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ABSTRACT
This volume of the Final Report on the Interpretive Study of Research and Development in Elementary School Mathematics contains materials which are most appropriate for the researcher. Whether he is working at the pre-doctoral level or the post-doctoral level, the researcher has a recurrent need to know the results of previous research, and the status of the topic to be explored. One of the difficulties which any researcher faces is locating those studies which will be of most use to him. Prior to this time, no single source of information on research in elementary school mathematics was available. Instead there were various types of lists, no one of which was complete or current. The compilation of reports of research on elementary school mathematics was begun in a dissertation by Suydam in which 799 reports are categorized, annotated, and evaluated. This volume extends this compilation, with 306 additional reports listed. This represents an updating to include reports published in journals between 1966 and 1968, plus those with pre-1966 publication dates which were not included in the first compilation. (Authors)

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INTERPRETIVE STUDY OF RESEARCH AND DEVELOPMENT IN ELEMENTARY SCHOOL MATHEMATICS

VOLUME 2: COMPILATION OF RESEARCH REPORTS

Marilyn N. Suydam
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The Pennsylvania State University
University Park, Pennsylvania 16802

June 30, 1969

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OVERVIEW

This Final Report of Phase I of the Interpretive Study of Research and Development in Elementary School Mathematics is bound in three volumes. Volume 1 describes the study and presents the summarized findings, in a form which should prove useful to teachers and principals. Volume 2, containing the compilation of categorized research reports, will possibly prove to be primarily of use to researchers. In Volume 3, reports of developmental projects are summarized; those teaching mathematics education courses may find these particularly helpful.

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VOLUME 2

PART III: COMPILATION OF RESEARCH REPORTS

Introduction

This volume of the Final Report on the Interpretive Study of Research and Development in Elementary School Mathematics contains materials which are most appropriate for the researcher. Whether he is working at the pre-doctoral level or the post-doctoral level, the researcher has a recurrent need to know the results of previous research, and the status of the topic to be explored. One of the difficulties which any researcher faces is locating those studies which will be of most use to him. Prior to this time, no single source of information on research in elementary school mathematics was available. Instead there were various types of lists, no one of which was complete or current.

The compilation of reports of research on elementary school mathematics was begun in a dissertation by Suydam[1] in which 799 reports are categorized, annotated, and evaluated. This volume extends this compilation, with 306 additional reports listed. (This number includes instances of a single article containing two or more research reports.) This represents an updating to include reports published in journals between 1966 and 1968, plus those with pre-1966 publication dates which were not included in the first compilation.

Need for Evaluation of Research

Scrutiny of the literature reveals that, through the years, there have been many complaints about the deficiencies of educational research. Since research efforts vary widely in quality, the question of how much confidence can be placed in the findings of a study is one of considerable importance. Because of this, a comprehensive compilation and synthesis must contain an evaluative component. This is one of the

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1 Suydam, Marilyn N. An Evaluation of Journal-Published Research Reports on Elementary School Mathematics, 1900-1965. (Unpublished doctoral dissertation.) The Pennsylvania State University, 1967.

significant characteristics of the present study (as well as the previous one).

It might be noted that questionnaires, which were answered by mathematics editors of elementary school textbooks and college professors of courses on the teaching of elementary school mathematics, strongly indicated the need for knowledge of studies and research findings which are valid. With the vast amount of material being published, it is increasingly important to sift the important from the unimportant, the generalizable from the non-generalizable, the good from the poor.

Instrument for Evaluating Experimental Research Reports (Marilyn N. Suydam)

The Instrument for Evaluating Experimental Research Reports was developed as part of a dissertation[2] and a previous U.S.O.E. project[3] to serve as a tool in evaluating one significant type of research. The comments and criticisms made by researchers through the years were collated; nine points were found to be repeated again and again:

(1) Importance or significance of the problem
(2) Definition of the problem
(3) Design of the study
(4) Control of variables
(5) Sampling procedures
(6) Use of instruments
(7) Analysis of data
(8) Interpretation of results
(9) Reporting of the research

These nine points form the basis for the questions which comprise the instrument. In addition, certain "key points" are provided for consideration in ascertaining a rating for each question, with a pair of

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[2] Ibid.

[3] Suydam, Marilyn N. Compilation of Research Results in Elementary Arithmetic Since 1900. Final Report, Small Grants Project, U. S. Office of Education, 1967.

adjectives intended to focus the attention of all raters on the same pertinent aspects of each question. The Instrument is included in Appendix B.

Two investigations of the degree of reliability of interrater agreement which could be expected in the use of the instrument have been reported.[4] In the first study, the interrater agreement was found to be .91, while the coefficient of reliability which provides a measure of the consistency probable with a single rater using the instrument is .77. In the second and more extensive study, the interrater agreement was .94, while the coefficient for a single rater was .57.

The Instrument for Evaluating Experimental Research Reports was previously applied to 246 reports of research on elementary school mathematics. Use of it in the present study is on additional reports.

Instrument for Evaluating Survey Research Reports (Richard L. Kohr)

The Instrument for Evaluating Survey Research Reports was developed for use in this project. It was constructed by abstracting the major questions and subsumed key points from numerous articles and books dealing with survey methodology. In form, it parallels the Instrument for Evaluating Experimental Research Reports, but it differs in its emphasis on specific aspects. It is included in Appendix C, together with directions for its use, addenda to be used for interpretation, and an expanded report of a test for reliability.

This test indicates that the estimate of reliability for interrater agreement varies from .80 to .95, depending on the group of judges being considered. For the combined group, the coefficient is .80, while for the group of judges who rated the survey reports in this volume, it is .95. For single raters, the estimates range from .34 to .86, with the group of judges involved in the present work attaining .86.

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4 Suydam, Marilyn N. An Instrument for Evaluating Experimental Educational Research Reports. Journal of Educational Research 61: 200-203; January 1968.

Explanation of Coding for the Compilation

The format is the one used in the previous project, so that the printed form of these materials is consistent. Each page indicates the mathematical topic at the top; the list of these topics, developed pragmatically from the subject and the research, are listed in Appendix D. The pages are grouped by topic, with studies listed in alphabetical order by authors' last names. Cross references are included whenever appropriate. When a topic is skipped, it indicates no reports were categorized under that topic in the present list, though some were so categorized in the previous list. After each primary reference, the major findings or conclusions of the study are presented, and, when appropriate, the primary independent and dependent variables are then noted. After this, there are two or three lines which present, when it is appropriate to the type and when ascertained from the report, information for the following ten categories, including the results of evaluation with one of the two instruments and assignment to a final evaluative category.

1. Type of study: Many categories have been suggested by writers in the field of educational research. Similarities and differences from the definitions of categories used by others will be found. The definitions of descriptive, survey, case study, action, correlation, ex post facto and experimental developed for use in this study may be found in Appendix E.

2. Design paradigm: The initial source of paradigms, or basic models which approximate a description of the procedures, was Campbell and Stanley[5]. However, modifications and additions were necessary in order to classify actual research. Sparks[6] has given more precise explanations of each of the paradigms, listed in Appendix F.

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[5] Campbell, Donald T. and Stanley, Julian C. Experimental and Quasi-Experimental Designs for Research on Teaching. In Handbook of Research on Teaching. (Edited by N. L. Gage.) Chicago: Rand McNally and Co., 1963. Pp. 171-246.

[6] Sparks, Jack N. Research Paradigms. Monograph prepared for Pennsylvania Department of Public Instruction, 1967.

3. Sampling procedure: The three essentials in sampling involve identification of (1) the population, (2) the sample and how it was selected, and (3) how treatments were assigned to the sample groups. These are presented by using the numeral which corresponds to the above aspect, and then a symbol: only (used after 1 when only the population was identified); r, for random; m, for matched; s, for selected; a, for all; and i, for insufficient information.

4. Sample size: This is stated in terms of the total number of pupils and/or classes which were involved in analysis of the data.

5. Statistical procedure: The basic list of the type of statistical procedure, formula, or method used in a study was that proposed by Tatsuoka and Tiedeman[7]. As additional procedures were found to be used in the research reports, they were included in the list, presented in Appendix G. The basic division is between descriptive and inferential statistics. Descriptive statistics do not (readily) lend themselves to generalization, while this is one of the characteristics generally applied to inferential statistics.

6. Grade level: The grade level of the pupils with whom the research was conducted is noted. When no grade level was specified, either age level or grade level to which the findings are applicable might be noted.

7. Duration: The time involved in conducting the research study is noted, with retention interval (if any) stated separately.

8. Type of test: "Norm" indicates that the test used in the study is a standardized instrument, for which data on a large sample or samples are available. "Non-norm" indicates a test for which such data are not available. In the majority of these cases, the test was constructed by the researcher.

9. Qualitative value: This information was obtained by application of either the Instrument for Evaluating Experimental Research

[7] Tatsuoka, Maurice M. and Tiedeman, David V. Statistics as an Aspect of Scientific Method in Research on Teaching. In Handbook of Research on Teaching. (Edited by N. L. Gage). Chicago: Rand McNally and Co., 1963. Pp. 142-170.

Reports or the Instrument for Evaluating Survey Research Reports. The sum of the numerical scores assigned to each question may be considered as a basis for some degree of comparison. A total of 9 to 12 would indicate that the report seems excellent in terms of the criteria; 13 to 20, very good; 21 to 28, good; 29 to 36, fair; and 37 to 45 poor. It should be recognized that the primary use of these scores should be to serve as an <u>indication</u> of the degree of validity to be expected from the findings as projected from the report.

10. <u>Evaluative category</u>: The experimental research has been assigned to a composite evaluative category. This index is included to aid the reader in locating those studies which may best meet his purposes. The symbols "EPD," "ED," "EP," and "NE" represent:

EPD - Purpose, type of study, design, and statistical procedures seem sound and pertinent to curriculum today under the stated definition of experimental research.

ED - Type of study, design, and statistical procedures seem sound and pertinent to curriculum today under the stated definition of experimental research, but the purpose does not seem pertinent.

EP - Purpose seems pertinent to curriculum today, but type of study, design, and/or statistical procedures do not seem sound and/or accurate today under the stated definition of experimental research.

NE - The study is not considered experimental research under the stated definition.

The coding which is used parallels the alphanumeric designations on the outlines of categories presented in Appendices D, E, F, and G. Dashes are used to indicate that information is not available and/or not applicable.

An example of how this information will be presented on the pages which follow is contained in Figure 1.

e; 3.4; 2) s, 3) r; 5 classes; 3.2; gr. 4; 5 wks.; norm;
27 (3, 2, 3, 3, 2, 4, 3, 4, 3); EPD.

Figure 1.

CODED INFORMATION FORMAT FOR THE TEN CATEGORIES

Each bit of information refers to one of the ten points, in order. What this indicates is illustrated or interpreted in Figure 2.

A bibliography which merges this listing and the previous compilation will be found in Appendix A.

	Information	Given "code"	"Translation" from lists
1.	Type of study	e	experimental
2.	Design paradigm	3.4	pretest-posttest, insufficient information about sampling
3.	Sampling procedure	2) s, 3) r	sample selected (means unknown), randomly assigned to treatment
4.	Sample size	5 classes	5 classes
5.	Statistical procedure	3.2	analysis of variance
6.	Grade level	gr. 4	grade 4
7.	Duration	5 wks.	5 weeks
8.	Type of test	norm	normative test
9.	Qualitative value	27 (3, 2, 3, 3, 2, 4, 3, 4, 3)	total value, 27; other numerals are those assigned to each question on the Instrument for Evaluating Experimental Research Reports
10.	Evaluative category	EPD	purpose, type of study, design, and statistical procedure seem sound and pertinent to curriculum today under the stated definition of experimental research

Figure 2.

EXAMPLE OF DECODED INFORMATION
FOR THE TEN CATEGORIES

Historical development and
procedures (a-1)

Judd, Charles Hubbard. Psychological Analysis of the Fundamentals of Arithmetic. Suppl. Ed. Monog. 32: 1-15; Feb. 1927 (1st of 6 parts).

Methods employed by individuals and systems employed by different societies for counting and analyzing number ideas are discussed.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Bradley, R. C. and Earp, N. Wesley. The Effective Teaching of Roman Numerals in Modern Mathematics Classes. Sch. Sci. Math. 66: 415-420; May 1966. (see c-15)

Bassler, Otto C. Intermediate Versus Maximal Guidance - A Pilot Study. Arith. Teach. 15: 357-362; Apr. 1968.

A pilot study was carried out to gain insight into the relative effects of two methods of instruction, intermediate guidance and maximal guidance, upon achievement and transfer tasks, measured by post and retention tests. Results were used to formulate several hypotheses for future investigation.

(I) maximal or intermediate guidance in instructional process; ability level. (D) achievement score; horizontal and vertical transfer; posttest and retention.

e; 3.8; 1) only; 10 pupils; 1.4, 1.6; gr. 2; retention after 4 wks.; non-norm; 31 (2, 3, 4, 4, 5, 4, 4, 3, 2); EP.

Brownell, William A. Arithmetic in Grades I and II. Duke U. Studies in Ed. 6: 1-175; 1941 (3rd of 5 chapters).

