arithmetic Curriculum," Elementary School Journal, 38:344-55, January, 1938.

Dickey, John W., "Comments on Middle-Grade Arithmetic," The Arithmetic Teacher, 5:37-38, February, 1958.

Ellsworth, Elmer E., "Number Experiences of 390 Children from Grades Three-Six in an Urban Area," Education, 61:485-87, April, 1941.

Fox, Marion W., "Manipulative Materials in Intermediate Grades," The Arithmetic Teacher, 5:140-42, April, 1958.

Gibb, E. Glenadine, "A Review of a Decade of Experimental Studies Which Compared Methods of Teaching Arithmetic," Journal of Educational Review, 46:603-08, April, 1953.

Gibb, E. Glenadine and H. Van Engen, "Mathematics in the Elementary Grades," Review of Educational Research, 27:329-42, October, 1957.

Grossnickle, Foster E., "Individualizing Instruction in Arithmetic," The Instructor, 63:65, May, 1954.

Guiler, W. S. and Vernon Edwards, "An Experimental Study of Methods of Instruction in Computational Arithmetic," Elementary School Journal, 43:353-60, February, 1943.

Harap, H. L, and E. Mapes, "The Learning of Fundamentals in an Arithmetic Activity Program," Elementary School Journal, 34:515-26, March, 1934.

Harding, Lowry W. and Inez Bryant, "An Experimental Comparison of Drill and Direct Experience in Arithmetic Learning in Fourth Grade," Journal of Educational Research, 37: 321-37, January, 1944.

Holmes, Darrell, and Lois Harvey, "An Evaluation of Two Months of Grouping," Educational Research Bulletin, 35: 213-22, November, 1956.

Hillman, Gertrude Dick, "Horizontally, Vertically, and Deeper Work for the Fast-Moving Class," The Arithmetic Teacher, 5:34-37, February, 1958.

"Influence of Research on Instruction in Arithmetic," The Mathematics Teacher, 45:187-92, March, 1952.

Ivie, Claude, Lilybel Gunn and Ivon Holladay, "Grouping in Arithmetic in the Normal Classroom," The Arithmetic Teacher, 4:219-21, November, 1957.

Johnson, Donovan A., "A Study of the Relative Effectiveness of Group Instruction," School Science and Mathematics, 56:609-16, November, 1956.

Kinsella, John J., "Is Research in Mathematics Education Really Necessary?" The Mathematics Teacher, 50:300-01, April, 1957.

Moser, Harold E., "Levels of Learning Planning in Depth," The Arithmetic Teacher, 3:221-25, December, 1956.

Osburn, W. J., "Levels of Difficulty in Long Division," Elementary School Journal, 46:441-47, April, 1946.

Pikal, Frances, "Review of Research Related to the Teaching of Arithmetic in the Upper Elementary Grades, School Science and Mathematics, 57:41-47, January, 1957.

Plank, Emma N., "Observations on Attitudes of Young Children Toward Mathematics," The Mathematics Teacher, 43:252-63 October, 1950.

Ruch, G. M., "Relative Difficulty of the One Hundred Multiplication Facts with Special Reference to Textbook Construction," Elementary School Journal, 32:369-77, January, 1932.

Sherer, L,, "Some Implications from Research in Arithmetic," Childhood Education, 29:320-24, March, 1953.

Spears, M., "Five Ways to Improve Arithmetic Instruction," The Arithmetic Teacher, 3:30, February, 1956.

Stevens, Marion Paine, "Teaching Arithmetic Some Important Trends in Our Schools Today," The Grade Teacher, 62:54, April, 1945.

Stevenson, Gordon K., "Attitudes Toward Reading and Arithmetic Instruction," The Arithmetic Teacher, 5:161-62, April, 1958.

Treacy, John P., "The Relationship of Reading Skills to the Ability to Solve Arithmetic Problems," Journal of Educational Research, 38:86-95, October, 1944.

Weaver, J. Fred, "Differentiated Instruction in Arithmetic: An Overview and a Promising Trend," Education, 74:300-05, January, 1954.

_____, "Research on Arithmetic Instruction-1957," The Arithmetic Teacher, 5:109-18, April, 1958.

_____, "Six Years of Research on Arithmetic Instruction: 1951-1956," The Arithmetic Teacher, 4:89-99, April, 1957.

Wrightstone, J. Wayne, "Influence of Research on Instruction in Arithmetic," The Mathematics Teacher, 45:187-92, March, 1952.

Hartung, Maurice L., "Selected References on Elementary School Instruction: Arithmetic," The Elementary School Journal, 58:170-72, December, 1957.

Williams, Catherine M., "Arithmetic Learning in an Experience Curriculum," Educational Research Bulletin, 28:154-168, September 14, 1949.

C. ARTICLES IN COLLECTIONS

Berger, Emil J., "Principles Guiding the Use of Teacher- and Pupil-Made Learning Aids," Twenty-second Yearbook of the National Council of Teachers of Mathematics, Washington, D.C.: The National Council of Mathematics Teachers, 1954. Pp. 158-70.

Grossnickle, Foster, "Materials for Grade IV Through Grade VI," Twenty-second Yearbook of the National Council of Teachers of Mathematics, Washington, D.C.: The National Council of Mathematics Teachers, 1954. Pp 131-34.

Hanna, Paul R., "Opportunities for the Use of Arithmetic in an Activity Program," Tenth Yearbook of the National Council of Teachers of Mathematics, New York: Bureau of Publications, Teachers College, Columbia University, 1935. Pp 85-120.

Kraft, Ona, "Adjusting Work Within the Class to the Varying Abilities of Its Members," Twenty-second Yearbook of The National Council of Teachers of Mathematics, Washington, D.C.: The National Council of Mathematics Teachers, 1954. Pp 45-49.

Murphy, H. George, "Methods Used to Provide Differentiated Curriculums Within the Classroom," Twenty-second Yearbook of the National Council of Teachers of Mathematics, Washington, D.C.: The National Council of Mathematics Teachers, 1954. Pp 50-56.

Smith, Rolland R., "Provisions for Individual Differences," Twenty-first Yearbook of the National Council of Teachers of Mathematics, Washington, D.C.: The National Council of Mathematics Teachers, 1953, Pp 271-302.

APPENDICES

APPENDIX A

CHILDREN'S COMMENTS RECORDED DURING THE ARITHMETIC STUDY

Group I

"I sure do like enrichment days." RL23

"Making up puzzles isn't as easy as it looks." JK19

"We don't have any extra time now." GC7

"It's hard but fun." RL23

"This is interesting." JS32

"These are really great books,"JK19; "I sure do like these new books," JJ17;"Will we get to use them again?"RL23;

"These are the best yet," SM26; (Concerning the Row-Peterson Enrichment for Arithmetic.)

"Say, that (cancellation) makes it a lot easier." JJ17

"This (grouping) is harder in some ways and easier in others. The assignments are harder but I like working along as fast as I can. And I really like enrichment." RL23

"I think what we did yesterday was intersting. I liked it." (Reports written during enrichment.) JJ17

Group II

"This is easier in some ways and harder in others." TM25

"These are sort of easy." TL21

"How did we get ahead of them?" TM25

Group III

"These are easier after we discuss them." (Story Problems) MB1

APPENDIX A

CHILDREN'S COMMENTS RECORDED DURING THE ARITHMETIC STUDY

Group I

"I sure do like enrichment days." RL2J

"Making up puzzles isn't as easy as it looks! JCLJ

"We don't have any extra time now." GCJ

"It's hard but fun." RL2J

"This is interesting." JSJ2

"These are really great books."JCLJ; "I sure do like these new books," JJLJ;"Will we get to use them again?"RL2J;

"These are the best yet," SNZ6; (Concerning the New-Peterson Enrichment for Arithmetic.)

"Say, that (cancellation) makes it a lot easier." JJLJ

"This (grouping) is harder in some ways and easier in others. The assignments are harder but I like working along as fast as I can. And I really like enrichment." RL2J

"I think what we did yesterday was interesting. I liked it." (Reports written during enrichment.) JJLJ

Group II

"This is easier in some ways and harder in others." TM2J

"These are sort of easy." TL2I

"How did we get ahead of them?" TM2J

Group III

"These are easier after we diagram them." (Story Problems) RSJ

"It's easier to measure a big room with a big tape measure and a little line with a ruler." JW39

"How did we get ahead of Group II?" MB4

"Now that I've caught on, these graphs are easy." KW38

Group IV

"This is easier than fractions." DS31

"These circle cards are fun." PG12

"We've finished all our work." RD10

"These story problems don't seem as hard as they used to be." DS31

"I never did like arithmetic before but I really do now and I'm learning, too." BH14

"Even the division isn't so hard any more." BH14

Group V

"This isn't hard." WD8

"Ounces are a little confusing." WD8

"I finished all my work today." WD8

"I've finished my work two days in a row." WD8

"Finished first again, Miss Hart." WD8

"I like to put my own numbers in story problems." JV37

"I never did understand what to do but now I'm getting it pretty good." JV37

"I don't count on my fingers anymore. Just don't seem to need to." WD8

"It's easier to measure a big room with a big tape measure
and a little like with a ruler." LVJ9

"How did we get ahead of Group II" MD8

"Now that I've caught on, these groups are easy." KW38

Group IV

"This is easier than fractions." DBJ1

"These circle cards are fun." EBJ2

"We've finished all our work." EBJ0

"These story problems don't mean as much as they used to
be." DBJ1

"I never did like arithmetic before but I really do now and
I'm learning, too." BAL4

"Even the division isn't so hard any more." BAL4

Group V

"This isn't hard." VDB

"Queues are a little confusing." VDB

"I finished all my work today." VDB

"I've finished my work two days in a row." VDB

"Finished first again, Miss Hart." VDB

"I like to work with numbers in story problems." LVJ7

"I never did understand what to do but now I'm getting it
pretty good." LVJ7

"I don't count on my fingers anymore. Just don't need to
need to." VDB

"When are we going to use our books again?" GN27

"Do you think we could get to do some harder problems after we finish our work so that we can catch up with the others?" GN27

"This is really getting easy, Miss Hart. And we all finished, too." GN27

"I really think grouping was a great idea. I learned a lot and the other way I wasn't getting anywhere. It sure helped me to be grouped." JV37

APPENDIX B

PARENTS' INVENTORY ABOUT ARITHMETIC GROUPING

1. "Gerald hasn't mentioned arithmetic groups. For awhile he hasn't had homework. He has had no difficulty after he didn't have homework." Mrs. R.D.N.