A systematic program of arithmetic instruction was evaluated for accuracy of response and procedures used for addition and subtraction. Students showed definite growth in terms of objectives.

s; ---; 2) s, 3) a; 503 pupils in 21 classes; 1.1, 1.3, 1.6, 1.8, 1.10; grs. 1-2; 1 yr.; non-norm; 27 (2, 2, 3, 3, 4, 4, 5, 2, 2); NE.

Brownell, William A. Conceptual Maturity in Arithmetic Under Differing Systems of Instruction. El. Sch. J. 69: 151-163; Dec. 1968. (see d-3)

Brownell, William A. and Moser, Harold E. Meaningful vs. Mechanical Learning: A Study in Grade III Subtraction. Duke U. Studies in Ed. 8: 1-207; 1949.

Four combinations of the independent variables were administered to equated groups in each of the three cities. Findings were:

1) Children with limited meaningful arithmetic backgrounds did better with decomposition.

2) Mechanical instruction seemed to work best with equal-addition.

3) Crutches were most effective with decomposition and were discarded by most children.

4) Meaningful teaching aided understanding, retention and transfer.

5) Previous meaningful arithmetic learning facilitates new learning, providing readiness.

6) Meaningful teaching of the decomposition method would seem to be the preferred.

(I) subtraction by decomposition or equal addition, meaningful or mechanical instruction. (D) rate, accuracy, understanding, transfer, smoothness of performance.

e; 2.9; 2) s, 3) m; 1,400 pupils; 1.1, 1.4, 1.6, 3.4; gr. 3; 15 days; 1 month retention; norm, non-norm; 16 (1, 1, 2, 3, 2, 2, 3, 1, 1); EPD.

Cronin, Robert Emmet. The Effect of Varying Amounts of Traditional and Modern Mathematics Instruction Relative to Sex and Intellectual Ability on Both the Traditional and Modern Mathematics Achievement of Eighth Grade Pupils. Catholic Ed. R. 65: 548-549; Dec. 1967. (see f-3a)

Feldhake, Herbert J. Student Acceptance of the New Mathematics Programs. Arith. Teach. 13: 14-19; Jan. 1966. (see a-4)

Friebel, Allen C. Measurement Understandings in Modern School Mathematics. Arith. Teach. 14: 476-480; Oct. 1967.

Students taught by S.M.S.G. maintained achievement similar to those in the traditional program, but achieved significantly superior growth in arithmetic reasoning and on measurement.

(I) S.M.S.G. or traditional program. (D) achievement gain scores.

e; 2.4; 2) s, 3) r; 171 pupils in 6 classes; 1.4, 2.6, 3.2, 3.4;

gr. 7; 1 yr.; norm, non-norm; 19 (2, 2, 3, 2, 1, 3, 1, 3, 2); EPD.

Grafft, William D. and Ruddell, Arden K. Cognitive Outcomes of the S.M.S.G. Mathematics Program in Grades 4, 5, and 6. Arith. Teach. 15: 161-165; Feb. 1968.

Nonparametric comparison of three years of instruction with S.M.S.G. or California State Arithmetic materials found 1) no significant difference in computation. High and average I.Q. and achievement groups using S.M.S.G. materials showed 1) an increase in understanding of multiplication principles and 2) greater achievement in a new arithmetic learning situation.

(I) S.M.S.G. or California State Arithmetic Program; high, average, or low I.Q.; arithmetic achievement. (D) multiplication computational achievement; understanding of principles of multiplication (achievement and interview); achievemert in learning advanced mathematics.

F; ---; 1) s, 2) a, 3) r; 482 pupils in 29 classes, 22 schools;

1.13, 4.4; gr. 6; 3 yrs.; norm, non-norm; 23 (1, 2, 3, 3, 4, 3,

3, 2, 2); NE.

Henderson, Kenneth B. and Rollins, James H. A Comparison of Three Stratagems for Teaching Mathematical Concepts and Generalizations by Guided Discovery. Arith. Teach. 14: 503-508; Nov. 1967.

Three inductive stratagems were found to be effective in teaching concepts and generalizations.

(I) three inductive stratagems. (D) achievement scores.

e; 2.16; 2) s, 3) r; 150 pupils; ---; gr. 8; 3 days; norm,

non-norm; 29 (1, 3, 4, 3, 2, 3, 5, 4, 4); EP.

Houston, W. Robert and DeVault, M. Vere. Mathematics In-service Education: Teacher Growth Increases Pupil Growth. Arith. Teach. 10: 243-247; May 1963. (see t-5)

Hungerman, Ann D. Achievement and Attitude of Sixth Grade Pupils in Conventional and Contemporary Mathematics Programs. Arith. Teach. 14: 30-39; Jan. 1967.

Conclusions are:

1) Achievement data significantly favored the non-S.M.S.G. group in the test of conventional arithmetic and the S.M.S.G. in the test of contemporary mathematics.

2) Achievement in both groups was found to have a marked positive relationship to intelligence.

3) Attitude toward mathematics was similarly positive in both groups.

4) Socio-economic level demonstrated little or no relationship to either achievement or attitude toward mathematics.

(I) S.M.S.G. or conventional programs. (D) achievement, attitude scores.

F; ---; 2) s, 3) s, 565 pupils in 20 classes; 1.4, 3.2, 3.3, 3.4,

3.5, 6.4; grs. (4, 5), 6; 3 yrs.; norm; 33 (3, 3, 4, 4, 4, 3,

5, 4, 3); NE.

Lerch, Harold H. and Kelly, Francis J. A Mathematics Program for Slow Learners at the Junior High Level. Arith. Teach. 13: 232-236; Mar. 1966. (see e-2)

Meconi, L. J. Concept Learning and Retention in Mathematics. J. Exp. Ed. 36: 51-57; Fall 1967. (see: Meconi, L. J. The Mathematically Gifted Student and Discovery Learning. Math. Teach. 60: 862-865; Dec. 1967.)

High ability pupils learned and retained effectively the necessary concepts for problem solving performance and retention regardless of instructional method (rule and example, guided discovery, or rule).

(I) three instructional methods. (D) achievement, retention scores.

e; 2.21; 2) s, 3) r; 45 pupils; 1.4, 3.2; grs. 8, 9; 2-3 days (retention after 4 wks.); non-norm; 23 (1, 2, 3, 3, 3, 4, 3, 2, 2); EPD.

Morfitt, Margaret D. K. Comparison of Individual-Concrete Methods and Class Methods in the Teaching of Arithmetic. Br. J. Ed. Psychol. 7: 196-203; June 1937.

This study investigated the difference among a Montessori school, a traditional school, and a special school in "concrete" estimations. Results indicate type of instruction did not affect speed, and children trained in "concrete" situations seemed to show higher performance.

(I) Montessori, traditional, or special instruction.
(D) responses to "spot" and "multiplication" test.

F; ---; 1) only; ---; 1.4; ---; ---; non-norm; 37 (2, 3, 5, 5, 5, 5, 4, 4, 4); NE.

Paige, Donald D. A Comparison of Team Versus Traditional Teaching of Junior High School Mathematics. Sch. Sci. Math. 47: 365-367; Apr. 1967.

Team teaching appeared to be more successful at eighth grade level than at seventh grade; eighth graders indicated they received more individual help in team classes. Neither grade indicated team teaching as a favorite form of instruction.

(I) team teaching or single-teacher methods. (D) achievement, retention, attitude scores.

a; ---; 2) m; 300 pupils; 2.6, 3.15; grs. 7, 8; 1 semester; ---; ---; NE.

Pate, Robert Thomas. Transactional Pattern Differences Between School Mathematics Programs. Arith. Teach. 13: 21-25; Jan. 1966.

This study investigated differences between traditional and S.M.S.G. teaching and found, among other things, that S.M.S.G. teachers ask questions for comprehension, and traditional teachers recall; differences do occur in teacher-pupil interaction.

s; ---; 1) s, 2) s, 3) a; 40 classes; 1.3, 3.15; gr. 4; ---;

non-norm; 31 (2, 3, 4, 4, 4, 4, 4, 3, 3); NE.

Price, Edette B.; Prescott, Arthur L.; and Hopkins, Kenneth D. Comparative Achievement with Departmentalized and Self-Contained Classroom Organization. Arith. Teach. 14: 212-215; Mar. 1967.

No significant differences in arithmetic achievement scores were found for groups who were in departmentalized or self-contained classrooms.

(I) departmentalized or self-contained classrooms. (D) achievement difference scores.

e; 3.21; 2) s, 3) a; 173 pupils; 1.4, 3.3, 3.5; gr. 5; 9 months;

norm; 18 (1, 3, 2, 2, 3, 2, 2, 1, 2); EPD.

Rainey, Dan S. and Kelley, Francis J. An Evaluation of a Programmed Textbook with Educable Mentally Retarded Children. J. Excep. Child. 34: 125-126; Oct. 1967. (see e-2)

Retzer, Kenneth A. and Henderson, Kenneth B. Effect of Teaching Concepts of Logic on Verbalization of Discovered Mathematical Generalizations. Math. Teach. 40: 707-710; Nov. 1967. (see c-13)

Reys, Robert E. and Knowles, Lois. What is the Status of Elementary School Mathematics? El. Sch. J. 68: 167-171; Jan. 1968. (see d-1)

Schott, Andrew F. New Tools, Methods for Their Use, and a New Curriculum in Arithmetic. Arith. Teach. 4: 204-209; Nov. 1957. (see d-3)

Scott, Lloyd F. Summer Loss in Modern and Traditional Elementary School Mathematics Programs. Calif. J. Ed. Res. 28: 145-151; May 1967.

While most children have some summer loss, there is no systematic relationship between amount of loss and type of program (modern or traditional).

(I) effect of G.C.M.P. or traditional programs after 1 summer. (D) retention.

a; ---; 1) only; 332 pupils in 16 classes; 1.4, 3.3, 3.5; grs. 1-6;

1 summer; norm, non-norm; ---; NE.

Sloan, Fred A., Jr. and Pate, Robert Thomas. Teacher-Pupil Interaction in Two Approaches to Mathematics. El. Sch. J. 67: 161-167; Dec. 1966.

Results of observations of the teacher's questions and functions, and pupil's responses, occurring in classes using modern mathematics materials or traditional materials, were compared. Teachers using modern mathematical materials showed more use of: 1) recall and demonstration-of-skill questions, 2) content development, 3) analysis and comprehension questions.

(I) S.M.S.G. or traditional program. (D) patterns of teacher-pupil interaction.

F; ---; 2) s; 40 classes; 1.6, 2.6; gr. 4; 2 observations; non-

norm; 26 (2, 2, 2, 4, 4, 3, 3, 4, 2); NE.

Ter Keurst, Arthur J. Rote Versus Discovery Learning. Sch. and Commun. 55: 42, 44; Nov. 1968.

This study seemed to show that rote-learning and discovery cannot be isolated from one another and attempts to show superiority are simply distinctions of degree.

(I) instruction in average summing; sex; I.Q. (D) achievement scores.

e; 2.2; 1) s, 2) s, 3) s; 26 pupils; 1.4, 3.4; gr. 4; 3 wks.;

non-norm; 37 (3, 4, 4, 5, 4, 5, 5, 4, 3); EP.

Worthen, Blaine R. Discovery and Expository Task Presentation in Elementary Mathematics. J. Ed. Psychol. 59: 1-13; Feb. 1968.

Instruction with materials that differed in respect to discovery or expository sequencing, with many variables controlled, resulted in: 1) superior initial learning for expository method; 2) superior retention and transfer of heuristics (problem-solving set) for discovery method.

(I) method of task presentation--discovery, expository.
(D) attitude, achievement, retention, transfer scores.

e; 2.1; 2) s, 3) m; 432 pupils in 16 classes, 8 schools; 1.4,

1.5, 3.5; grs. 5-6; 6 wks. (after 5 and 11 wks. retention); norm,

non-norm; 11 (1, 1, 1, 1, 2, 2, 1, 1, 1); EPD.

Worthen, Blaine R. A Study of Discovery and Expository Presentation: Implications for Teaching. J. Teach. Ed. 19: 223-242; Summer 1968. (see Worthen, Blaine R. Discovery and Expository Task Presentation in Elementary Mathematics. J. Ed. Psychol. 59: 1-13; Feb. 1968.)

This study compared two task presentations (Discovery) and (Exposition) and found (D) to be significantly superior in retention and transfer.

(I) discovery or expository teaching; equated materials: 1) interjection of knowledge, 2) introduction to generalizations, 3) method of answering questions, 4) interaction, 5) eliminating false concepts. (D) achievement, transfer, retention, attitude scores.

e; 2.1; 2) s, 3) m; ---; 1.4, 1.5, 3.5; ---; ---; norm, non-norm;

13 (2, 1, 1, 2, 2, 2, 1, 1, 1); EPD.

Abrego, Mildred Brown. Children's Attitudes Toward Arithmetic. Arith. Teach. 13: 206-208; Mar. 1966.

Students who liked traditional mathematics also liked an "interim unit on modern mathematics." No relationship was found between attitude and achievement for the small, above-average sample, nor were there differences between boys and girls.

(I) modern or traditional math instruction. (D) attitude scores.

e; 3.19; 1) only; 24 pupils; 3.4, 4.3, 5.2, 6.4; gr. 4; 6 wks.;

non-norm; 33 (2, 4, 5, 5, 5, 3, 2, 4, 3); EP.

Dutton, Wilbur H. Another Look at Attitudes of Junior High School Pupils Toward Arithmetic. El. Sch. J. 68: 265-268; Feb. 1968.

A comparison of 1956 and 1966 junior high pupil attitudes toward arithmetic found a slightly favorable change, the recent group having had new mathematics.

s; ---; 1) only; 300 pupils in 9 classes (1966), 459 pupils

(1956); 1.1, 1.6; jr. high; ---; non-norm; 27 (2, 3, 3, 4, 3, 3,

4, 3, 3); NE.

Feldhake, Herbert J. Student Acceptance of the New Mathematics Programs. Arith. Teach. 13: 14-19; Jan. 1966.

The feelings of upper and average ability students towards new mathematics and chapters of a text were investigated by use of a questionnaire. Results indicated need for improvement in presentation of some chapters and decreased difficulty for comprehension.

s; ---; 1) only; 427 pupils in 13 classes; 2.6, 5.2, 6.5; gr. 7;

---; non-norm; 33 (2, 3, 4, 5, 4, 5, 4, 3, 3); NE.

Hudgins, Bryce B. and Loftis, Lorraine. The Invisible Child in the Arithmetic Class: A Study of Teacher-Pupil Interaction. J. Genet. Psychol. 108: 143-152; Mar. 1966.

The amount and kind of interaction between pupils and teachers was investigated with reference to pupils identified as: 1) high ability, recognized by peers; 2) high ability not recognized by peers; 3) average in ability and recognition. Visible and invisible pupils did not differ from each other but differed from the average in amount of initiated interaction. Teachers initiated interaction more frequently with average pupils.

(I) visible pupils: high ability, recognized by peers; invisible pupils: high ability, not recognized by peers; average pupils. (D) quantity and kind of interaction or lack of.

F; ---; 2) s, 3) all; 31 pupils in 12 classes, 12 teachers; 1.4,

3.4; grs. 5, 6; 4 observations; non-norm; 24 (2, 2, 3, 3, 3, 3,

4, 2, 2); NE.

Hungerman, Ann D. Achievement and Attitude of Sixth-Grade Pupils in Conventional and Contemporary Mathematics Programs. Arith. Teach. 14: 30-39; Jan. 1967. (see a-3)

Lerch, Harold H. Arithmetic Instruction Changes Pupils' Attitudes Toward Arithmetic. Arith. Teach. 7-8: 117-119; Mar. 1961. (see e-4)

Maertens, Norbert. Effects of Arithmetic Homework Upon the Attitudes of Third Grade Pupils Toward Certain School-Related Structures. Sch. Sci. Math. 68: 657-662; Oct. 1968. (see a-5e)

Burton, Cassie B. Results of Definite Drill in Four Fundamental Processes as Shown by the Woody-McCall Mixed Fundamentals. Yrbk. of Dept. El. Sch. Prin. 5: 323-328; 1925.

This study investigated the effect of drill on the four fundamental processes and found drill to be effective if meaningful.

(I) drill work in four fundamental processes. (D) achievement gain scores.

F; ---; 2) a, 3) a; 2,560 pupils; 1.3; grs. 3-8; 6 wks.; norm;

39 (3, 4, 4, 5, 5, 5, 5, 4, 4); NE.

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926 (5th of 7 parts). (see e-1)

Kirby, - - -. Practice in the Case of School Children. Columbia Studies in Ed. 3: 1-98; 1913.

This study investigated the effects of varying intervals of practice in addition and division. In addition, practice increased the amount but not the accuracy. In division, both amount and accuracy increased with practice. Both addition and division gains were greatest with shortest intervals of practice. The author also demonstrated that after several months' interval, a 30-minute practice restored peak performance.

(I) practice time on sheets. (D) achievement gain scores.

e; 2.11; 2) s, 3) a; 1,350 pupils in 39 classes; 1.3, 1.5, 1.8;

grs. 3-4; 2 yrs.; norm, non-norm; 20 (2, 1, 2, 2, 3, 3, 3, 2, 2);

EPD.

Lutes, Olin S. An Evaluation of Three Techniques for Improving Ability to Solve Arithmetic Problems. U. Iowa Monog. in Ed. 6: 1-41; June 1926.

This study investigated the effect of specific drill on errors of a) principle, b) comprehension, and c) computation and found: 1) More intelligent students gain more from drill; 2) Drill in computation had greatest gain; 3) All groups gained, including control; 4) Motivation is most important; 5) Computational improvement aids other areas.

(I) three "drill" techniques. (D) problem solving gain scores.

e; 2.11; 1) only; 256 pupils; 1.4, 1.5, 6.4; gr. 6; 12 wks.;

norm; 17 (1, 2, 2, 2, 3, 2, 2, 2, 1); EPD.

Meddleton, Ivor G. An Experimental Investigation Into the Systematic Teaching of Number Combinations in Arithmetic. Br. J. Ed. Psychol. 26: 117-127; June 1956.

This study investigated the hypothesis that systematic, short review work in basic math produces significantly higher levels of achievement. The results were confirmatory and the study well done.

(I) teaching method: 1) random, 2) systematic; socio-economic level. (D) achievement gain scores.

e; 2.10; 2) s, 3) m; 252 pupils in 4 classes; 1.4, 3.2, 3.5;

gr. 4; ---; norm, non-norm; 20 (1, 2, 2, 3, 2, 3, 2, 3, 2); EPD.

Merton, Elda L. and Banting, G. O. Remedial Work in Arithmetic. Yrbk. of Dept. El. Sch. Prin. 2: 395-429; 1923. (see e-2)

Pigge, Fred L. Analysis of Covariance in a Randomly Replicated Arithmetic Methods Experiment. J. Exp. Ed. 34: 73-83; Summer 1966. (see b-6)

Pigge, Fred L. Frequencies of Unwritten Algorisms. Arith. Teach. 14: 588-593; Nov. 1967. (see b-6)

Suppes, Patrick; Jerman, Max; and Groen, Guy. Arithmetic Drills and Review on a Computer-Based Teletype. Arith. Teach. 13: 303-309; Apr. 1966.

Practice on arithmetic facts can be presented via a teletype. Difficulty level was found to be related to the type and form of problems. Time to completion and number of errors were found to be positively related.

(I) drill via teletype. (D) number of errors.

a; ---; 1) only; 41 pupils; 1.4, 1.7; gr. 4; 7 wks.; ---; 38

(3, 4, 5, 5, 5, 4, 4, 4, 4); NE.

Wheat, H. Responses of School Children to Conventional Arithmetic Problems. Columbia Studies in Ed. 359: 1-124; 1928. (see a-5b)

Woody, Clifford. Some Investigations Resulting From the Testing Program in Arithmetic: An Investigation to Determine the Influence of Specialized Drill in Reading Upon the Solution of Verbal Problems. Ind. U. Sch. Ed. Bull. 6: 30-39; Apr. 1930 (1st of 3 studies). (see a-5b)

Zahn, Karl G. Use of Class Time in Eighth-Grade Arithmetic. Arith. Teach. 13: 113-120; Feb. 1966. (see b-6)

Bowman, Herbert Lloyd. The Relation of Reported Preference to Performance in Problem Solving. U. Mo. Bull. 30: 1-52; Sept. 1929.

The relationship between pupils' reported preference and actual performance on five types of arithmetic problems, equated in difficulty, was studied. The five types of problems were differentiated by settings of 1) adult activities; 2) children's activities; 3) science; 4) a puzzle; 5) computation. Conclusions reached were: 1) Reported preference correlated with performance at .56; 2) Relationship was not large enough to predict performance from reported preference; 3) Pupils of higher performance and ability evidenced a lower degree of relationship between preference and performance; 4) Lower ability pupils preferred computation problems; 5) Girls showed a higher preference and performance on puzzle and computation problems; boys, on adult, child and science; 6) Of problems involving descriptive situations, the child type was most preferred and successfully performed, and the science type was ranked lowest.

c; ---; 2) s, 3) a; 564 pupils; 1.1, 1.4, 1.6, 5.2, 6.4; grs. 7, 8; 2 months; norm, non-norm; ---; NE.

Brownell, William A. The Effect of Unfamiliar Settings on Problem Solving. Duke U. Studies in Ed. 1: 1-86; 1931.

Investigation of the relative unfamiliarity of a situation for arithmetic problems as a source of special difficulty showed: 1) Accuracy of computation was not affected; 2) Difficulty of problem determines to some extent the influence of the setting; 3) It seemed to take more time to solve with unfamiliar settings; 4) Least skilled pupils were most affected by unfamiliar settings; 5) Generally, unfamiliar settings did not affect responses.

(I) degree of familiarity of problem situation. (D) number correct.

s; ---; 1) only; 256 pupils in 4 schools; 1.1, 1.4, 1.6, 6.4; gr. 5; ---; non-norm; 27 (3, 3, 4, 4, 3, 3, 3, 2, 2); NE.

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926 (5th of 7 parts). (see e-1)

Hudgins, Bryce B. and Smith, Louis M. Group Structure and Productivity in Problem-Solving. J. Ed. Psychol. 57: 287-296; Oct. 1966.

Group solutions to problems were not better than the independent solutions by the most able member of the group if he was perceived to be most able; when he was not so perceived in arithmetic, the group did better. A shift in the group's perception of a low-status high-ability member occurred if the group's scores were not better than the individual's.

(I) ability levels; task: arithmetic or social studies problems; status of pupil (pre-task); S.E.S. (D) number of problems solved: individual, group; status of pupil (post-task).

e; 2.11; 2) s, 3) m; 144 pupils; 1.4, 3.4; grs. 5-8; 1 hr.; norm;

22 (2, 1, 3, 2, 2, 3, 4, 2, 3); EPD.

Lerch, Harold H. and Hamilton, Helen. A Comparison of a Structured-Equation Approach to Problem Solving With a Traditional Approach. Sch. Sci. Math. 66: 241-246; Mar. 1966.

Pupils who studied a structured equation approach to problem solving were better able to program problem solving situations than those who studied a traditional approach, but did not differ on processing ability.

(I) structured equation or "traditional" approach. (D) achievement gain-difference scores for determining program and process.

e; 3.21; 1) only; 45 pupils in 2 classes; 1.4, 3.3, 3.4; gr. 5;

5 months; non-norm; 32 (1, 4, 4, 5, 5, 4, 3, 3, 3); EP.

Lutes, Olin S. An Evaluation of Three Techniques for Improving Ability to Solve Arithmetic Problems. U. Iowa Monog. in Ed. 6: 1-41; June 1926. (see a-5a)

Lyda, W. J. and Duncan, Frances M. Quantitative Vocabulary and Problem Solving. Arith. Teach. 14: 289-291; Apr. 1967.

Direct study of vocabulary contributes to growth in problem solving.

(I) direct study of quantitative vocabulary. (D) achievement gain scores.

e; 1.2; 2) s; 25 pupils; 1.4, 1.5, 3.4; gr. 2; 8 wks.; norm; 38

(3, 4, 4, 5, 4, 5, 4, 5, 4); EP.

Meconi, L. J. Concept Learning and Retention in Mathematics. J. Exp. Ed. 36: 51-57; Fall 1967. (see a-3)

Monroe, Walter S. How Pupils Solve Problems in Arithmetic. U. Ill. Bull. 44: 1-30; 1929.

A series of tests devised to compare pupils responses to different kinds of statements of the same problem resulted in: 1) Technical terminology increased difficulty; 2) Irrelevant data increased difficulty; 3) Concrete settings did not differ from abstract settings in difficulty; 4) Familiar terminology was easiest; 5) Analysis of 250 papers showed little reflective thinking.

s; ---; 2) r, 3) r; 9,256 pupils; 1.1, 1.6; grs. 6-8; ---; non-

norm; 26 (2, 2, 3, 2, 3, 5, 4, 3, 2); NE.

Rimoldi, H. J. A.; Aghi, M.; and Burder, G. Some Effects of Logical Structure, Language, and Age in Problem Solving in Children. J. Genet. Psychol. 112: 127-143; Mar. 1968. (see g-6)

Scott, Ralph and Lighthall, Frederick F. Relationship Between Content, Sex, Grade, and Degree of Disadvantage in Arithmetic Problem Solving. J. Sch. Psychol. 6: 61-67; Fall 1967.

No statistically significant relationship was found between need content of problems and degree of disadvantage of pupils.

r; ---; 2) s, 3) r; 132 pupils; 1.4, 3.2, 6.1, 6.4; grs. 3, 4;

1 day; norm; ---; NE.

Stern, Carolyn. Acquisition of Problem-Solving Strategies in Young Children and Its Relation to Verbalization. J. Ed. Psychol. 58: 245-252; Apr. 1967.

Young children can be taught strategies which will improve their ability to solve certain types of problems. The single hypothesis strategy seemed more effective than the multiple hypothesis one; verbalization had little effect.

(I) two strategy programs: multiple hypothesis or single hypothesis testing (color, shape, size, number); each under two conditions of verbalization: not-speaking, speaking; M.A.
(D) criterion scores.

e; 2.15; 2) a, 3) r; 107 pupils; 1.4, 3.2, 3.4, 3.[illegible] gr. 3;

6 days (retention after 7 wks.); non-norm; 14 (2, 1, 2, 1, 2, 2,

1, 2, 1); EPD.

Stern, Carolyn and Keislar, Evan R. Acquisition of Problem Solving Strategies by Young Children and Its Relation to Mental Age. Am. Ed. Res. J. 4: 1-12; Jan. 1967.