GN27, Group V

2. "At times she seems to grasp arithmetic and sometimes she doesn't. At the last of school she seemed to be able to understand it better." Mrs. J.J.C

MB1, Group III

3. "Carol always has enjoyed arithmetic. She hasn't mentioned it too much." Mrs. H.B.

CB2, Group II

4. "Arithmetic seemed much easier for Susan the last part of the year." Mrs. B.B.

SB3, Group III

5. "He has mastered division much better. When he came out he didn't know much about it. Marc likes arithmetic best." Mrs. J.B.

MB4, Group III

6. "Sandy has mentioned groups. She said she was in the fourth group. She still doesn't comprehend fully though she has improved. She didn't have much homework the last periods." Mrs. W.R.B.

SB6, Group IV

7. "Gary hasn't mentioned his arithmetic work. He seemed to work well." Mrs. J.C.

GC7, Group I

8. "She has mentioned arithmetic lately. She is more interested. For awhile it was getting her down. She hasn't had homework. She seems to be catching on better." Mrs. J.G.H.

BH14, Group IV

9. "Sometimes arithmetic is easier and sometimes it's harder. Her specific difficulty is division. She has had less homework." Mrs. R.I.

MI15, Group V

10. "Jerre was trying to get into the first group. Things at school have always come easy for Jerre. She had to work a little harder. When she was moved to Group II she was challenged to improve." Mrs. J.W.J.

JJ18, Group II

11. "Johnny has enjoyed the arithmetic group and does fine. He didn't have so much homework." Mrs. J.J.K.

JK19, Group I

12. "William hasn't mentioned arithmetic recently. He had had difficulty earlier. In fact it was an everyday problem before." Mrs. H.C.D.

WD8, Group V

APPENDIX C

SAMPLE LESSON ASSIGNMENTS

Group I

Adding fractions and whole numbers

What does the question ask? (Story problems)

Adding mixed numbers

(p. 270-275)

Group II

Adding unlike fractions

Practice with fractions

Used fraction charts and felt board

Group III

Terms of fractions

Adding like fractions

Used fraction kits and felt boards

Group IV

Dividing by 5's, fill in the blanks (How many 3's in 9?)

Dividing dollars and cents, problems

Used circle games and flash cards for additional experience

Group V

Addition and subtraction facts

Dozen--harder addition (no carrying), meaning of numbers

Subtracting big numbers, making numbers bigger (26-62)

Used blocks, flash cards, dominoes in groups of two

Arithmetic

1. Reduce to lowest terms:

$\frac{5}{20}$ $\frac{5}{15}$ $\frac{12}{20}$ $\frac{12}{24}$ $\frac{12}{16}$ $\frac{9}{24}$ $\frac{10}{12}$ $\frac{8}{10}$

2. Write the missing numerators:

A. $\frac{1}{8} = \frac{\quad}{16}$ C. $\frac{1}{4} = \frac{\quad}{8}$ E. $\frac{3}{4} = \frac{\quad}{12}$ G. $\frac{4}{5} = \frac{\quad}{10}$

B. $\frac{1}{3} = \frac{\quad}{15}$ D. $\frac{2}{3} = \frac{\quad}{6}$ F. $\frac{1}{12} = \frac{\quad}{24}$ H. $\frac{1}{5} = \frac{\quad}{20}$

3. Change to whole or mixed numbers:

$\frac{10}{7}$ $\frac{7}{4}$ $\frac{5}{3}$ $\frac{12}{12}$ $\frac{9}{6}$ $\frac{5}{5}$ $\frac{15}{8}$

Add:

4). $\frac{1}{5}$ $\frac{3}{7}$ $\frac{1}{4}$ $\frac{5}{8}$ $\frac{1}{16}$ $\frac{1}{10}$

$\frac{2}{5}$ $\frac{2}{7}$ $\frac{1}{9}$ $\frac{1}{8}$ $\frac{5}{16}$ $\frac{1}{10}$

5). $\frac{7}{9}$ $\frac{11}{12}$ $\frac{7}{16}$ $\frac{9}{10}$ $\frac{3}{7}$ $\frac{5}{16}$

$\frac{4}{9}$ $\frac{11}{12}$ $\frac{15}{16}$ $\frac{7}{10}$ $\frac{4}{7}$ $\frac{11}{16}$

6). $8\frac{3}{10}$ $9\frac{1}{12}$ $7\frac{1}{6}$ $6\frac{5}{8}$ $8\frac{1}{9}$

$3\frac{1}{10}$ $6\frac{1}{12}$ $6\frac{1}{6}$ $5\frac{1}{8}$ $7\frac{2}{9}$

7). $3\frac{7}{16}$ $4\frac{4}{7}$ $3\frac{11}{12}$ $5\frac{9}{14}$

$9\frac{5}{16}$ $9\frac{4}{7}$ $7\frac{7}{12}$ $3\frac{11}{16}$

8). $7\frac{7}{10}$ $4\frac{1}{8}$ $9\frac{1}{5}$

$9\frac{7}{10}$ $8\frac{7}{8}$ $8\frac{4}{5}$

Subtract:

9) $\frac{4}{5}$ $\frac{7}{8}$ $\frac{9}{10}$ $\frac{11}{12}$ $\frac{5}{16}$ $\frac{8}{9}$

$\frac{3}{5}$ $\frac{1}{8}$ $\frac{7}{10}$ $\frac{7}{12}$ $\frac{5}{16}$ $\frac{5}{9}$

10) $9\frac{7}{8}$ $15\frac{5}{7}$ $10\frac{3}{10}$ $16\frac{7}{12}$

5 $7\frac{3}{7}$ $6\frac{1}{10}$ $7\frac{1}{12}$

$12\frac{13}{16}$ $14\frac{1}{8}$

$5\frac{11}{16}$ $6\frac{1}{8}$

RIPE CHERRIES

What color are cherries when they are ripe? _____ Pretend these cherries are ripe and ready to eat. Color them. How many cherries are here? _____ If these cherries were real and you ate 6 of them, how many would be left? _____ If you ate 1 more, how many would then be left? _____

14 −6 = 8	14 −8 = 6	8 +6 = 14	6 +8 = 14	7 +7 = 14	7 +0 = 7	14 −7 = 7	14 −0 = 14
14 −6 =	14 −8 =	8 +6 =	6 +8 =	7 +7 =	7 +0 =	14 −7 =	14 −0 =

ADDING LARGER NUMBERS

14 5	24 5	44 5	54 5	94 5	34 5	74 5	84 5
11 8	41 8	71 8	31 8	21 8	61 8	91 8	51 8
17 2	77 2	97 2	27 2	67 2	47 2	87 2	37 2
13 6	43 6	63 6	93 6	23 6	33 6	53 6	83 6

My name is _____

APPENDIX D

ACHIEVEMENT TESTS

ARITHMETIC I

1. 4553 + 11 + 9834 + 2

2. Subtract:
83206
14765

3. Multiply:
$167
24

4. Multiply:
930
200

5. What does the sum of 588, 963, and 148 equal?

6. $45\overline{)2368}$

7. 69591 minus 7809 =

8. Subtract:
892250
4238

9. $7832 \div 89 =$

10. $58\overline{)4467}$

11. How many minutes must be added to 150 minutes to make 3 hours?

12. 953 times 6190 =

13. $50.00 minus $26.50 =

14. How many pints must be added to 5 pints to make one gallon?

15. 1622 divided by 45 =

ARITHMETIC 2

1. John read about one cub airplane that sold for $2450 and another that sold for $2994. What was the difference in the price of the two planes?

2. Frank sold berries for 38 cents a box. How much did he receive for 9 boxes?

3. One week Jack earned 75 cents by washing the car, 60 cents by raking leaves, and $1.80 by selling vegetables. How much did he earn altogether?

4. Tom spent $21.00 for three sweaters. How much did each sweater cost?

5. Helen had saved $12.60. She bought a croquet set for $8.35. How much money did she have left?

ARITHMETIC 3

Write the abbreviation of each of the following terms:

inch _____

feet _____

yards _____

rod _____

mile _____

pair _____

dozen _____

pound _____

ounces _____

ton _____

minute _____

hour _____

day _____

week _____

year _____

bushel _____

peck _____

quart _____

pint _____

gallon _____

ARITHMETIC 4

Fill in the missing numbers:

1 lb. = ____ oz.

1 yd. = ____ ft.

1 bu. = ____ pk.

1 min. = ____ sec.

1 doz. = ____ things

1 qt. = ____ pt.

1 hr. = ____ min.

12 mo. = ____ yr.

1 wk. = ____ da.

12 in. = ____ ft.

365 da. = _____yr.

24 hr. = _____da.

4 pk. = ____ bu.

60 sec. = ____ min.

1 pk. = ____ qt.