Pupils taught a single-hypothesis testing strategy scored significantly higher than those taught a multiple-hypothesis strategy or control treatments. There was a significant positive correlation between M.A. and the acquisition of the multiple hypothesis strategy.

(I) four treatments: multiple hypothesis or single hypothesis testing, practiced or no-practice control (number, color, size, shape); M.A., sex. (D) criterion scores.

e; 2.16; 2) s, 3) r; 110 pupils; 1.4, 3.2, 3.4, 6.4; gr. 3;

4 days; norm, non-norm; 18 (2, 1, 3, 2, 2, 2, 2, 2, 2); EPD.

Sutherland, John. An Investigation Into Some Aspects of Problem Solving in Arithmetic. Br. J. Ed. Psychol. 11: 215-222; Nov. 1941 (Part I; 12: 35-46; Feb. 1942 (Part II).

Three major factors emerged, a general "g" factor, a verbal factor, and a number factor. The general factor "g" refers to general intelligence. It was also determined that all children, especially those of lower ability, find it easier to solve arithmetic problems set in a familiar situation rather than in unfamiliar situations.

r; ---; 2) all; 134 pupils; 6.1; age 11; ---; norm, non-norm; ---;

NE.

Terry, Paul Washington. How Numerals are Read: An Experimental Study of the Reading of Isolated Numerals and Numerals in Arithmetic Problems. Suppl. Ed. Monog. 18: 1-110; 1922. (see a-5h)

Traub, Ross E. Importance of Problem Heterogeneity to Programed Instruction. J. Ed. Psychol. 57: 54-60; Jan. 1966. (see d-5)

Wheat, H. Responses of School Children to Conventional Arithmetic Problems. Columbia Studies in Ed. 359: 1-124; 1928.

This study investigated the differences between "imaginative" and "conventional" word problems. There were no significant differences, and any differences resulted from individual differences or chance.

r; ---; 2) s; 660 pupils; 1.4, 1.6, 6.4; grs. 5-8; ---; ---; ---;

NE.

Wilson, John W. The Role of Structure in Verbal Problem Solving. Arith. Teach. 14: 486-497; Oct. 1967.

For all types of problems combined, for direct and indirect problems taken separately, and for all mental age levels involved, the wanted-given treatment was found to be superior to either practice-only or action-sequence on all dependent variables studied.

(I) 3 programs of problem-solving: action-sequence structure, wanted-given structure, practice only (control). (D) choice of correct operation; growth; correct answers; speed.

e; 2.15; 2) r, 3) r; 80 pupils; 1.3, 1.4, 3.2, 3.4, 3.6; gr. 4;

9 wks.; norm, non-norm; 10 (1, 1, 1, 1, 2, 1, 1, 1, 1); EPD.

Woody, Clifford. Some Investigations Resulting From the Testing Program in Arithmetic: An Investigation to Determine the Influence of Specialized Drill in Reading Upon the Solution of Verbal Problems. _Ind. U. Sch. Ed. Bull._ 6: 30-39; Apr. 1930 (1st of 3 studies).

Experimental classes that used practice booklets for solving verbal arithmetic problems made greater gains in problem solving and analysis than the control classes.

(I) practice in reading verbal problems; sex, age, M.A. (D) gain scores in problems, fundamentals, vocabulary and reading.

e; 2.1; 2) m, 3) i; 195 pupils in 6 school systems; 1.1, 1.4,

1.5; grs. 5-7; 10 wks.; norm; 28 (2, 3, 3, 3, 3, 4, 5, 3, 2);

EPD.

Maertens, Norbert. Effects of Arithmetic Homework Upon the Attitudes of Third Grade Pupils Toward Certain School-Related Structures. Sch. Sci. Math. 68: 657-662; Oct. 1968.

Three homework treatments, rotated within each class for equal periods of time, did not affect attitudes toward school-related structures. Intelligence was not a determining factor.

(I) homework treatments: no homework, teacher prepared or experimenter prepared. (D) attitude: 1) school, 2) arithmetic, 3) spelling, 4) homework, 5) teacher, 6) reading.

e; 3.25; 2) s, 3) r; 319 pupils in 12 classes, 4 schools; 1.4.

3.2; gr. 3; 1 yr.; norm, non-norm; 22 (1, 2, 3, 2, 3, 4, 2, 3, 2);

EPD.

Dutton, Wilbur H. New Mathematics for Ethiopian Elementary Schools. Arith. Teach. 15: 115-125; Feb. 1968.

Data and discussion of three of Ethiopia's major problems in curriculum improvement involved in the development of a new mathematics program for elementary schools was presented. Resulting conclusions were: 1) Poor achievement was due in part to inadequate instruction; 2) Cultural heritage and previous experiences of children were not being utilized; 3) Pupils and teachers did not understand basic arithmetic concepts; 4) Instructional practices hindered pupil achievement; 5) Pre-service and in-service educational programs for teachers should be expanded; 6) Textbooks and instruction through grade 6 should be in Amharic.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Pace, Angela. Understanding of Basic Concepts of Arithmetic: A Comparative Study. J. Ed. Res. 60: 107-120; Nov. 1966.

Formal instruction beginning one year earlier for English pupils was considered in comparison of English and New York State pupils' achievement of basic mathematical concepts: In relation to age, English pupils were superior to 5th grade New York State pupils. In relation to years of instruction, 6th grade New York State pupils were superior. Equalization of age and years of instruction resulted in no difference.

(I) age, years of instruction. (D) concept achievement.

F; ---; 1) s, 2) r; England - 2,692 pupils in 60 schools; New York State - 3,206 pupils in 47 schools; 1.1, 1.4, 1.6, 3.2; grs. 5, 6; ---; non-norm; 26 (3, 2, 3, 4, 2, 3, 4, 3, 2); NE.

Sato, Ryoichiro. Commentary on the International Study of Achievement in Mathematics. Arith. Teach. 15: 103-107; Feb. 1968.

Author's opinions and viewpoints are given concerning the higher performance of Japanese pupils compared to United States pupils on international mathematics test scores.

d; ---; ---; ---; 1.4, 1.6; grs. 8, 12; ---; norm; ---; NE.

- - -. Time for Mathematics! Br. Elem. Math. J. 1: 56-57; Autumn 1963.

Total hours of instruction per week for various subjects in the first six years of school is reported for different countries. The U.S.A. and U.K. allow about one-half as much time for mathematics instruction as the U.S.S.R.

d; ---; 1) s; 45 countries; 1.1; grs. 1-6; ---; ---; ---; NE.

Roberts, Dorothy M. and Bloom, Irving. Mathematics in Kindergarten--Formal or Informal? El. Sch. J. 67: 338-341; Mar. 1967.

No significant differences were found between groups using four types of programs.

(I) four programs. (D) achievement gain difference scores (growth patterns in skills, concepts, general readiness).

a; ---; 2) s; 90 pupils in 4 classes; ---; kdg.; 14 wks.; non-norm; ---; NE.

Woody, Clifford. Knowledge of Arithmetic Possessed by Young Children. Ind. U. Sch. Ed. Bull. 6: 50-85; Apr. 1930.

An inventory test constructed to measure knowledge of different arithmetic situations found that previous to formal instruction: 1) Young children possessed considerable knowledge of arithmetic; 2) Correct responses were frequently reached slowly, by tedious and circuitous routes. A questionnaire submitted to parents gave results indicating: 1) Home life influenced the development of basic arithmetic knowledge.

s; ---; 2) r, 3) a; 2,695 pupils; 1.1, 1.6, 1.8; grs. k-2; ---; non-norm; 23 (2, 2, 2, 3, 3, 4, 4, 2, 1); NE.

Brownell, William A. Arithmetic in Grades I and II. Duke U. Studies in Ed. 6: 1-175; 1941 (2nd of 5 chapters). (see c-1)

Brownell, William and Carper, Doris V. Learning the Multiplication Combinations. Duke U. Studies in Ed. 7: 1-177; 1943 (8th of 10 chapters). (see c-3c)

Brownell, William A. Arithmetic in Grades I and II. _Duke U. Studies in Ed._ 6: 1-175; 1941 (3rd of 5 chapters). (see a-3)

Flournoy, Frances. A Study of Pupils' Understanding of Arithmetic in the Intermediate Grades. _Sch. Sci. Math._ 47: 325-333; Apr. 1967. (see f-2)

Flournoy, Frances. A Study of Pupils' Understanding of Arithmetic in the Primary Grades. _Arith. Teach._ 14: 481-485; Oct. 1967. (see f-2)

Pace, Angela. The Effect of Instruction Upon the Development of the Concept of Number. _J. Ed. Res._ 62: 183-189; Dec. 1968. (see g-6)

Ter Keurst, Arthur J. Rote Versus Discovery Learning. _Sch. and Commun._ 55: 42, 44; Nov. 1968. (see a-3)

Donaldson, P. R. Programmed Mathematics in Primary Schools. Prim. Math. 6: 31-37; June 1968. (see d-5)

Jarvis, Oscar T. Arithmetic and Science Time Allotment Practices in Intermediate Grades. Sch. Sci. Math. 66: 322-324; Apr. 1966.

Survey of Texas Gulf Coast school districts found a wide diversity in time allotment for both subjects, with less time allotment for science.

s; ---; 1) only; 55 school districts; 1.1, 1.6; grs. 4-6; ---;

non-norm; 31 (3, 4, 3, 3, 4, 4, 4, 3, 3); NE.

Pigge, Fred L. Analysis of Covariance in a Randomly Replicated Arithmetic Methods Experiment. J. Exp. Ed. 34: 73-83; Summer 1966.

A random replication design having three different instruction time ratios of classroom activities found children had significantly higher retention in computation, understanding and total performance when 50 and 75 percent of class time was spent on developmental-meaningful activities compared to 75 percent spent on drill activities.

(I) percentage of time spent on drill and developmental-meaningful activities. (D) achievement scores, retention.

e; 2.13; 2) r, 3) r; ---; 1.4, 3.5; gr. 5; 6 wks., retention;

norm, non-norm; 16 (1, 1, 2, 2, 1, 3, 1, 3, 2); EPD.

Pigge, Fred L. Frequencies of Unwritten Algorisms. Arith. Teach. 14: 588-593; Nov. 1967. (see: Shuster, Albert H. and Pigge, Fred L. Retention Efficiency of Meaningful Teaching. Arith. Teach. 12: 24-32; Jan. 1965.)

The group exposed to drill for 75% of class time used the most mental arithmetic in answering test items. No differences in number of items solved correctly were found on the posttest, but the 75%-drill group solved fewer correctly on the retention test.

(I) three schedules of type of activity: 75% developmental-meaningful - 25% drill; 50% developmental-meaningful - 50% drill; and 25% developmental meaningful - 75% drill.
(D) number of responses with unwritten algorithm; achievement scores; retention.

e; 3.30; 2) s, 3) i; 18 classes; 1.1, 2.6; grs. 5, 6; 22 days (retention after 6 wks.); non-norm; 30 (3, 3, 3, 4, 4, 4, 3, 3, 3); EPD.

Thies, L. J. A Time Factor in Arithmetic Texts. U. Iowa Monog. in Ed. 2: 1-38; Feb. 1926. (see d-1)

Zahn, Karl G. Use of Class Time in Eighth-Grade Arithmetic. Arith. Teach. 13: 113-120; Feb. 1966.

1) Students who spent 56% or 67% of their time on developmental activities scored higher than those who spent the greater proportion of their time on practice.

2) Boys achieved more than girls.

3) Middle and lower ability groups were not affected differently by the time variation, while the upper ability group having 67% drill achieved significantly higher than those having more practice time.

(I) varying amount of time for developmental and practice activities (67-33, 56-44, 44-56, 33-67); ability levels.
(D) achievement gain scores: reasoning, concepts, computation, total.

e; 2.9; 2) m, 3) r; 120 pupils; 1.4, 2.6, 3.2, 3.3, 3.4; gr. 8; 18 wks.; norm; 15 (2, 1, 2, 2, 2, 2, 1, 1, 2); EPD.

Beilin, Harry and Gillman, Irene S. Number Language and Numer Reversal Learning. J. Exp. Child Psychol. 5: 263-277; June 1967.

The relationship between the child's number language status and his ability to deal with problem-solving tasks was studied. Shift performance was unrelated to number language test performance and verbal training in the reversal task; number language knowledge was related to the cardinal-ordinal number task. Optional shift behavior appears to be highly related to the nature of the stimulus materials and the shift design.

(I) training with and without reversals of cardinal and ordinal number stimuli. (D) achievement scores: number language knowledge, use of verbal cues, performance in cardinal-ordinal task.

e; 3.19; 2) s; 100 pupils (I), 44 pupils (II); 1.1, 1.6, 2.6, 3.2, 6.4; gr. 1; 3-4 days; norm, non-norm; 19 (2, 2, 2, 4, 2, 2, 1, 2, 2); EPD.

Brownell, William A. The Development of Children's Number Ideas in the Primary Grades. Suppl. Ed. Monog. 35: 1-241; Aug. 1928 (Part 1 of 6).

With various grouping patterns the difficulty of apprehension of numbers when presented in visual concrete (dots) form is proportional to the number of objects exposed with no numbers from 3 to 12 being more difficult.

s; ---; 2) s, 3) a; 1,858 pupils in 8 schools; 1.1, 1.4, 1.6, 1.13; grs. 1-7; 6 wks.; non-norm; 27 (3, 3, 3, 3, 3, 2, 5, 3, 2); NE.