1 gal. = ____ qt.

1 yr. = _____wk.

1 nickel = ____ cents

2 nickels = ____ cents

1 dime = ____ nickels

100 cents = _____dollar

1 dollar = ____ quarters

1 quarter = ____ cents

1 half-dollar = ____ cents

1 dollar = ____ quarters

1 dollar = ____ dimes

1 half-dollar = ____ quarters

4 quarters = ____ cents

1 dollar = ____ nickels

53)1514 74)4200 28)1805

77)3504 21)$12.81 87)2490

24)17164 71)43141 82)66026

ARITHMETIC 6

1. The owner of a pet shop sold 18 lizards at 25 cents each. He also sold 1 white rabbit for $1.75. How much did he receive in all?

2. Ralph bought a pair of gloves for $1.98 and a sweater for $6.50. How much change did he receive from $10.00?

3. John picked 26 quarts of strawberries. His mother used 8 quarts to make preserves. He sold the rest to 6 neighbors. Each bought the same number of quarts. How many quarts did each one buy?

4. Howard had 18 quarts of shelled lima beans for sale. He sold ½ of them Saturday morning at 59 cents a quart. How much did he receive for the beans he sold Saturday morning?

5. Helen's allowance is 75 cents a week. She saves 30 cents of it each week. How much does she spend in 18 weeks?

ARITHMETIC 7

1. How many zeros are needed to write one million in figures? _____

2. Place commas where they belong in this number: 145206840.

3. How many figures does it take to write five hundred, sixty-eight thousand, four hundred ninety-eight? _____

4. In counting, what number comes just after 1,000? _____

   What number comes just before 1,000? _____

5. What is the place value of each 6 in 6,486,676? _____

   _____

6. What do the zeros show in the number 4,000? _____

7. Which is the largest of the following numbers? _____

   3,360,125 3,070,645 3,310,989

8. In the number 28,315 the figure 1 is in _____ place.

9. In the number 9,086 there are _____ ones, _____ tens, _____ hundreds, and _____ thousands.

10. Write the following numbers in words:

    14,304 _____

    180,593 _____

    1,746,050 _____

11. Write the following numbers in figures:

    A. Seven thousand, eight hundred fifty-six _____

    B. Six hundred ninty thousand, twenty-five _____

    C. Two million, two hundred thousand, two hundred fifty

    _____

ARITHMETIC 8

. Find the average of 9, 11, 13, 7, and 10.

. What is the average of 45, 50, 51, and 46?

. Find the average of 497, 500, 502, and 493/

ell what each of the following words mean:

uotient _____

um _____

ultiplier _____

emainder _____

ividend _____

ultiplicand _____

roduct _____

ivisor _____

ifference _____

is Quick-Scoring Mental Ability Tests: New Edition

BETA TEST: FORM EM

BETA
EM

Arthur S. Otis

---

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

e..... Grade..... Boy..... Girl.....
First name Initial Last name

of birth..... How old are you now?.....
Month Day Year

.....19.....School..... City and state.....

Read these directions. Do what they tell you to do.

his is a test to see how well you can think. It contains questions of different kinds. Under each question there are or five possible answers. You are to read each question and decide which of the answers below it is the right answer. ot spend too much time on any one question. Here are three sample questions.

ple a: Which one of the five things below is soft?
(1) **glass** (2) **stone** (3) **cotton** (4) **iron** (5) **ice**

he right answer, of course, is *cotton*. The word *cotton* is No. 3. Now look at the "Answer es for Samples" at the right. In the five spaces after the Sample "a," a heavy mark has made, filling the space under the 3. This is the way to answer the questions.
ry the next sample question yourself. Do not write the answer; just put a heavy mark in pace under the number corresponding to the right answer.

ANSWER SPACES FOR SAMPLES

	1	2	3	4	5
a			▮		
	6	7	8	9	10
b					
	11	12	13	14	15
c					

ple b: A robin is a kind of —
(6) **plant** (7) **bird** (8) **worm** (9) **fish** (10) **flower**

he answer is *bird*, which is answer 7; so you should answer Sample "b" by putting a heavy in the space under the 7. Try the Sample "c."

ple c: Which one of the five numbers below is larger than 55?
(11) **53** (12) **48** (13) **29** (14) **57** (15) **16**

he correct answer for Sample "c" is 57, which is No. 14; so you would answer Sample "c" by making a heavy black that fills the space under the number 14. Do this now.
ead each question carefully and decide which one of the answers is best. Notice what number your choice is. Then, ne answer sheet, make a heavy black mark in the space under that number. In marking your answers, always re that the question number on the answer sheet is the same as the question number in the test booklet. Erase letely any answer you wish to change, and be careful not to make stray marks of any kind on your answer sheet your test booklet. When you finish a page, go on to the next page. If you finish the entire test before the time is o back and check your answers. Work as rapidly and as accurately as you can.
he test contains 80 questions. You are not supposed to be able to answer all of them, but do the best you can. You e allowed half an hour after the examiner tells you to start. Try to get as many questions right as possible. Be ul not to go so fast that you make mistakes. Do not spend too much time on any one question. No questions t the test will be answered by the examiner after the test begins. Lay your pencil down.

Do not turn this booklet until you are told to begin.

Published by World Book Company, Yonkers-on-Hudson, New York, and Chicago, Illinois

AGE ____ Years ____ Months

SCORE ____

IQ ____

Page 6

64 61 62 63 64 65
65 66 67 68 69 70
66 71 72 73 74 75
67 1 2 3 4 5
68 6 7 8 9 10
69 11 12 13 14 15
70 16 17 18 19 20
71 21 22 23 24 25
72 26 27 28 29
73 31 32 33 34 35
74 36 37 38 39 40
75 41 42 43 44 45
76 46 47 48 49 50
77 51 52 53 54 55
78 56 57 58 59
79 61 62 63 64 65
80 66 67 68 69 70

Page 5

45 41 42 43 44 45
46 46 47 48 49
47 51 52 53 54 55
48 56 57 58 59
49 61 62 63 64 65
50 66 67 68 69
51 71 72 73 74 75
52 1 2 3 4 5
53 6 7 8 9 10
54 11 12 13 14 15
55 16 17 18 19 20
56 21 22 23 24 25
57 26 27 28 29 30
58 31 32 33 34 35
59 36 37 38 39
60 41 42 43 44 45
61 46 47 48 49 50
62 51 52 53 54
63 56 57 58 59

Page 4

25 26 27 28 29 30
26 31 32 33 34 35
27 36 37 38 39 40
28 41 42 43 44 45
29 46 47 48 49 50
30 51 52 53 54
31 56 57 58 59 60
32 61 62 63 64 65
33 66 67 68 69
34 71 72 73 74 75
35 76 77 78 79 80
36 81 82 83 84 85
37 1 2 3 4 5
38 6 7 8 9 10
39 11 12 13 14 15
40 16 17 18 19
41 21 22 23 24 25
42 26 27 28 29 30
43 31 32 33 34 35
44 36 37 38 39 40

Page 3

1 1 2 3 4 5
2 6 7 8 9 10
3 11 12 13 14 15
4 16 17 18 19 20
5 21 22 23 24
6 26 27 28 29 30
7 31 32 33 34 35
8 36 37 38 39
9 41 42 43 44 45
10 46 47 48 49 50
11 51 52 53 54 55
12 56 57 58 59 60
13 61 62 63 64 65
14 66 67 68 69 70
15 71 72 73 74 75
16 76 77 78 79
17 81 82 83 84 85
18 86 87 88 89 90
19 91 92 93 94 95
20 1 2 3 4 5
21 6 7 8 9 10
22 11 12 13 14 15
23 16 17 18 19 20
24 21 22 23 24 25

NOTE. *This Answer Sheet is not intended for machine scoring.*

1 The opposite of weak is —
(1) poor (2) sick (3) tall (4) strong (5) young

2 Which of the five words below comes first in the dictionary?
(6) brown (7) black (8) blown (9) break (10) blend

3 Which answer tells best what a teakettle is?
(11) a tool (12) a weapon (13) a utensil (14) a thing (15) a machine

4 An eggshell is to an egg the same as an orange skin is to —
(16) a lemon skin (17) an orange (18) an orange seed (19) a hen (20) a clamshell

5 Ruth is prettier than Sadie but not so pretty as Mabel. Therefore, Mabel is (?) Sadie.
(21) not so pretty as (22) just as pretty as (23) *cannot say which* (24) prettier than

6 The mayor is to a city as the governor is to —
(26) a nation (27) a president (28) a state (29) a council (30) an office

7 A stove is to heat as a refrigerator is to —
(31) a kitchen (32) cold (33) electricity (34) gas (35) food

8 Three of the four designs at the right are alike in some way. Which one is not like the other three?
(36)  (37)  (38)  (39) 

9 Northwest is to southeast as up is to —
(41) north (42) higher (43) northeast (44) down (45) under

10 The opposite of clockwise is —
(46) backward (47) counterclockwise (48) right (49) left (50) round

11 Which of the five words below comes first in the dictionary?
(51) times (52) stand (53) ruled (54) grand (55) quill

12 Which of the five persons below is most like a carpenter, a plumber, and a bricklayer?
(56) a postman (57) a lawyer (58) a truck driver (59) a doctor (60) a painter

13 Which of the following sentences tells best what an arm is?
(61) It goes in the coat sleeve. (62) You can put it around something.
(63) It carries the hand. (64) It is the part of the body attached to the shoulder.
(65) We have two of them.

14 Four of the following things are alike. Which one is different from the other four?
(66) a beet (67) a peach (68) a radish (69) an onion (70) a potato

15 What is to hearing as an eye is to sight?
(71) glasses (72) voices (73) a sound (74) an ear (75) an earphone

16 Three of the four designs at the right are alike in some way. Which one is not like the other three?
(76)  (77)  (78)  (79) 

17 Which of the five things below is most like the moon, a balloon, and a ball?
(81) sky (82) a cloud (83) a marble (84) an airplane (85) a toy

18 Fur is to a rabbit as feathers are to —
(86) a pillow (87) a bird (88) a hair (89) an animal (90) a nest

19 What is the most important reason for using screens at windows?
(91) They are easy to paint. (92) They improve the looks of the windows.
(93) They keep out flies but let in the breeze. (94) They keep out burglars.
(95) They are easier to keep clean than windows are.

20 Which of the five words below comes *last* in the dictionary?
(1) front (2) local (3) lemon (4) floor (5) knoll

21 The moon (?) around the earth. (Which of the following words completes the sentence best?)
(6) turns (7) goes (8) moves (9) revolves (10) spins

22 Printing is to a book as writing is to —
(11) talking (12) a letter (13) a pen (14) a friend (15) reading

23 Which of the five things below is most like a chimney, a roof, and a door?
(16) a chair (17) a bed (18) a stove (19) a window (20) a desk

24 The ground is to an automobile as water is to —
(21) a train (22) gasoline (23) the engine (24) a ship (25) a river

(Go on to the next page.)

64 The one of two objects that is not so good as the other is said to be —
(61) **unsuitable** (62) **lesser** (63) **single** (64) **inferior** (65) **unnecessar**

65 If the following words were rearranged to make the best sentence, the *last* word of the sentence would beg what letter?
fall clouds from the raindrops dark
(66) **f** (67) **d** (68) **t** (69) **c** (70) **r**

66 An object or institution that is not likely to move or change is said to be —
(71) **fundamental** (72) **stable** (73) **temporary** (74) **solid** (75) **basic**

67 Worst is to bad as (?) is to good.
(1) **more** (2) **better** (3) **best** (4) **very good** (5) **excellent**

68 If the following persons were arranged in order, which one would be in the middle?
(6) **grandfather** (7) **grandson** (8) **brother** (9) **uncle** (10) **nephew**

69 A man who buys and sells when there is considerable danger of loss is said to —
(11) **transact** (12) **stipulate** (13) **contract** (14) **speculate** (15) **bargain**

70 Which tells best what a refrigerator is?
(16) **a piece of kitchen furniture** (17) **a place to store food**
(18) **an electrical device for the kitchen** (19) **a large white box**
(20) **a cabinet for keeping food cold**

71 There is a saying, "A bird in the hand is worth two in the bush." It means — (21) **Two birds are worth more th**
(22) **Something you are sure of is twice as good as something doubtful.**
(23) **Your own bird is worth two that belong to others.**
(24) **It is hard to catch birds that are in bushes.**

72 When the time by a clock was 14 minutes past 9, the hands were interchanged. The clock then said about —
(26) **14 minutes past 3** (27) **14 minutes of 10** (28) **14 minutes past 2**
(29) **14 minutes of 3**

73 One number is wrong in the following series. What should that number be?
1 9 2 8 3 9 4 8 5 9 6 8 7 9 8 9
(31) **9** (32) **7** (33) **8** (34) **6** (35) **5**

74 The boy deserves (?) for his effort and perseverance.
(36) **condemnation** (37) **censure** (38) **scholarship** (39) **commendation**
(40) **a medal**

75 One number is wrong in the following series. What should that number be?
1 2 4 8 16 32 48 128
(41) **96** (42) **6** (43) **64** (44) **12** (45) **24**

76 If I have a large box with 4 smaller boxes in it and 3 very small boxes in each small box, how many boxes do I have in all?
(46) **7** (47) **12** (48) **13** (49) **16** (50) **17**

77 If each 3 in the following series were changed to a 2 and if each 1 were dropped out, the seventh 2 would be fo by what number? (Do not mark the paper.)
1 2 5 2 3 1 5 2 3 4 2 3 1 3 4 2 2 2 5
(51) **1** (52) **3** (53) **2** (54) **4** (55) **5**

78 There is a saying, "An ounce of prevention is worth a pound of cure." It means —
(56) **Prevention is a good cure.** (57) **Prevention and cure can be purchased by**
(58) **It is much better to prevent something than to cure it.**
(59) **It is much better to cure something than to prevent it.**

79 Which of the five words below is most like heavy, blue, and nice?
(61) **weight** (62) **round** (63) **sky** (64) **color** (65) **weather**

80 In a foreign language, *boli deta kipo* means *very good weather; boli cora* means *bad weather;* and *deta sedu* means *w* What word means *good?*
(66) **boli** (67) **deta** (68) **cora** (69) **kipo** (70) **sedu**

45 A chair is most likely to have —
(41) **rockers** (42) **upholstery** (43) **legs** (44) **a seat** (45) **arms**

46 A boy has three dogs. Their names are Rover, Spot, and Fido. Rover is larger than Spot and Spot is larger than Fido. Therefore, Rover is (?) Fido.
(46) **smaller than** (47) **larger than** (48) **the same size as** (49) ***cannot say which***

47 Wood is to box as wire is to —
(51) **iron** (52) **electricity** (53) **doorbell** (54) **screen** (55) **fire**

48 There is a saying, "It is a long road that has no turning." It means —
(56) **Most long roads are straight.** (57) **Things are bound to change sooner or later.**
(58) **Most short roads have turns.** (59) **It is a bad idea to turn around on the road.**

49 Which of the five things below is most like a sheet, a towel, and a handkerchief?
(61) **a blanket** (62) **a coat** (63) **a napkin** (64) **a carpet** (65) **a mattress**

50 Three of the four designs at the right are alike in some way. Which one is not like the other three? (66)  (67)  (68)  (69) 

51 If the following were arranged in order, which one would be in the middle?
(71) **foundation** (72) **walls** (73) **ceiling** (74) **roof** (75) **floor**

52 Which one of these series contains a wrong number?
(1) **2–4–6–8–10** (2) **1–3–5–7–9** (3) **3–6–9–12–15** (4) **1–4–7–10–12**
(5) **2–5–8–11–14**

53 A pair of trousers always has —
(6) **a belt** (7) **cuffs** (8) **pockets** (9) **a crease** (10) **seams**

54 One number is wrong in the following series. What should that number be?
8 1 8 2 8 3 8 4 8 5 8 6 8 7 8 9
(11) **9** (12) **7** (13) **6** (14) **8** (15) **5**

55 A machine that works rapidly and well is said to be —
(16) **fluent** (17) **revolutionary** (18) **novel** (19) **automatic** (20) **efficient**

56 What letter in the following series appears a third time nearest the beginning?
A C E B D D E A B C B E C A D A B C D E
(21) **A** (22) **C** (23) **D** (24) **E** (25) **B**

57 The stomach is to food as the heart is to —
(26) **a man** (27) **the lungs** (28) **blood** (29) **a pump** (30) **beating**

58 In the alphabet, which letter follows the letter that comes next after Q?
(31) **O** (32) **S** (33) **P** (34) **T** (35) **R**

59 Most persons prefer automobiles to buses because —
(36) **it is always cheaper to use an automobile.** (37) **the bus carries too many persons.**
(38) **an automobile gets you where you want to go when you want to go.**
(39) **automobiles are easier to park.**

60 The opposite of contract is —
(41) **explode** (42) **detract** (43) **expend** (44) **die** (45) **expand**

61 In a certain row of trees one tree is the fifth one from either end of the row. How many trees are there in the row?
(46) **5** (47) **8** (48) **10** (49) **9** (50) **11**

62 There is a saying, "Honesty is the best policy." It means —
(51) **Honesty is more important than generosity.**
(52) **In the long run it pays to be honest.** (53) **Honest people become wealthy.**
(54) **You can never tell what a dishonest person will do.**

63 Three of the four designs at the right are alike in some way. Which one is not like the other three? (56)  (57)  (58)  (59) 

(*Go on to the next page.*)

25 If grapefruit are 4 for a quarter, how much will two dozen cost?
(26) 23¢ (27) 60¢ (28) 96¢ (29) $1.50 (30) $1.00

26 The author is to a book as the inventor is to a —
(31) machine (32) bookmark (33) discoverer (34) writer (35) magazin

27 Which of the following tells best what a kitchen is?
(36) a room in which to cook (37) a place to keep knives and forks
(38) a part of a house (39) a room with a table and chairs
(40) a room next to the dining room

28 If the following words were rearranged to make the best sentence, with what letter would the *last* word of the sentence begin?
wood made often of are floors
(41) a (42) m (43) w (44) f (45) o

29 Which of the five things below is most like tea, milk, and lemonade?
(46) water (47) vinegar (48) coffee (49) olive oil (50) mustard

30 Three of the four designs at the right are alike in some way. Which one is not like the other three?
(51)  (52)  (53)  (54) 

31 Which of the sentences below tells best what a kitten is?
(56) It has whiskers. (57) It is a small animal that drinks milk.
(58) It is a playful animal. (59) It is afraid of dogs. (60) It is a young cat.