Brownell, William A. The Development of Children's Number Ideas in the Primary Grades. Suppl. Ed. Monog. 35: 1-241; Aug. 1928 (Part 2 of 6).

Change in methods of apprehension of visual concrete numbers was investigated by questioning, observation, drawing and exposure time. Pupils in the first two grades did not generally employ abstract methods, and usually counted by ones.

s; ---; 2) s, 3) i; 6 schools; 1.1, 1.6; grs. 1-5; ---; non-norm;

35 (3, 3, 3, 4, 5, 5, 5, 4, 3); NE.

Brownell, William A. The Development of Children's Number Ideas in the Primary Grades. Suppl. Ed. Monog. 35: 1-241; Aug. 1928 (Part 3 of 6).

Relationships between assigned variables were investigated in relation to the development of ability to apprehend visual concrete numbers. No significant relationships were discovered within grades.

r; ---; 2) s, 3) a; 140 pupils in 2 schools; 6.4; grs. 1-3; ---;

---; ---; NE.

Brownell, William A. The Development of Children's Number Ideas in the Primary Grades. Suppl. Ed. Monog. 35: 1-241; Aug. 1928 (Part 4 of 6)

Results of individual testing of apprehension of visual concrete numbers, in terms of number of errors, time to respond and method reportedly used for obtaining responses, along with grade level, I.Q., M.A., and C.A. were analyzed for each individual. Conclusions were:

1) Use of more mature methods increased with grade level combined with increased facility and efficiency.

2) Higher I.Q. seemed to be associated positively with accuracy of apprehension and development of mature concepts, especially at higher grades.

3) There seemed to be several successive steps in developing mature methods of dealing with concrete numbers.

4) A slight positive relationship was found between accuracy and speed of apprehension.

s; ---; 2) s, 3) a; 58 pupils; 1.1; grs. 1-4; ---; non-norm;

27 (3, 3, 3, 2, 3, 3, 5, 3, 2); NE.

Brownell, William A. Arithmetic in Grades I and II. Duke U. Studies in Ed. 6: 1-175; 1941 (2nd of 5 chapters).

Test results are presented along with similar results of Buckingham and MacLatchy studies, Woody and Grant. Results confirmed MacLatchy and Buckingham findings (not Woody's) in that:

1) About one-tenth of pupils stopped counting before ten.

2) Nine out of ten subjects could enumerate ten objects or more.

3) 60% could name the numbers to ten when concretely represented.

4) 66% could reproduce all the numbers to ten.

5) City children did better than rural on exact comparison of concrete numbers.

6) A large number of pupils correctly answered problems of easy combinations.

s; ---; 2) s, 3) r; 692 pupils in 24 schools; 1.1, 1.6; gr. 1;

2 yrs.; non-norm; 27 (2, 3, 3, 2, 3, 4, 4, 3, 3); NE.

Judd, Charles Hubbard. Psychological Analysis of the Fundamentals of Arithmetic. Suppl. Ed. Monog. 32: 1-15; Feb. 1927 (1st of 6 parts). (see a-1)

Judd, Charles Hubbard. Psychological Analysis of the Fundamentals of Arithmetic. Suppl. Ed. Monog. 32: 37-52; Feb. 1927 (3rd of 6 parts).

1) There was steady progress up through the grades in ability to count series of sounds and flashes of light.

2) There was a gradual reduction of physical movement with increase in grade level.

(I) presentation of series of sounds, flashes of light, physical movement. (D) number of errors in counting.

F; ---; 2) s, 3) a; 120 pupils; 1.1; grs. 1-6; ---; non-norm;

27 (3, 3, 3, 2, 3, 2, 5, 3, 3); NE.

Morfitt, Margaret D. K. Comparison of Individual-Concrete Methods and Class Methods in the Teaching of Arithmetic. Br. J. Ed. Psychol. 7: 196-203; June 1937. (see a-3)

Risden, Gladys. A Remedy is Suggested for Math Carelessness. The Clearing House 31: 203-206; Dec. 1956.

This is a case study of Leah, a 'counter.' She was taught gradually to perceive and think in terms of groups. Her arithmetic grade improved.

c; ---; ---; 1 pupil; ---; ---; ---; ---; ---; NE.

Brownell, William A. Arithmetic in Grades I and II. Duke U. Studies in Ed. 6: 1-175; 1941. (see c-1)

Estes, Betsy and Combs, Ann. Perception of Quantity. J. Genet. Psychol. 108: 333-336; June 1966. (see g-6)

Morton, Dan M. Number Forms and Arithmetical Ability in Children. Br. J. Ed. Psychol. 6: 58-73; Feb. 1936.

Number forms were found to exist in a ratio of 1/43 for the whole group. Girls appear to possess number forms to a slightly higher degree (1/40) than boys (1/47) although the difference cannot be accepted as beyond limits of sampling error. Number forms of children are much more rudimentary than those of adults. Indications were found that, although they have no number forms, many children have the foundation on which they may subsequently develop.

s; ---; 2) s; 867 pupils; 1.6, 1.7, 6.10; ages 11-15; ---;

non-norm; 34 (4, 4, 2, 4, 4, 5, 4, 4, 3); NE.

Renwick, E. M. Children's Misconceptions Concerning the Symbols for Mathematical Equality. Br. J. Ed. Psychol. 2: 173-183; June 1932.

Results of testing the understanding of the equal sign found wide variation. Methods and sample are questionable.

s; ---; 2) s, 3) a; 121 girls; 1.1; grs. 7-8; ---; non-norm;

42 (4, 4, 5, 5, 5, 5, 5, 5, 4); NE.

Scaramuzzi, Louis E. Money is Only Imaginary. Clearing House 30: 280-283; Jan. 1956.

This is the study of one class exposed to the creative imagination and humor of an inventive and secure teacher, in studying arithmetic.

c; ---; 1) only; 1 class; ---; gr. 8; ---; ---; ---; NE.

Burton, Cassie B. Results of Definite Drill in Four Fundamental Processes as Shown by the Woody-McCall Mixed Fundamentals. Yrbk. of Dept. El. Sch. Prin. 5: 323-328; 1925. (see a-5a)

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926 (3rd of 7 parts).

With use of a dictaphone, permanent records of subject's operations doing basic whole number problems (+, -, x, ÷) were recorded and analyzed. Conclusions were: 1) Certain operations require more time, increasing total time; 2) Great irregularity in time is due to difference in knowledge of basic number combinations; 3) Variety of methods are employed by individuals.

s; ---; 1) only; 30 pupils; 1.1, 1.4, 1.6; grs. 3-6; ---; norm,

non-norm; 27 (3, 2, 4, 5, 2, 3, 4, 2, 2); NE.

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926 (4th of 7 parts). (see e-1)

Judd, Charles Hubbard. Psychological Analysis of the Fundamentals of Arithmetic. Suppl. Ed. Monog. 32: 71-96, 97-121; Feb. 1927. (see d-1)

Meddleton, Ivor G. An Experimental Investigation Into the Systematic Teaching of Number Combinations in Arithmetic. Br. J. Ed. Psychol. 26: 117-127; June 1956. (see a-5a)

Smith, Henry Lester and Eaton, Merrill Thomas. A Diagnostic Study of Efficiency in Arithmetic. Ind. U. Sch. Ed. Bull. 15: 3-49; 1939. (see e-1)

Brownell, William A. The Development of Children's Number Ideas in the Primary Grades. Suppl. Ed. Monog. 35: 1-241; Aug. 1928 (Part 5 of 6).

Group and individual tests of problems of 2-digit addition were administered with and without time limits. Addition by individuals was analyzed with regard to C.A., M.A., I.Q., number of errors, time, and methods used (as reported by subjects). Conclusions were: 1) Thorough understanding of concrete numbers resulted in transition to abstract number with less difficulty; 2) Difficulty with additive combinations were results of immature methods or lack of understanding of the relationship between experience with concrete and abstract.

s; ---; 2) s, 3) a; 15 pupils; 1.1; grs. 2-4; ---; non-norm;

33 (3, 3, 4, 4, 4, 4, 5, 3, 3); NE.

Brownell, William A. The Development of Children's Number Ideas in the Primary Grades. Suppl. Ed. Monog. 35: 1-241; Aug. 1928 (Part 6 of 6).

Results of group and individual tests of addition of three digits were analyzed for each individual in regard to I.Q., number of errors, time, and methods used for first and second addition. Conclusions were similar to chapter seven, with the aspects of understanding and meaning plus the movement through several stages to attain mature methods of apprehension.

s; ---; 2) s, 3) a; 33 pupils; 1.1; grs. 3, 4; ---; ---; 33 (3, 4,

3, 4, 4, 4, 5, 3, 3); NE.

Brownell, William A. Arithmetic in Grades I and II. Duke U. Studies in Ed. 6: 1-175; 1941 (2nd, 3rd of 5 chapters). (see a-3, c-1)

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926. (see c-1, c-3, e-1)

Kirby, - - -. Practice in the Case of School Children. Columbia Studies in Ed. 3: 1-98; 1913. (see a-5a)

Morfitt, Margaret D. K. Comparison of Individual-Concrete Methods and Class Methods in the Teaching of Arithmetic. Br. J. Ed. Psychol. 7: 196-203; June 1937. (see a-3)

Ter Keurst, Arthur J. Rote Versus Discovery Learning. Sch. and Commun. 55: 42, 44; Nov. 1968. (see a-3)

Woody, Clifford. Some Investigations Resulting From the Testing Program in Arithmetic: An Investigation to Determine the Transfer Effects of Three Different Methods of Teaching Three Different Types of Examples in Two-Place Addition. Ind. U. Sch. Ed. Bull. 6: 39-45; Apr. 1930 (2nd of 3 studies). (see g-1)

Brownell, William A. Arithmetic in Grades I and II. Duke U. Studies in Ed. 6: 1-175; 1941 (3rd of 5 chapters). (see a-3)

Brownell, William A.; Kuehner, Kenneth G.; and Rein, William C. Learning as Reorganization. Duke U. Press 3: 1-74; 1939.

This study examined the method $\begin{array}{r} 86 \\ \underline{-39} \\ 47 \end{array}$ as a "crutch" to borrowing in subtraction and found a significant decline in errors when taught for understanding. This condition was discussed in detail as a reorganization of behavior based on a new level of understanding.

(I) method of instruction (crutch and non-crutch).
(D) achievement scores.

e; 2.2; 2) m, 3) a; 419 pupils; 1.4, 3.4; gr. 3; 2 months;

non-norm; 14 (1, 2, 1, 2, 2, 2, 2, 1, 1); EPD.

Brownell, William A. and Moser, Harold E. Meaningful vs. Mechanical Learning: A Study in Grade III Subtraction. Duke U. Studies in Ed. 8: 1-207; 1949. (see a-3)

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926. (see e-1)

Rainey, Dan S. and Kelley, Francis J. An Evaluation of a Programed Textbook with Educable Mentally Retarded Children. J. Excep. Child. 34: 125-126; Oct. 1967. (see e-2)

Brownell, William and Carper, Doris V. Learning the Multiplication Combinations. Duke U. Studies in Ed. 7: 1-177; 1943 (4th of 10 chapters).

Children, taught mainly by drill: 1) did not have complete meaningful learning at the end of grade 5, but did have accuracy; 2) had many individual differences which were apparent at all levels of the grades and levels of work; 3) habituation was used more frequently with easy combinations than with difficult ones.

s; ---; 2) s, 3) a; 575 pupils in 4 schools; 1.1, 1.3, 1.8; grs. 3-5; ---; non-norm; 28 (2, 2, 3, 4, 3, 4, 5, 3, 2); NE.

Brownell, William and Carper, Doris V. Learning the Multiplication Combinations. Duke U. Studies in Ed. 7: 1-177; 1943 (5th of 10 chapters).

An extension of the first study including pupils of eight states, who had not had a single type of instruction, had similar findings: 1) accuracy without mastery; 2) indirect approach to mastery of combinations in terms of thought processes used; 3) interviews revealed habituation as the major process used.

s; ---; 2) s, 3) a; 3,026 pupils; 1.1, 1.3, 1.6, 1.8; grs. 3-5; ---; non-norm; 28 (2, 2, 3, 3, 4, 4, 5, 3, 2); NE.

Brownell, William and Carper, Doris V. Learning the Multiplication Combinations. Duke U. Studies in Ed. 7: 1-177; 1943 (6th of 10 chapters).

Selected subjects with complete data were used for correlational comparisons.

1) No high correlations between rate and C.A. or achievement.

2) A moderate relationship between I.Q. and accuracy for lower grades (3 and 4).

3) A moderate relationship between accuracy and M.A. and achievement for lower grades (3 and 4).

4) Higher medians for girls than boys in lower grades.

s; ---; 2) s, 3) s; 300 pupils; 1.3, 1.8, 6.4; grs. 3-5; ---;

norm, non-norm; 27 (2, 2, 3, 4, 4, 4, 3, 3, 2); NE.

Brownell, William and Carper, Doris V. Learning the Multiplication Combinations. Duke U. Studies in Ed. 7: 1-177; 1943 (8th of 10 chapters).