32 If the following were arranged in order, which one would be in the middle?
(61) pint (62) barrel (63) cup (64) quart (65) gallon

33 If Tom is brighter than Dick and Dick is just as bright as Harry, then Harry is (?) Tom.
(66) brighter than (67) not so bright as (68) just as bright as (69) *cannot say*

34 Count each 4 that has a 2 next after it in this row.
2 4 1 4 2 3 5 4 6 2 4 7 5 2 4 4 2 3 9 4 3 2 8 7 8 4 2 2 4 5 5 2 2 4 2
How many are there?
(71) 1 (72) 2 (73) 3 (74) 4 (75) 5

35 The opposite of ignorance is —
(76) beauty (77) knowledge (78) goodness (79) honesty (80) truth

36 Four of the following words have something in common. Which one is not like the other four?
(81) cowardly (82) dishonest (83) poor (84) stingy (85) rude

37 A photograph is 3 inches wide and 5 inches long. If it is enlarged to be 12 inches wide, how long will it be?
(1) 8 in. (2) 20 in. (3) 14 in. (4) 15 in. (5) 60 in.

38 The opposite of spend is —
(6) give (7) earn (8) money (9) take (10) use

39 Which of the following sentences tells best what an airplane is?
(11) It flies. (12) It is something to travel in. (13) It is a flying conveyance.
(14) It has wings and a tail. (15) It is a mechanical bird.

40 A man drove 9 miles east from his home, and then drove 4 miles west. He was then (?) of his home.
(16) 5 miles east (17) 5 miles west (18) 13 miles east (19) 13 miles west

41 If the following words were rearranged to make the best sentence, with what letter would the *last* word of the tence begin?
men deep the a trench dug long
(21) d (22) l (23) t (24) s (25) m

42 A pitcher is to cream as a bowl is to —
(26) baseball (27) a saucer (28) coffee (29) sugar (30) a dish

43 If the following words were rearranged to make the best sentence, the *last* word of the sentence would begin with letter?
cook the pie a made apple deep
(31) c (32) p (33) a (34) d (35) m

44 A very strong feeling of affection is called —
(36) sympathy (37) pity (38) admiration (39) love (40) esteem

(Go on to the next

IOWA EVERY-PUPIL TESTS OF BASIC SKILLS

New Edition

97
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TEST D: BASIC ARITHMETIC SKILLS — FORM N

ELEMENTARY BATTERY — GRADES 3-4-5

By

H. F. SPITZER, in collaboration with ERNEST HORN, MAUDE MCBROOM, H. A. GREENE, and E. F. LINDQUIST (General Editor), all of the College of Education, State University of Iowa, with the Assistance of the Faculty of the University Experimental Schools.

CONVERSION TABLES *

I

Raw Score	Grade Equivalents Pt. I	Pt. II	Pt. III
35	----	72	----
34	----	69	----
33	----	67	----
32	----	63	----
31	----	62	----
30	----	60	----
29	----	59	----
28	----	58	----
27	100	57	96
26	94	56	88
25	85	55	80
24	73	54	72
23	70	53	70
22	66	52	65
21	63	51	64
20	61	50	61
19	59	48	59
18	58	47	57
17	56	46	55
16	53	44	52
15	51	43	50
14	50	42	48
13	47	41	46
12	44	40	45
11	42	39	43
10	40	37	42
9	38	36	40
8	36	35	38
7	34	34	36
6	31	33	34
5	28	31	32
4	26	30	30
3	24	28	28
2	22	27	26
1	21	25	24
0	18	24	22

II

Raw Score	Total Scores Raw Score	Grade Equiv.	Raw Score	Grade Equiv.
35	89–76		59–55	29–39
34	88–74		58–54	28–39
33	87–72		57–54	27–38
32	86–71		56–53	26–38
31	85–70		55–53	25–37
30	84–69		54–52	24–37
29	83–68		53–52	23–36
28	82–67		52–51	22–35
27	81–66		51–51	21–35
26	80–65		50–50	20–34
25	79–65		49–50	19–33
24	78–64		48–49	18–33
23	77–64		47–48	17–32
22	76–63		46–48	16–31
21	75–63		45–47	15–31
20	74–62		44–47	14–30
19	73–62		43–46	13–29
18	72–61		42–46	12–29
17	71–61		41–45	11–28
16	70–60		40–45	10–27
15	69–60		39–44	9–27
14	68–59		38–44	8–26
13	67–59		37–43	7–25
12	66–59		36–43	6–24
11	65–58		35–42	5–24
10	64–58		34–42	4–23
9	63–57		33–41	3–22
8	62–57		32–41	2–22
7	61–56		31–40	1–21
6	60–56		30–40	0–20

* See Examiner's Manual, page 6.

Do not turn this page until you are told to do so.
Your teacher will tell you what to do.

Name _____
(LAST NAME) (FIRST NAME)

Sex _____ Grade _____ Date _____
(BOY OR GIRL)

Age on Last Birthday _____ Number of Months Since Last Birthday _____
(YEARS)

Town or City _____

School _____

Teacher _____

SCORES

	Poss. Score	Raw Score	Grade Equivalent	
PART I: VOCABULARY AND FUNDAMENTAL KNOWLEDGE	(27)			
II: FUNDAMENTAL OPERATIONS	(35)			
III: PROBLEMS	(27)			
TOTAL	(89)			

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PART I

VOCABULARY AND FUNDAMENTAL KNOWLEDGE

Directions: Each of the questions in this test is followed by four possible answers. Only one of these answers is correct or better than any of the others. Place an **X** in the box in front of the answer that you think is best.

Sample:

0. How many inches in a foot?

- ☐ 1
- ☐ 8
- ☐ 5
- ☐ 12

---

1. Twelve quarts are how many gallons?

- ☐ 2
- ☐ 4
- ☐ 3
- ☐ 6

2. Which of these is five thousand two hundred one?

- ☐ 5201
- ☐ 52001
- ☐ 5210
- ☐ 5000201

3. What is a pound?

- ☐ It is a measure of length
- ☐ It is something heavy
- ☐ It is about a quart
- ☐ It is sixteen ounces

4. For what does the 5 in 51 stand?

- ☐ Five tens
- ☐ Five hundreds
- ☐ Five units
- ☐ Five per cent

5. What time is it by this clock?

- ☐ 9 minutes to 6
- ☐ 15 minutes past 5
- ☐ 25 minutes past 9
- ☐ 15 minutes to 6

6. How many dimes are there in one and one-half dollars?

- ☐ 5
- ☐ 10
- ☐ 15
- ☐ 25

7. Which of these numbers is an odd number?

- ☐ 12
- ☐ 20
- ☐ 25
- ☐ 28

8. How would you read 30,507?

- ☐ Thirty thousand five hundred seven
- ☐ Three hundred five thousand seven
- ☐ Thirty million three hundred seven
- ☐ Three million five hundred seven

9. How much money is here?

pennies

dimes

nickels

a quarter dollar

- ☐ 63¢
- ☐ 9¢
- ☐ 78¢
- ☐ 58¢

10. Into how many thirds can you divide a candy bar?

- ☐ 2
- ☐ 4
- ☐ 3
- ☐ 6

11. Which of these numbers is the largest?

- ☐ 2797
- ☐ 3079
- ☐ 3102
- ☐ 999

A B C D

12. If the line above is a picture of a stick 36 inches in length, how many inches would there be from A to B on such a stick?

- ☐ 3
- ☐ 18
- ☐ 9
- ☐ 36

13. What part of the stick lies between A and C in the picture above?

- ☐ One-half
- ☐ One-fourth
- ☐ One-third
- ☐ One-tenth

---

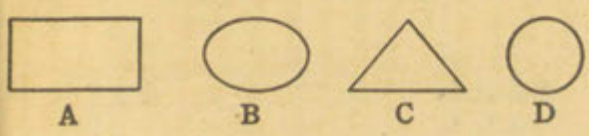
14. Which is the longest distance?

- ☐ A thousand feet
- ☐ Two city blocks
- ☐ Two hundred yards
- ☐ One-half mile

(Go on to the next page.)

How many tens are in two hundred?

- ☐ Two
- ☐ Twenty
- ☐ Ten
- ☐ One hundred



Which of the figures given above is a circle?

☐ A ☐ B ☐ C ☐ D

Which of the figures given above is a rectangle?

☐ A ☐ B ☐ C ☐ D

If you add one bushel to one million bushels, how many bushels will there be?

- ☐ Two million
- ☐ One billion
- ☐ One million one
- ☐ There isn't any number that large

In the rooms of an ordinary house, about how high is the ceiling from the floor?

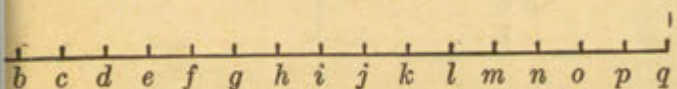
- ☐ 5 feet
- ☐ 17 feet
- ☐ 8 feet
- ☐ 20 feet

What happens to a number like 200 when one of the zeros is taken away?

- ☐ The number becomes 10 units smaller
- ☐ The number is divided by 100
- ☐ The number is divided by 10
- ☐ The value of the number does not change

Which tells you to find the difference between 9 and 5?

- ☐ 5/9
- ☐ 9 − 5
- ☐ 9 + 5
- ☐ 9 × 5



Which of the letters along the line given above is one-fourth of the distance from *a* to *q*?

☐ *b* ☐ *e* ☐ *h* ☐ *m*

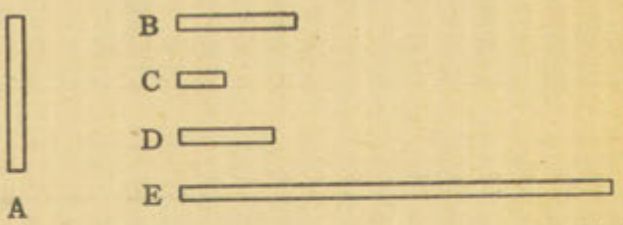
23. In counting a large number of pennies, why is it better to put them in piles of ten and count by tens than to count by ones?

- ☐ Because it is the only way to get the answer
- ☐ Because you do not need to count each penny
- ☐ Because you can't count that far by ones
- ☐ Because you are less likely to make mistakes

24. In working the subtraction problem shown at the right, why can we "borrow" 1 from the 3 and add it to the 6 to get 16, as if the 1 were 10?

$$\begin{array}{r} 36 \\ -\ 19 \\ \hline 17 \end{array}$$

- ☐ Because arithmetic books say it should be done that way
- ☐ Because if you added just 1 to the 6, you would have only 7; and 9 cannot be subtracted from 7
- ☐ Because the 3 stands for 3 tens, so the 1 we borrow really stands for 10
- ☐ Because you would not get 7 in the answer unless you could subtract 9 from 16



25. Which of the lines shown above is about one-third as long as line A?

☐ B ☐ C ☐ D ☐ E

26. What is the area of a square piece of linoleum that is 2 feet on each side?

- ☐ 2 square feet
- ☐ 4 feet square
- ☐ 4 square feet
- ☐ 8 feet square

27. Which of these fractions is the largest?

- ☐ $\frac{1}{3}$
- ☐ $\frac{1}{8}$
- ☐ $\frac{1}{10}$
- ☐ $\frac{1}{6}$

Score on Part I

(Do not go on to the next page until you are told to do so.)

PART II. FUNDAMENTAL OPERATIONS

Directions: Work these examples as quickly as you can, but be very careful not to make mistakes. Write y answer in the answer box.

1 Add

8
5

2 Add

27
4

3 Add

36
67

4 Add

2
8
5
7
9
4
6

5 Add

$ 4.65
1.70
.89
19.06

$

6 Subtract

9
4

7 Subtract

16
9

8 Subtract

50
17

9 Subtract

63
28

10 Subtract

104
57

11 Subtract

$5.34
2.04

$

12 Add

359
671
104
465

13 Subtract

8325
4308

14 Multiply

7
8

15 Multiply

56
4

16 Multiply

947
7

17 Divide

4) 24

18 Divide

6) 366

19 Divide

7)847

20 Multiply

35
26

(Go on to the next pac

1 Multiply

$$\begin{array}{r} 64 \\ \times\ 80 \\ \hline \end{array}$$

2 Multiply

$$\begin{array}{r} 307 \\ \times\ 42 \\ \hline \end{array}$$

3 Multiply

$$\begin{array}{r} 528 \\ \times\ 306 \\ \hline \end{array}$$

4 Divide

$$6 \overline{)\ 4235}$$

5 Divide

$$16 \overline{)\ 3721}$$

26 Divide

$$46 \overline{)\ 2213}$$

27 Add

$$\frac{1}{3} + \frac{1}{3} =$$

28 Add

$$3\frac{3}{4} + 6 =$$

29 Subtract

$$\begin{array}{r} \frac{4}{5} \\ -\ \frac{1}{5} \\ \hline \end{array}$$

30 Subtract

$$\begin{array}{r} 6\frac{5}{6} \\ -\ 2 \\ \hline \end{array}$$

31 Multiply

$$\begin{array}{r} 5763 \\ \times\ 3600 \\ \hline \end{array}$$

32 Multiply

$$\frac{1}{3} \times 6 =$$

33 Add

$$\begin{array}{r} .2 \\ .9 \\ .4 \\ .7 \\ \hline \end{array}$$

34 Multiply

$$8 \times 2\frac{1}{2} =$$

35 Divide

$$342 \overline{)\ 205884}$$

(Do not go on to the next page until you cre told to do so.)

Score on Part II

9

PART III. PROBLEMS

Directions: Work these problems as quickly as you can. Do the work right on this paper and write your answer in the answer box. Be sure to read carefully.

1. For pets, Tom has 5 rabbits, 2 cats, a pony and a dog. How many pets does Tom have?

2. Mother had bought 12 cakes for Mary's party. After each of the children had eaten one, there were still 3 cakes left. How many children were at the party?

3. Grandmother bought a sack of candy for Ann, Bob, and Martha. They shared the candy equally. How many of the 15 pieces in the sack did each of the children get?

4. Betty had 3 story books; Alice had 4 story books; Fred had 2 story books and 2 painting books; and Peter had 5 story books. How many story books did the children have?

5. John worked 8 hours every day for 5 days last week. How many hours did John work last week?

10

6. Robert saves 5 dollars a month from the money earns delivering papers. How many months w it take before he has saved $35?

7. The fourth grade decided to have a valenti party. They spent 35 cents for red paper f decorations, 15 cents for paste, $1.52 for refres ments, and 40 cents for prizes for games. Ho much money did the fourth grade spend for t valentine party?

8. Of the 1217 stamps in Jim's stamp book, 563 a American stamps. How many of the stamps a from other countries?

9. There were 30 boxes of colored pencils in the a room at school. If there were 16 pencils in eac box, how many colored pencils were there?

(Go on to the next page

pencils are 3¢ apiece at the school supply ounter, how many pencils can Tom buy for 15¢?

ast week Ted worked 17 hours in his father's tore. This week he worked 11 hours. On the verage, how many hours did Ted work in a week?

Mabel picked 8 quarts of strawberries for Mrs. ames; Tom picked three-fourths as many as Mabel did. How many quarts of berries did Tom ick?

Some boy scouts started on a hiking trip at 7 o'clock in the morning and came back at 2 o'clock that afternoon. How many hours did the boys hike?

14. On the average, how long did it take the boys to walk one mile if they walked 16 miles in 4 hours?

15. Joe keeps one-fourth of the money he gets for selling magazines. Last week, he sold $4.80 worth of magazines. How much money did Joe earn selling magazines last week?

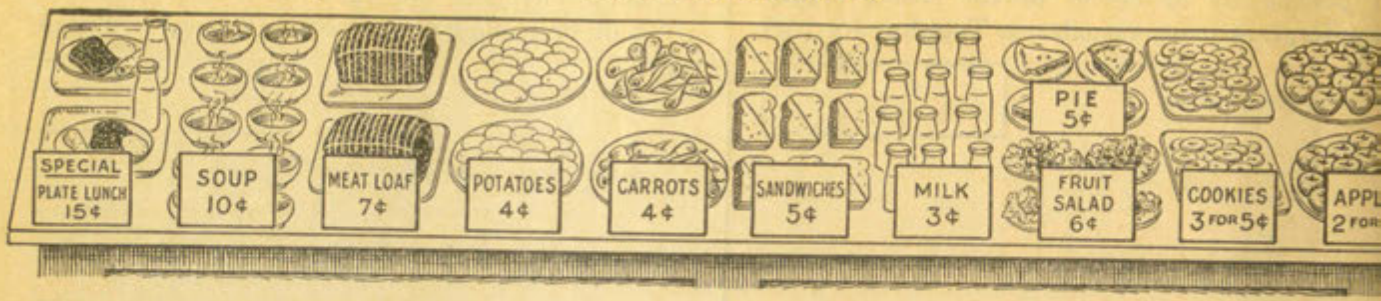
16. Jack wanted to know how far he would have to walk to reach his grandfather's farm. He figured that it was three-fourths of a mile from his home to the corner of town, one-half mile from the corner to the creek bridge, another one-half mile along the creek, and one-fourth of a mile from the creek to grandfather's gate. How far would Jack have to walk?

17. Miss Jones wanted to know how many sheets of paper were in a pile of paper in the school supply cupboard. It was too hard to count them all, so she counted the number of sheets in one inch of the pile. About how many sheets of paper were there if one inch contained 200 sheets and the pile was 13 inches high?

(Go on to the next page.)

13 14

School Lunch Counter



The problems below all use this school lunch counter. Look at the counter to find the cost of the th You do not have to allow for a sales tax.

18. How much would John have to pay for 2 sandwiches?

19. Mary bought a sandwich and 3 cookies. How much did she have to pay?

20. Bob bought 2 apples. If he gave the cashier 25 cents, how much change should he get back?

21. Tom bought 3 sandwiches and a bowl of soup. How much did he have to pay for his lunch?

22. How much would 2 apples and 6 cookies cost?

23. Billy bought a bottle of milk and a piece of How much change should he get back from dime that he paid?

24. Ted Smith paid the bill for himself and his ters. If they each had a "Special Plate Lun and a cookie, how much did Ted have to pay

25. Meat loaf, potatoes, carrots and milk made up "Special Plate Lunch." How much did M save by buying the plate lunch rather than by ting the same things separately at the counter

26. Tom bought a "Special Plate Lunch" and s fruit salad. How much change should he get b from $1.00?

27. Four of the boys decided to buy some things the lunch counter for a picnic after school. T bought 8 sandwiches, 4 apples, and 12 cook What was the total amount they had to pay these things?

(Turn your booklet over and wait until the papers are collect

IOWA EVERY-PUPIL TESTS OF BASIC SKILLS

New Edition

TEST D: BASIC ARITHMETIC SKILLS — FORM L

93

ELEMENTARY BATTERY — GRADES 3-4-5

By

H. F. SPITZER, in collaboration with ERNEST HORN, MAUDE MCBROOM, H. A. GREENE, and E. F. LINDQUIST (General Editor), all of the College of Education, State University of Iowa, with the Assistance of the Faculty of the University Experimental Schools.