Children's readiness for multiplication combinations in third grade was investigated with group and interview tests. Children who had no previous multiplication instruction showed the following:

1) Were highly successful.

2) Were more successful when combinations were in sequence.

3) Approximately 1/4 added 1 instead of the multiplicand.

4) Were more accurate when the multiplier was the smaller number.

5) Were more accurate when the product was smaller.

6) A majority understood and used the multiplication process.

s; ---; 1) only; 98 pupils in 3 schools; 1.1, 1.3, 1.4, 1.6;

gr. 3; ---; non-norm; 27 (1, 3, 3, 4, 3, 4, 4, 3, 2); NE.

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926. (see e-1)

Crist, Robert L. Use of a Programed Multiplication Text Under Group-Paced and Individual-Paced Conditions. AV Comm. R. 14: 507-513; Winter 1966. (see d-5)

Grafft, William D. and Ruddell, Arden K. Cognitive Outcomes of the S.M.S.G. Mathematics Program in Grades 4, 5, and 6. Arith. Teach. 15: 161-165; Feb. 1968. (see f-2)

Harvey, Margaret A. Children's Responses to Two Types of Multiplication Problems. Arith. Teach. 13: 288-292; Apr. 1966.

1) Equal additions multiplication problems were less difficult to solve and conceptualize, and less difficult to select a "way to think about" than Cartesian product problems.

2) Cartesian product problems were more readily solved by high achievers in arithmetic than by low achievers, by boys than by girls, and by those with above average intelligence (not substantiated with data).

(I) two test forms; two types of problems requiring equal additions or Cartesian product multiplication; sex; two sequences of tasks. (D) achievement scores.

e; 2.19; 2) r, 3) r; 64 pupils; 3.4, 2.6; gr. 2; 1 testing;

non-norm; 23 (1, 2, 2, 2, 2, 3, 4, 3, 4); EPD.

Morfitt, Margaret D. K. Comparison of Individual-Concrete Methods and Class Methods in the Teaching of Arithmetic. Br. J. Ed. Psychol. 7: 196-203; June 1937. (see a-3)

Rainey, Dan S. and Kelley, Francis J. An Evaluation of a Programed Textbook with Educable Mentally Retarded Children. J. Excep. Child. 34: 125-126; Oct. 1967. (see e-2)

Schell, Leo M. Learning the Distributive Property by Third Graders. Sch. Sci. Math. 68: 28-32; Jan. 1968.

Third grade pupils were taught basic facts of multiplication and the distributive property in a total of nine lessons and were tested on both aspects.

1) Grade 3 pupils learned to use distributive property in two lessons plus a review lesson.

2) Distributive property items were more difficult than non-distributive property items.

3) Pupils scoring high on non-distributive items performed well on distributive items.

4) Low scoring pupils had more difficulty with distributive than non-distributive property items.

s; ---; 1) only; 198 pupils; 1.1, 1.4, 1.6, 3.4; gr. 3; 10 days; non-norm; 32 (2, 3, 3, 4, 5, 5, 4, 3, 3); NE.

Buswell, G. T. Diagnostic Studies in Arithmetic. _Suppl. Ed. Monog._ 30: 1-212; July 1926. (see e-1)

Kirby, - - -. Practice in the Case of School Children. _Columbia Studies in Ed._ 3: 1-98; 1913. (see a-5a)

Schane, Evelyn B. Characteristic Errors in Common Fractions at Different Levels of Intelligence. Pittsburgh Sch. 12: 155-168; Mar./Apr. 1938.

This study investigated errors in fractions at three intelligence levels and found little systematic pattern.

s; ---; 2) s; 274 pupils; 1.6; grs. 6-8; 4 days; norm; 34 (2, 3, 4, 5, 4, 3, 5, 4, 4); NE.

Pigge, Fred L. Analysis of Covariance in a Randomly Replicated Arithmetic Methods Experiment. J. Exp. Ed. 34: 73-83; Summer 1966. (see b-6)

Pigge, Fred L. Frequencies of Unwritten Algorisms. Arith. Teach. 14: 588-593; Nov. 1967. (see b-6)

Pigge, Fred L. Analysis of Covariance in a Randomly Replicated Arithmetic Methods Experiment. J. Exp. Ed. 34: 73-83; Summer 1966. (see b-6)

Pigge, Fred L. Frequencies of Unwritten Algorisms. Arith. Teach. 14: 588-593; Nov. 1967. (see b-6)

Grafft, William D. and Ruddell, Arden K. Cognitive Outcomes of the S.M.S.G. Mathematics Program in Grades 4, 5, and 6. Arith. Teach. 15: 161-165; Feb. 1968. (see f-2)

Kyte, George C. and Fornwalt, James E. A Comparison of Superior Children with Normal Children in the Rate Mastery of the Multiplication of Fractions. J. Ed. Res. 60: 346-350; Apr. 1967.

Normal ability students required a longer period of instruction to reach the same criterion as superior-ability students.

(I) I.Q., content. (D) mastery and retention tests.

e; 3.21; 2) s, 3) s; 62 pupils; 1.4; grs. 5, 6; 49 days (normal),

27 days (superior); non-norm; 30 (3, 2, 3, 4, 4, 3, 4, 4, 3); EPD.

Romberg, Thomas A. A Note on Multiplying Fractions. Arith. Teach. 15: 263-265; Mar. 1968.

Analyses of how students answered test problems dealing with multiplication of fractions found a larger percentage of modern students failing to cancel.

s; ---; 2) i; 691 tests; 1.1, 1.6; gr. 6; ---; norm; 38 (3, 4, 5,

5, 4, 3, 5, 5, 4); NE.

Bergen, Patricia M. Action Research on Division of Fractions. Arith. Teach. 13: 293-295; Apr. 1966.

The complex fraction (reciprocal) and inversion methods were found to be significantly superior to the common denominator method for all types of problems except division of proper fractions or mixed numbers by proper fractions. No significant difference between reciprocal and inversion methods was evidenced after the first test.

(I) common denominator, inversion, or complex fraction (reciprocal) method. (D) achievement scores.

a; ---; 1) only; 63 pupils in 3 classes; 1.4, 3.2, 3.3, 3.4;

gr. 6; 7 days (retention after 4 wks., 8 wks., 1 yr.); ---; ---;

NE.

Dutton, Wilbur H. Teaching Time Concepts to Culturally Disadvantaged Primary-Age Children. Arith. Teach. 14: 358-364; May 1967.

Instruction on time concepts resulted in increased achievement. For the culturally disadvantaged, sequential instruction must be provided.

(I) lessons (taped and direct) on time concepts. (D) time test.

e; 1.2; 2) s; 100 pupils; 1.1, 1.4; grs. k-3; 5 wks.; non-norm;

27 (2, 2, 3, 4, 4, 3, 4, 3, 2); EPD.

Friebel, Allen C. Measurement Understandings in Modern School Mathematics. Arith. Teach. 14: 476-480; Oct. 1967. (see a-3)

Paige, Donald D. and Jennings, Margaret. Measurement in the Elementary School. Arith. Teach. 14: 354-357; May 1967.

First and second grade texts were found to be very inconsistent on amount of measurement taught. Beginning in third grade, half the books examined put measurement concepts in a separate chapter, and agreement in content increased.

d; ---; ---; 39 series; ---; ---; ---; ---; ---; NE.

Pick, Herbert L., Jr. and Pick, Anne D. A Developmental and Analytic Study of the Size-Weight Illusion. J. Exp. Child Psychol. 5: 362-371; Sept. 1967. (see g-6)

Sawada, Daiyo and Nelson, L. Doyal. Conservation of Length and the Teaching of Linear Measurement: A Methodological Critique. Arith. Teach. 14: 345-348; May 1967. (see g-6)

Scaramuzzi, Louis E. Money is Only Imaginary. Clearing House 30: 280-283; Jan. 1956. (see c-2)

Scott, Lloyd. A Study of the Case for Measurement in Elementary School Mathematics. Sch. Sci. Math. 66: 714-722; Nov. 1966.

Mean scores for grade levels on similar measurement and non-measurement problems showed no significant differences in performance. The results did not seem to support the idea that problems using measurement terms are too difficult for young children.

s; ---; 2) a, 3) r; 662 pupils; 1.4, 1.6, 3.4, 4.6; grs. 3-6;

---; non-norm; 25 (2, 3, 2, 3, 4, 3, 3, 3, 2); NE.

Traub, Ross E. Importance of Problem Heterogeneity to Programed Instruction. *J. Ed. Psychol.* 57: 54-60; Jan. 1966. (see d-5)

Brinkmann, Erwin H. Programed Instruction as a Technique for Improving Spatial Visualization. J. Appl. Psychol. 50: 179-184; Apr. 1966. (see d-5)

D'Augustine, Charles. Factors Related to Achievement With Selected Topics in Geometry and Topology. Arith. Teach. 13: 192-197; Mar. 1966.

1) No treatment significantly affected results; 2) Shorter periods were more effective than longer periods; 3) Most efficiency was achieved in grade 6. An investigation of factors which relate to achievement with geometrical and topological topics, presented by a programed text, found reading and arithmetic achievement to be significant factors, and shorter (30 min.) working periods more effective than longer (50 min.) periods.

(I) grade level; sex, length of instruction period (0-30-50 min.). (D) achievement gain scores.

e; 2.15; 2) r, 3) r; 270 pupils; 1.4, 3.3, 3.4, 3.5; grs. 5-7;

---; norm, non-norm; 18 (2, 2, 2, 3, 1, 3, 2, 2, 1); EPD.

Henderson, Kenneth B. and Rollins, James H. A Comparison of Three Stratagems for Teaching Mathematical Concepts and Generalizations by Guided Discovery. Arith. Teach. 14: 503-508; Nov. 1967. (see a-3)

Weaver, J. Fred. Levels of Geometric Understanding Among Pupils in Grades 4, 5, and 6. Arith. Teach. 13: 686-690; Dec. 1966.

An exploratory form of an inventory for geometric understanding was given to conventional and contemporary program classes with no significant differences.

(I) conventional or contemporary program classes. (D) mean number of correct responses.

F; ---; 2) s, 3) a; 12 classes; 1.4; grs. 4-6; ---; non-norm;

34 (3, 3, 4, 4, 4, 5, 4, 4, 3); NE.

Lewis, Michael. Probability Learning in Young Children: The Binary Choice Paradigm. J. Genet. Psychol. 108: 43-48; Mar. 1966. (see g-4)

Mays, W. Logic for Juniors. Teach. Arith.: Br. Elem. Math J. 3: 3-10; Autumn 1965. (see g-6)

Retzer, Kenneth A. and Henderson, Kenneth B. Effect of Teaching Concepts of Logic on Verbalization of Discovered Mathematical Generalizations. Math. Teach. 40: 707-710; Nov. 1967.

Study of logic resulted in greater ability to verbalize mathematical generalizations, especially for the gifted students.

(I) study of logical concepts; ability level. (D) ability to verbalize generalizations.

e; 3.4; 2) s, 3) i; 80 pupils; 3.2; grs. 7, 8; ---; non-norm;

26 (2, 2, 3, 4, 4, 3, 2, 3, 3); EPD.

Bradley, R. C. and Earp, N. Wesley. The Effective Teaching of Roman Numerals in Modern Mathematics Classes. Sch. Sci. Math. 66: 415-420; May 1966.

Teachers believe Roman numerals should be taught, but cite varying objectives such as reading clocks, page numbers, dates, and outlines. Few develop historical comparisons or stress underlying principles, which seems especially important to the authors.

s; ---; 1) only; 132 teachers; 1.6 (%); grs. 3-5; 1 questionnaire;

non-norm; 33 (4, 3, 4, 4, 4, 3, 3, 4, 4); NE.

Hebron, M. E. A Factorial Study of Learning a New Number System and Its Relation to Attainment, Intelligence and Temperament. Br. J. Ed. Psychol. 32: 38-45; Feb. 1962. (see f-3)

Paige, Donald D. Learning While Testing. J. Ed. Res. 59: 276-277; Feb. 1966. (see g-7)

Schlinsog, George W. The Effects of Supplementing Sixth-Grade Instruction with a Study of Nondecimal Numbers. Arith. Teach. 15: 254-263; Mar. 1968.

This study examined the effects of non-decimal instruction on basic understanding, computational ability, underachievement, and preference. No significant differences were found in a very carefully conducted study.

(I) instruction in a) non-decimal, b) decimal, c) none.
(D) scores on a) understand nd. system, b) arithmetic computation, c) preference analysis.

e; 2.13; 2) s, 3) r; 12 classes; 1.4, 1.6, 2.6, 3.2, 3.5; gr. 6;

12 wks.; non-norm; 18 (2, 1, 2, 3, 2, 3, 1, 2, 2); EPD.

Buswell, G. T. and John, Lenore. The Vocabulary of Arithmetic: Chapter 5, How New Terms Are Introduced in Textbooks. Suppl. Ed. Monog. 38: 91-99; 1931. (see d-6)

Hicks, Randall C. Elementary Series and Texts for Teachers - How Well Do They Agree? Arith. Teach. 15: 266-270; Mar. 1968.

Analysis of teacher texts and elementary series by inclusion of topic found: 1) wide diversity of topics between the two; 2) greater agreement of relevant topics for pupil texts than for teacher texts; 3) 20 topics were found in 75% of texts in both categories.

d; ---; 2) i; 16 teacher textbooks, 11 student arithmetic series;

1.6; grs. 3 through 6; ---; ---; ---; NE.

Judd, Charles Hubbard. Psychological Analysis of the Fundamentals of Arithmetic. Suppl. Ed. Monog. 32: 71-96; Feb. 1927 (5th of 6 parts).

Analysis of four series of textbooks of the ways the processes of addition, subtraction, multiplication, and division were referred to, found: 1) 410 types of addition problems; 2) 374 variations of subtraction problems; 3) 521 kinds of multiplication problems; 4) 594 kinds of division problems.

d; ---; ---; 4 text series; ---; ---; ---; ---; ---; NE.

Judd, Charles Hubbard. Psychological Analysis of the Fundamentals of Arithmetic. Suppl. Ed. Monog. 32: 97-121; Feb. 1927 (6th of 6 parts).

A summary of the preceding investigations (Chapters 1-5) is given with a formulated psychology of the fundamentals of arithmetic, partially based on the investigations. The psychology of arithmetic fundamentals proposed for teaching is a combination of the psychology of the learner and the psychology of the number system with mental processes determined by organization and understanding of lower processes.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Monroe, Walter S. and Clark, John A. The Teacher's Responsibility for Devising Learning Exercises in Arithmetic. U. Ill. Bull. 31: 1-92; 1926 (4th of 5 parts).

Analysis of ten textbooks, series two and three, for frequencies of problem types and number of problem types showed: 1) an average of 2,400 verbal problems, with wide variation; 2) an average of 167 problem types as compared to the 333 possible ones identified by the author, with wide variation in series.

d; ---; ---; 10 textbooks; ---; grs. 2, 3; ---; non-norm; ---;

NE.

Paige, Donald D. and Jennings, Margaret. Measurement in the Elementary School. Arith. Teach. 14: 354-357; May 1967. (see c-8)

Reys, Robert E. and Knowles, Lois. What is the Status of Elementary School Mathematics? El. Sch. J. 68: 167-171; Jan. 1968.

This study surveyed 75 randomly selected school districts' math curriculum and found a large trend toward modern math.

s; ---; 1) s, 2) r; 75 districts; 1.6; elem.; ---; non-norm;

20 (2, 2, 1, 2, 2, 3, 3, 3, 2); NE.

Scott, Lloyd. A Study of the Case for Measurement in Elementary School Mathematics. Sch. Sci. Math. 66: 714-722; Nov. 1966. (see c-8)

Smith, Henry Lester and Eaton, Merrill Thomas. An Analysis of Arithmetic Textbooks (First Period - 1790 to 1820). Ind. U. Sch. Ed. Bull. 18: 1-52; Jan. 1942.

This part of the overall study compared texts from 1790-1820 and reached the following conclusions:

1) The deductive method was used exclusively.

2) No effort was made to interest the learner.

3) Topic presented first - whole numbers.

4) Topic presented most - percentages.

5) Topic presented included conics, trigonometry, foreign exchange, algebra.

6) Problem presented in three classes: a) economic - represented by indebtedness and shipping, b) socio-economic - represented by military and travel, c) sociological - represented by beverages.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Smith, Henry Lester and Eaton, Merrill Thomas. An Analysis of Arithmetic Textbooks (Second Period - 1821 to 1850). Ind. U. Sch. Ed. Bull. 18: 1-108; Nov. 1942.

This part of the overall study compared texts from 1821-1850 and reached the following conclusions:

1) The inductive method was introduced in some texts.

2) No real effort to interest the learner, though some.

3) Topic presented first - arithmetic symbolism.

4) Topic presented most - whole number operations.

5) New topics included - time, banking, taxes.

6) Old topics excluded - algebra, conics, foreign exchange.

7) Problems presented in three classes: a) economic - food and farm, b) socio-economic - education, military and travel, c) sociological - beverages.

d; ---; ---; ---; ---; ---; ---; --; ---; NE.

Smith, Henry Lester and Eaton, Merrill Thomas. An Analysis of Arithmetic Textbooks (Third Period - 1851 to 1880). Ind. U. Sch. Ed. Bull. 18: 1-108; Nov. 1942.

This part of the overall study compared texts from 1851 to 1880 and reached the following conclusions:

1) Both inductive and deductive methods were used, often in the same text.

2) Emphasis away from the interest of the learner toward his mental discipline.

3) No topic shift noticeable, no change in topic emphasis.

4) Topics beginning to be graded - easy to hard.

5) Topics presented with attention to natural order rather than logical order.

6) With focus on mental discipline - much drill and review material.

7) Problems presented in three classes: a) economic - food and farm, occupations, b) socio-economic - education, travel, c) sociological - alcoholic beverages.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Smith, Henry Lester and Eaton, Merrill Thomas. An Analysis of Arithmetic Textbooks (Fourth Period - 1881 to 1910). Ind. U. Sch. Ed. Bull. 19: 1-58; July 1943.

This part of the overall study compared texts from 1881 to 1910 and reached the following conclusions:

1) The introductory justification began.

2) Learner interest neglected for better-built books, more teacher instruction, pictures, arrangements.

3) New topics presented - stocks, number properties and metric system.

4) Topics presented most - fundamental operations.

5) In general, texts made no advance in method, presented no new problem emphasis (indeed began to lack practicability) and no experimentation, no new psychological idea.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Smith, Henry Lester and Eaton, Merrill Thomas. An Analysis of Arithmetic Textbooks (Fifth Period - 1911 to 1940). Ind. U. Sch. Ed. Bull. 19: 1-41; Nov. 1943.

This part of the overall study compared texts from 1911 to 1940 and reached the following conclusions:

1) Learner interest is considered important.

2) Drill, still important, is presented by games and pictures.

3) Many business topics are dropped, such as import and export.

4) New words are used to make texts intelligible to young learners.

5) Alcoholic beverage references disappear.

6) Problems presented in three classes all of which have emphasis on "real-life" practicability: a) economic - food, b) socio-economic - education, c) sociological - human relations.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Smith, Henry Lester; Eaton, Merrill T.; and Dugdale, Kathleen. One Hundred Fifty Years of Arithmetic Textbooks. Ind. U. Sch. Ed. Bull. 21: 1-149; Jan. 1945.

Fifty-nine textbooks, over 150 years of publications, chosen mainly for availability, were examined and compared. The major comparisons and results were:

1) The purpose has never changed and still is the practicability for the user (although the user has changed).

2) Content, following the user and psychological theory, has evolved from emphasis on the subject matter through various interest stages, to meeting needs of users.

3) Problems tended to drift from mathematical to "daily-life" emphasis.

d; ---; ---; ---; ---; elem.; ---; ---; ---; NE.

Thies, L. J. A Time Factor in Arithmetic Texts. U. Iowa Monog. in Ed. 2: 1-38; Feb. 1926.

This study investigated textbooks and time and found wide variation in text to text treatment in terms of time spent in class.

d; ---; ---; ---; ---; grs. 5, 6; ---; ---; ---; NE.

Brownell, William A. Conceptual Maturity in Arithmetic Under Differing Systems of Instruction. El. Sch. J. 151-163; Dec. 1968.

Subjects were interviewed by their teachers in selected schools in England and Scotland for comparing the three programs for promoting conceptual mathematical maturity. No quantitative evidence was published but conclusions were:

1) Scottish subjects who had the Cuisenaire program had less instruction time; demonstrated greater maturity of thought processes in finding answers but did not perform significantly better in verbalizing reasons than conventional program subjects.

2) The English conventional pupils ranked higher, and Dienes and Cuisenaire programs ranked equal for conceptual maturity.

3) In successful explanations of problem attacks the three programs were about equal.

(I) instructional program: conventional, Cuisenaire, Dienes (multibase arithmetic blocks). (D) achievement in understanding and level of thinking.

F; ---; 1) only; 1,406 pupils in 45 schools - Scotland & England;

1.4, 1.6; gr. 3; ---; non-norm; 33 (2, 3, 4, 5, 4, 4, 5, 3, 3);

NE.

Callahan, John J. and Jacobson, Ruth S. An Experiment with Retarded Children and Cuisenaire Rods. Arith. Teach. 14: 10-13; Jan. 1967. (see e-2)

Nasca, Donald. Comparative Merits of a Manipulative Approach to Second -Grade Arithmetic. Arith. Teach. 13: 221-226; Mar. 1966.

Cuisenaire and traditionally taught groups did not differ on a traditional achievement test, but the Cuisenaire group did significantly better on a test 'geared" to the more extensive content of the Cuisenaire program.

(I) use of program using Cuisenaire rods or 'traditional' activities. (D) achievement difference scores.

e; 3.21; 2) r, 3) i; 45 pupils in 2 classes; 1.4, 3.3, 3.5;

gr. 2; 1 yr.; norm, non-norm; 26 (1, 2, 4, 4, 4, 4, 3, 2, 2); EP.

Reddel, William D. and DeVault, M. Vere. In-Service Research in Arithmetic Teaching Aids. Arith. Teach. 7: 243-246; May 1960.

Mean increases were significant for pupils in: 1) arithmetic reasoning and total achievement with use of calculator and abacus; 2) arithmetic fundamentals with use of abacus; 3) arithmetic reasoning with place-value chart and number line for lower-achievement pupils. Mean increases in understanding were significant for teachers using hand calculators or abacus.

(I) use of aids: a) hand operated calculator (Educator), b) Aba counter (abacus), c) place-value chart and number line.
(D) pupils' and teachers' mathematical achievement gains.

e; 3.15; 2) s, 3) r; 270 pupils in 24 classes, 24 teachers;

1.4, 3.2, 3.4; gr. 5; 5 months; norm, non-norm; 25 (2, 2, 3, 3,

4, 3, 3, 3, 2); EPD.

Schott, Andrew F. New Tools, Methods for Their Use, and a New Curriculum in Arithmetic. Arith. Teach. 4: 204-209; Nov. 1957.

Together with unclear and insufficient details some data is presented comparing control and experimental classes. By inspection, rather than tests of significance, the author concludes that the experimental classes were superior to the control classes in achievement. Such findings must be considered as extremely tentative for reasons of possible novelty and teacher effects as well as on statistical grounds.

(I) new tools and methods. (D) arithmetic achievement.

a; ---; 1) only; variable (total = 332 pupils); 1.4; grs. 1-3;

varied 3 to 6 months; norm; 38 (3, 5, 5, 4, 4, 4, 5, 4, 4); NE.

Smith, Henry Lester and Eaton, Merrill Thomas. A Diagnostic Study of Efficiency in Arithmetic. Ind. U. Sch. Ed. Bull. 15: 3-49; 1939. (see e-1)

Triggs, E. The Value of a Desk Calculating Machine in Primary School Maths. Ed. Res. 9: 71-73; Nov. 1966.

Use of the desk calculator resulted in significantly improved performance, though the control group also showed significantly improved scores.

(I) use of desk calculator. (D) achievement gain scores.

a; ---; 2) s, 3) m; ---; 3.4; ages 9-5 to 10-4; 9 wks.; norm;

---; NE.

Eaton, Merrill T. The Value of the Dictaphone in Diagnosing Difficulties in Addition. Ind. U. Sch. Ed. Bull. 14: 5-10; Apr. 1938. (see e-1)

Suppes, Patrick; Jerman, Max; and Groen, Guy. Arithmetic Drills and Review on a Computer-Based Teletype. Arith. Teach. 13: 303-309; Apr. 1966. (see a-5a)

Brinkmann, Erwin H. Programed Instruction as a Technique for Improving Spatial Visualization. J. Appl. Psychol. 50: 179-184; Apr. 1966.

A group taught geometric topics such as point, set, line, ray, plane figure, and solids by the use of estimations of discrimination, identification, relationship and orientation with programed materials achieved significantly higher scores on a Geometry Inventory and on a Space Relations test than those who continued regular mathematics classes. Pupils who felt that teachers could teach better than a program more consistently scored below the median.

(I) programmed materials + tests or tests only. (D) spatial relations scores; achievement gain-difference scores; attitude; error rate.

e; 3.1; 2) s, 3) m; 50 pupils in 2 classes; 1.1, 1.4, 1.5, 1.6,

3.4; gr. 8; 3 wks.; non-norm; 34 (3, 4, 3, 4, 4, 5, 4, 3, 4); EP.

Crist, Robert L. Use of a Programed Multiplication Text Under Group-Paced and Individual-Paced Conditions. AV Comm. R. 14: 507-513; Winter 1966.

Pupils learned as well under group conditions as individually.

(I) individual- or group-paced use of programmed text.
(D) achievement difference scores.

e; 2.6; 2) m, 3) r; 33 pupils in 1 class; 1.4, 1.5, 3.4; gr. 3;

3 1/2-5 hrs.; non-norm; 37 (4, 3, 4, 5, 4, 4, 5, 4, 4); ED.

D'Augustine, Charles. Factors Related to Achievement With Selected Topics in Geometry and Topology. Arith. Teach. 13: 192-197; Mar. 1966. (see c-11)

Donaldson, P. R. Programmed Mathematics in Primary Schools. Prim. Math. 6: 31-37; June 1968.

This study found no statistically significant differences between groups of students taught with or without a teaching machine.

(I) use of teaching machine. (D) achievement scores.

e; 2.6; 1) i, 2) s, 3) m; 83 pupils; 1.4; ages 10, 11; ---;

non-norm; 35 (3, 3, 4, 4, 3, 5, 5, 4, 4); EP.