CONVERSION TABLES *

Raw Score	Grade Equivalents I Pt. I	Grade Equivalents I Pt. II	Grade Equivalents I Pt. III	Raw Score	Total Scores II Raw Score	Total Scores II Grade Equiv.	Total Scores III Raw Score	Total Scores III Grade Equiv.
35	----	77	----	35	84–87		55–52	27–36
34	----	74	----	34	83–84		54–52	26–36
33	----	72	----	33	82–82		53–51	25–35
32	----	68	----	32	81–79		52–50	24–34
31	----	67	----	31	80–77		51–50	23–34
30	----	65	----	30	79–75		50–49	22–33
29	----	63	----	29	78–74		49–48	21–32
28	----	62	----	28	77–72		48–48	20–32
27	83	60	115	27	76–70		47–47	19–31
26	78	58	110	26	75–68		46–47	18–30
25	74	57	105	25	74–67		45–46	17–29
24	69	54	99	24	73–65		44–45	16–28
23	65	53	93	23	72–64		43–44	15–27
22	61	52	88	22	71–64		42–44	14–27
21	57	50	82	21	70–63		41–43	13–25
20	52	48	77	20	69–63		40–43	12–24
19	49	47	73	19	68–62		39–43	11–24
18	47	46	68	18	67–61		38–42	10–23
17	45	45	63	17	66–60		37–42	9–22
16	43	43	59	16	65–59		36–42	8–21
15	42	43	57	15	64–58		35–41	7–20
14	40	42	54	14	63–57		34–41	6–19
13	38	40	52	13	62–57		33–40	5–18
12	36	39	50	12	61–56		32–39	4–17
11	34	38	48	11	60–56		31–39	3–16
10	33	37	47	10	59–55		30–38	2–15
9	31	36	44	9	58–54		29–38	1–14
8	29	35	43	8	57–54		28–37	0–13
7	28	33	41	7	56–53			
6	25	32	38	6				
5	23	30	36	5				
4	21	28	34	4				
3	19	25	31	3				
2	17	22	27	2				
1	15	20	23	1				
0	13	16	20	0				

* See Examiner's Manual, page 6.

Do not turn this page until you are told to do so.
Your teacher will tell you what to do.

Name _____
(LAST NAME) (FIRST NAME)

Sex _____ Grade _____ Date _____
(BOY or GIRL)

Age on Last Birthday _____ Number of Months
(YEARS) Since Last Birthday _____

Town or City _____

School _____

Teacher _____

SCORES

PART	Poss. Score	Raw Score	Grade Equivalent
I: VOCABULARY AND FUNDAMENTAL KNOWLEDGE	(27)		
II: FUNDAMENTAL OPERATIONS	(35)		
III: PROBLEMS	(22)		
TOTAL	(84)		

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1

PART I

VOCABULARY AND FUNDAMENTAL KNOWLEDGE

Directions: Each of the questions in this test is followed by four possible answers. Only one of these answers is correct or better than any of the others. Place an **X** in the box in front of the answer that you think is best.

Sample:

0. How many inches in a foot?

☐ 1 ☐ 8
☐ 5 ☐ 12

---

1. How many inches in a yard?

☐ 3 ☐ 12
☐ 9 ☐ 36

2. Which of these numbers is the largest?

☐ 1102 ☐ 1088
☐ 589 ☐ 985

3. How many eggs make a dozen?

☐ Two ☐ Twelve
☐ Six ☐ Twenty-four

4. How many dimes make a dollar?

☐ 4 ☐ 20
☐ 10 ☐ 100

5. Which of the following ways of counting is the fastest?

☐ By ones ☐ By fives
☐ By twos ☐ By tens

6. How much money is here?

pennies

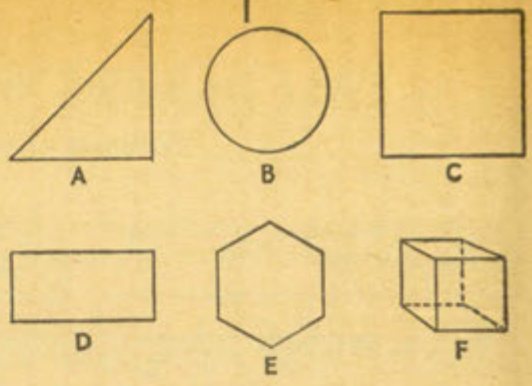
dimes

nickels

a quarter dollar

☐ 9 cents ☐ 59 cents
☐ 44 cents ☐ 75 cents

2



7. Which of the figures is a circle?

☐ A ☐ C
☐ B ☐ D

8. Which of the figures is a square?

☐ A ☐ E
☐ C ☐ F

9. Which of the figures is a triangle?

☐ A ☐ E
☐ D ☐ F

---

10. If you add one dollar to one million dollars, wh is the total number of dollars?

☐ Two million
☐ One billion
☐ There isn't any number that large
☐ One million one

11. In which of these numbers does the 2 stand for tw hundred?

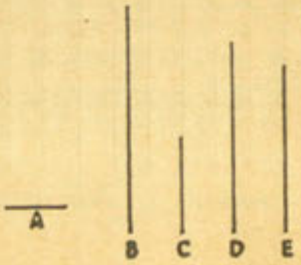
☐ 4296 ☐ 302
☐ 126 ☐ 2806

12. Four pints make how many quarts?

☐ One ☐ Eight
☐ Two ☐ Sixteen

13. Which line is about four times as long as line A

☐ B
☐ C
☐ D
☐ E



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. About how high from the floor is the top of the desk or table on which you are writing?

- ☐ About 10 inches
- ☐ About 35 inches
- ☐ About 25 inches
- ☐ About 50 inches

. What is an inch?

- ☐ It is a part of something
- ☐ It is one-twelfth of a foot
- ☐ It is a yard or a foot
- ☐ It is something very small

. How would you read this number: 60,209?

- ☐ Six thousand two hundred nine
- ☐ Six hundred and twenty-nine
- ☐ Sixty thousand two hundred nine
- ☐ Sixty-two hundred nine

. Which of these is one thousand two hundred six?

- ☐ 12006
- ☐ 1206
- ☐ 1260
- ☐ 1000206

. Which of these is an odd number?

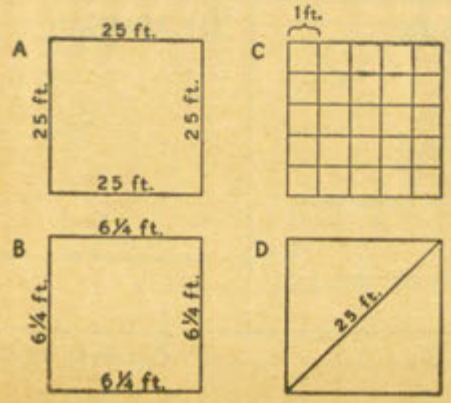
- ☐ 15
- ☐ 16
- ☐ 18
- ☐ 20

. What time is it according to the clock below?

- ☐ 5 minutes after 3
- ☐ 15 minutes after 1
- ☐ 45 minutes after 1
- ☐ 5 minutes after 1

. A garden is 25 ft. square. Which of the figures below is the correct diagram of the garden?

- ☐ A
- ☐ B
- ☐ C
- ☐ D



21. Which of these is the smallest?

- ☐ A bushel
- ☐ A gallon
- ☐ A pint
- ☐ A quart

22. Which of these is the longest distance?

- ☐ A hundred yards
- ☐ A half mile
- ☐ A thousand feet
- ☐ A city block

23. Why is 8 plus 5 always equal to 13?

- ☐ Because 8 is 3 units larger than 5
- ☐ Because 13 is larger than either 8 or 5
- ☐ Because arithmetic books all say so
- ☐ Because 8 units and 5 more units always count up to 13

24. For what does "lb." stand?

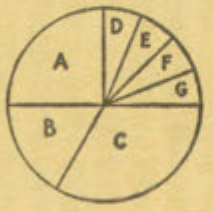
- ☐ Ounce
- ☐ Pound
- ☐ Foot
- ☐ Linear

25. Which of these fractions is the largest?

- ☐ $\frac{1}{4}$
- ☐ $\frac{1}{8}$
- ☐ $\frac{1}{6}$
- ☐ $\frac{1}{20}$

26. Which of these is equal to one-sixth of the whole figure?

- ☐ A
- ☐ B
- ☐ C
- ☐ D



27. If you want to know how much 8 books at 54 cents each will cost, why don't you add?

- ☐ Because adding won't give you the right answer
- ☐ Because multiplying is the quickest way to get the answer
- ☐ Because the numbers would be too big to add
- ☐ Because you multiply when you have one big number and one little one

Score on Part I

(Do not go on to the next page until you are told to do so.)

PART II. FUNDAMENTAL OPERATIONS

Directions: Work these examples as quickly as you can but be very careful not to make mistakes. Write y answer in the answer box.

1 Add

8
6

2 Add

9
8

3 Add

17
6

4 Add

54
38

5 Add

3
4
7
2
5
6
8

6 Subtract

9
3

7 Subtract

16
7

8 Subtract

30
14

9 Subtract

53
27

10 Subtract

103
35

11 Add

174
937
425
801

12 Subtract

4128
2109

13 Multiply

7
6

14 Multiply

84
5

15 Multiply

879
7

16 Divide

4) 12

17 Divide

6) 306

18 Divide

4) 524

19 Multiply

38
62

20 Multiply

504
29

(Go on to the next p

Multiply

$$\begin{array}{r} 623 \\ \times\ 304 \\ \hline \end{array}$$

Add

$$\begin{array}{r} \$\ 3.05 \\ 26.80 \\ .84 \\ 2.21 \\ \hline \end{array}$$

$

Subtract

$$\begin{array}{r} \$\ 8.15 \\ -\ 4.05 \\ \hline \end{array}$$

$

Divide

$$8 \overline{)\ 7265}$$

Add

$\frac{1}{5} + \frac{2}{5} =$

26 Add

$3\frac{3}{5} + 4 =$

27 Subtract

$$\begin{array}{r} \frac{7}{8} \\ -\ \frac{5}{8} \\ \hline \end{array}$$

28 Subtract

$$\begin{array}{r} 6\frac{2}{3} \\ -\ 4 \\ \hline \end{array}$$

29 Multiply

$\frac{3}{4} \times \frac{1}{2} =$

30 Multiply

$1\frac{1}{2} \times 1\frac{1}{3} =$

31 Add

$$\begin{array}{r} .2 \\ .3 \\ .5 \\ .4 \\ \hline \end{array}$$

32 Divide

$$11 \overline{)\ 2336}$$

33 Divide

$$46 \overline{)\ 2483}$$

34 Divide

$4 \div \frac{2}{3} =$

35 Divide

$2\frac{1}{2} \div 1\frac{1}{2} =$

(Do not go on to the next page until you are told to do so.)

Score on Part II

PART III. PROBLEMS

Directions: Work these problems as quickly as you can. Do the work right on this paper and write your answer in the answer box. Be sure to read carefully.

1. Kate has 4 kittens, Helen has 3, and Robert has 5. How many kittens do Kate and Robert have together?

2. "I saw 11 robins on the lawn," said Mary. "There were only 8 when I came in," said Joe. How many robins had come to the lawn since Joe had looked?

3. Peggy has 8 pieces of candy. She shares the candy equally with Nancy, Bob, and John. How many pieces does each child receive?

4. Ralph worked 5 hours on Monday, 4 hours on Wednesday, and 4 hours on Friday. How many hours did he work in all?

5. At 2 cents an ounce, how much will it cost to m a package weighing 13 ounces?

6. If you travel five miles in an hour, how many ho will it take you to travel fifteen miles?

7. In spelling, Jane had 13 words correct on Mond 18 on Tuesday, and 20 on Friday. What was average number correct?

8. There are 6228 books in the library, but 472 them are too old to be used. How many g books are there?

(Go on to the next pa

11

Fred bought one book for $1.57, another for $1.05, a pencil for 35 cents, and some paper for 6 cents. How much money did he spend?

In delivering papers, Jack rides his bicycle 56 miles every week. How many miles does he ride in delivering papers during 37 weeks?

One-fourth of the money in the school library fund belongs to the fifth grade. How much money can the fifth grade spend for books if there is $72.00 in the school library fund?

12

12. As Ted gave the clerk 25 cents, he said, "I want 4 one-cent stamps and the rest in three-cent stamps." How many three-cent stamps should he get?

13. In an apple orchard, there are 60 trees in each row. If there are 24 rows, how many trees are there in the orchard?

14. Four boys went to pick berries. Each boy had a gallon bucket. After picking for half an hour, they stopped to see how many berries they had picked. One boy had his bucket three-fourths full, another had his only one-fourth full, while the other two boys had their buckets about half full. How many gallons of berries had the boys picked?

(Go on to the next page.)

13

14

Grocery Store Display Rack

The problems below all use this grocery display rack. Look at the rack to find the cost of the thing You do not have to allow for a sales tax.

15. How much would Sam have to pay for four apples?

16. John's mother bought one dozen oranges and a bunch of carrots. How much did she have to pay the grocery man?

17. Tom's mother bought only 2 heads of lettuce. She gave the clerk 25¢. How much change should she get back?

18. Mr. Brown bought 2 loaves of bread, 6 buns, and 6 apples. What was the total amount of his bill?

19. How much would 2 bunches of carrots and bunches of radishes cost?

20. Mr. Smith bought a dozen oranges and a loaf bread. If he gave the clerk 50¢, how much chan should he receive?

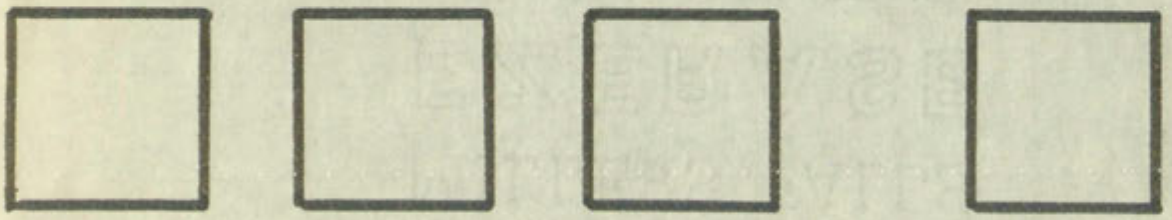
21. How much would Mr. Burns have to pay the cle if he bought 4 heads of lettuce, 9 bunches of ra ishes, and one-half dozen apples?

22. How much would you have to pay for 4 pounds bananas?

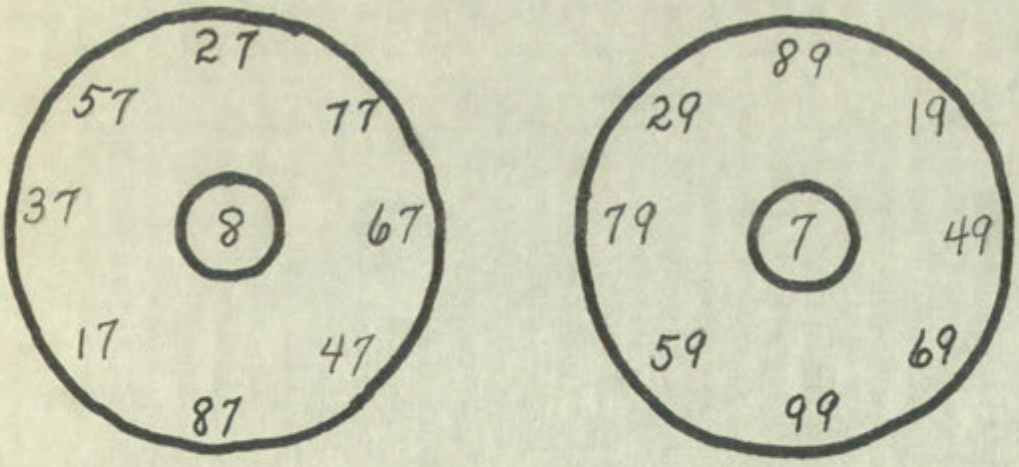
(Turn your booklet over and wait until the papers are collecte

APPENDIX E

1. Counting Blocks

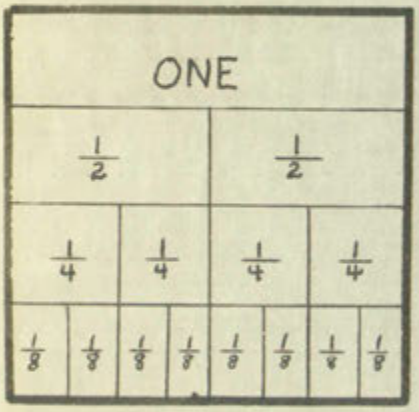


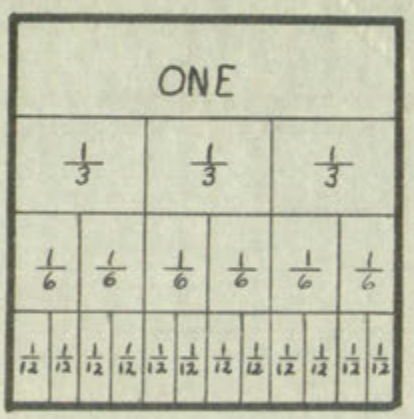
2. Circle Cards



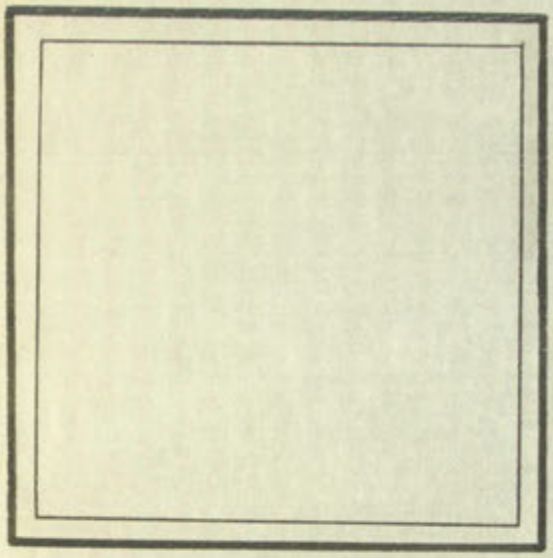
Diagrams of Some of the Teaching Materials

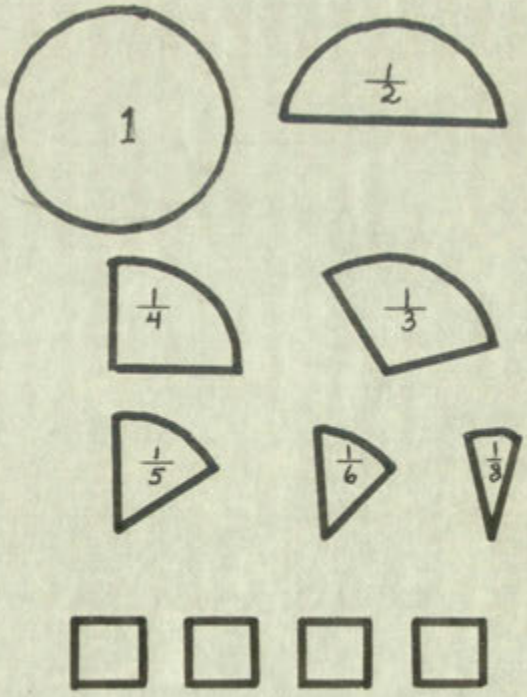
3. Fractional Charts





4. Felt Boards and Felt Circles, Squares, and Fractional Parts





ONE

ONE

1