Henderson, Kenneth B. and Rollins, James H. A Comparison of Three Stratagems for Teaching Mathematical Concepts and Generalizations by Guided Discovery. Arith. Teach. 14: 503-508; Nov. 1967. (see a-3)

Meconi, L. J. Concept Learning and Retention in Mathematics. J. Exp. Ed. 36: 51-57; Fall 1967. (see a-3)

Rainey, Dan S. and Kelley, Francis J. An Evaluation of a Programed Textbook with Educable Mentally Retarded Children. J. Excep. Child. 34: 125-126; Oct. 1967. (see e-2)

Suppes, Patrick; Jerman, Max; and Groen, Guy. Arithmetic Drills and Review on a Computer-Based Teletype. Arith. Teach. 13: 303-309; Apr. 1966. (see a-5a)

Traub, Ross E. Importance of Problem Heterogeneity to Programed Instruction. J. Ed. Psychol. 57: 54-60; Jan. 1966.

1) Pupils who worked heterogeneous subtask problems performed the task significantly better than those who worked either homogeneous or irrelevant review problems.

2) Different types of subtask problems affected learning independently of subject aptitude.

(I) type of problem (heterogeneous, homogeneous, irrelevant).
(D) number of correct solutions; aptitude.

e; 2.16; 2) s, 3) r; 294 pupils in 2 school districts; 1.4, 1.7, 3.2, 3.4, 3.5; gr. 6; 4 days; norm, non-norm; 16 (1, 1, 2, 2, 2, 3, 2, 2, 1); EPD.

Buswell, G. T. The Growth of Concepts of Technical Terms in Arithmetic. Ind. U. Sch. Ed. Bull. 6: 26-29; Apr. 1930.

Changes in concepts of words were investigated with individual tests of 25 words.

s; ---; 2) s, 3) a; 240 pupils; 1.1, 1.6; grs. 1-6; ---; non-norm;

32 (3, 3, 3, 3, 4, 3, 5, 4, 4); NE.

Buswell, G. T. and John, Lenore. The Vocabulary of Arithmetic. Suppl. Ed. Monog. 38: 1-146; 1931.

A list of 100 arithmetic terms was selected from previous research to study the nature and development of concepts of technical and semitechnical terms in the first six grades. The general understanding of terms was studied with group tests in grades four through six (Chapter 3). The growth of vocabulary was studied with individual tests in grades one through six (Chapter 4). The degree of explanation of terms was examined in ten textbooks (Chapter 5). General conclusions reached were: 1) Children did not show satisfactory understanding of terms; 2) Textbook explanations of terms were not adequate.

d; ---; ---; ---; 1.1, 1.4, 1.6; grs. 1-6; ---; ---; ---; NE.

Buswell, G. T. and John, Lenore. The Vocabulary of Arithmetic: Chapter 3, Group Tests of Vocabulary of Arithmetic. Suppl. Ed. Monog. 38: 15-41; 1931.

Results of group tests for understanding of 100 terms and 25 of the 100 terms showed:

1) An increase in number of terms known with an increase in grade level, but with great variation.

2) Great variation in difficulty when measured by correct response.

3) Technical terms were the most difficult, terms relating to time, space or quantity were least difficult.

4) Wide variations in responses for the 12 school systems.

5) No major decrease in misconceptions for some terms with an increase in grade level.

The reliability and validity of the test and subtest seems questionable.

s; ---; 2) s, 3) a; 1,500 pupils in 12 schools; 1.1, 1.4, 1.6;

grs. 4-6; ---; non-norm; 30 (3, 3, 2, 3, 4, 4, 5, 4, 2); NE.

Buswell, G. T. and John, Lenore. The Vocabulary of Arithmetic: Chapter 4, Individual Tests of Vocabulary of Arithmetic. Suppl. Ed. Monog. 38: 43-82; 1931.

Categorization of type of response for individual tests of 25 word meanings and eight phrase meanings found: 1) an increase in correct responses and decrease in omissions with higher grade levels; 2) an increase in correct responses with an increase in level of intelligence.

s; ---; 2) s, 3) a; 240 pupils in 3 schools; 1.1, 1.4, 1.6;

grs. 1-6; ---; non-norm; 30 (3, 3, 3, 3, 4, 3, 5, 3, 3); NE.

Buswell, G. T. and John, Lenore. The Vocabulary of Arithmetic: Chapter 5, How New Terms Are Introduced in Textbooks. Suppl. Ed. Monog. 38: 91-99; 1931.

Wide variation was found in textbooks in terms of the frequency of occurrence, grade introduced, and manner of use of 100 words. Approximately one-fourth of the terms did not appear in two basic vocabulary lists.

d; ---; 2) s, 3) a; 10 textbooks; 1.1; grs. 3, 4; ---; ---; ---;

NE.

Lyda, W. J. and Duncan, Frances M. Quantitative Vocabulary and Problem Solving. Arith. Teach. 14: 289-291; Apr. 1967. (see a-5b)

Woody, Clifford. Some Investigations Resulting From the Testing Program in Arithmetic: An Investigation to Determine the Influence of Specialized Drill in Reading Upon the Solution of Verbal Problems. Ind. U. Sch. Ed. Bull. 6: 30-39; Apr. 1930 (1st of 3 studies). (see a-5b)

<u>Quantitative concepts in other subject areas</u> (d-7)

Kolb, John R. Effects of Relating Mathematics to Science Instruction on the Acquisition of Quantitative Science Behaviors. *J. Res. in Sci. Tchg.* 5: 174-182; June 1967. (see g-1)

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926 (2nd of 7 parts).

Photographing eye movements in column addition found: 1) Random methods of addition were associated with poor results; 2) Fewer fixations were used by individuals who had higher addition scores; 3) Duration of fixations are greater than in reading.

s; ---; 1) only; 20 pupils; 1.1, 1.4, 1.6; grs. 4-7 and adult;

---; non-norm; 27 (3, 2, 4, 4, 3, 3, 4, 2, 2); NE.

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926 (3rd of 7 parts). (see c-3)

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926 (4th of 7 parts).

Individual diagnosis of pupils fundamental operations in problem solving (work habits) found various poor work habits. The most frequent were:

1) In addition, errors in combinations, counting, split numbers, and added number carried last.

2) In subtraction, errors in combination, counting, not allowing for borrowing.

3) In multiplication, errors in combinations, adding carried number, carried wrong number and writing rows of zeros.

4) In division, errors in combinations, subtraction, multiplication, remainder larger than divisor and omitting zero.

5) Four, five or six poor habits per pupil for addition, increasing with the next higher process.

s; ---; 2) s, 3) s; 61 pupils; 1.1, 1.4, 1.6; grs. 3-6; ---;

non-norm; 24 (2, 2, 3, 4, 2, 3, 4, 2, 2); NE.

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926 (5th of 7 parts).

The diagnosis of individual pupils fundamental operations in problem solving was extended, having teachers do diagnosing, and giving consideration to I.Q. and arithmetic achievement. Similar results were found for the kind and frequency of habits. Remedial drill practice was done by students resulting in fair improvement, with little difference for I.Q. levels of average and low groups.

e; 1.2; 2) s; 352 pupils in 79 classes; 1.1, 1.4, 1.6; grs. 3-6;

10 wks.; norm; 32 (2, 3, 4, 5, 4, 4, 5, 3, 2); EP.

Buswell, G. T. Diagnostic Studies in Arithmetic. Suppl. Ed. Monog. 30: 1-212; July 1926 (6th and 7th of 7 parts).

From previous studies, a specific plan of diagnosis with materials is provided. Suggestions for remedial treatments suggested by teachers are given.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Counts, George Sylvester. Arithmetic Tests and Studies in the Psychology of Arithmetic. Suppl. Ed. Monog. 1: 1-125; 1917. (see f-1)

Eaton, Merrill T. The Value of the Dictaphone in Diagnosing Difficulties in Addition. Ind. U. Sch. Ed. Bull. 14: 5-10; Apr. 1938.

Verbal recorded responses during pre-test, and remedial drill situations, aided in diagnosing difficulties in addition.

c; ---; 2) s; 5 pupils; ---; grs. 1, 5, 8; 5 wks.; non-norm; ---;

NE.

Roberts, Gerhard H. The Failure Strategies of Third Grade Arithmetic Pupils. Arith. Teach. 15: 442-446; May 1968.

From analysis of items of third grade computation on a standardized achievement test, errors were classified into four major categories: 1) wrong operation; 2) computation error; 3) defective algorithm; 4) undiscernable errors. Defective algorithms accounted for the largest number of errors. Errors due to carelessness or lack of familiarity with addition and multiplication facts were fairly constant for all levels.

s; ---; 2) a, 3) r; 148 tests; 1.1, 1.6; gr. 3; ---; norm;

25 (2, 3, 3, 2, 3, 2, 3, 4, 3); NE.

Schane, Evelyn B. Characteristic Errors in Common Fractions at Different Levels of Intelligence. Pittsburgh Sch. 12: 155-168; Mar./Apr. 1938. (see c-4)

Smith, Henry Lester and Eaton, Merrill Thomas. A Diagnostic Study of Efficiency in Arithmetic. Ind. U. Sch. Ed. Bull. 15: 3-49; 1939.

A mechanical device was used to make group diagnostic study of basic number facts of addition, subtraction, multiplication and division. Group findings were:

1) A gradual decline in mastery of basic facts, with addition facts more thoroughly mastered.

2) As combinations increase in size, number of errors increased.

3) Combinations containing zero were most frequently missed.

Nine individuals scoring lowest in the four processes recorded their number activity in solving problems via a dictaphone, with physical behavior recorded by the experimenter. This, plus other information on health, I.Q., home environment, school citizenship, achievement, and arithmetic achievement was presented in a case study for each pupil.

s, c; ---; 2) a, 3) s; 77 groups, 9 individuals; 1.1, 1.4, 1.5,

1.9; gr. 4; ---; non-norm; 30 (3, 3, 4, 4, 3, 3, 5, 3, 2); NE.

Woody, Clifford. Some Investigations Resulting From the Testing Program in Arithmetic: Case Study of a Girl in Grade VIIB Who Was Doing Unsatisfactory Work in Arithmetic. Ind. U. Sch. Ed. Bull. 6: 45-49; Apr. 1930 (3rd of 3 studies).

After diagnosis of arithmetic difficulties, three ten-minute periods per week were used for additional individualized practice. Achievement gain of one to three years was made in many areas but loss was noted in some sub-tests.

c; ---; ---; 1 pupil; ---; gr. 7; ---; norm; ---; NE.

Callahan, John J. and Jacobson, Ruth S. An Experiment with Retarded Children and Cuisenaire Rods. Arith. Teach. 14: 10-13; Jan. 1967.

Use of Cuisenaire rods increased knowledge and understanding of number facts and properties.

(I) use of Cuisenaire rods. (D) achievement.

a; ---; 1) only; 1 class; ---; age 7-10 (retarded); 9 wks.;

non-norm; ---; NE.

Cawley, John F. and Goodman, John O. Interrelationships Among Mental Abilities, Reading, Language Arts, and Arithmetic with the Mentally Handicapped. Arith. Teach. 15: 631-636; Nov. 1968.

Intercorrelations of test results for mentally handicapped showed significant correlation between:

1) Verbal and motor abilities with arithmetic concepts, reasoning, and computation.

2) Total reading performance with primary mental ability subtests, except space.

3) Computation and reading for older subjects, not younger.

4) Primary mental abilities and achievement for the majority of the intercorrelations.

The question is raised, is computation higher because it is easier, or because it is stressed?

r; ---; 2) s, 3) a; ---; 1.4, 6.4; grs. 1-8; ---; norm; ---; NE.

Hamza, Mukhtar. Retardation in Mathematics Amongst Grammar School Pupils. Br. J. Ed. Psychol. 22: 189-195; Nov. 1952. (see f-2)

Lerch, Harold H. and Kelly, Francis J. A Mathematics Program for Slow Learners at the Junior High Level. Arith. Teach. 13: 232-236; Mar. 1966.

This study yielded significant results in identifying slow learners and developing a special curriculum in junior high mathematics as well as other subjects. The curriculum was the product of intense teacher-pupil interaction.

(I) specially designed curriculum vs. traditional curriculum.
(D) achievement gain scores.

e; 2.4; 2) r; 74 pupils; 1.4, 3.13; gr. 7; 1 yr.; norm; 24 (2, 3, 3, 3, 3, 2, 3, 2, 3); EPD.

Merton, Elda L. and Banting, G. O. Remedial Work in Arithmetic. Yrbk. of Dept. El. Sch. Prin. 2: 395-429; 1923.

This study listed remedial-work suggestions for Waukesha, Wisconsin schools which raised the performances on the Buckingham reasoning scale.

s; ---; 1) only; ---; ---; ---; ---; ---; 35 (4, 3, 3, 5, 4, 3, 5, 4, 4); NE.

Rainey, Dan S. and Kelley, Francis J. An Evaluation of a Programmed Textbook With Educable Mentally Retarded Children. J. Excep. Child. 34: 125-126; Oct. 1967.

Programmed instruction was more effective than either rote or understanding procedures when pupils were reading above the 2.3 grade level.

(I) use of programmed text or rote or understanding methods.
(D) achievement gains for multiplication, division, reasoning and word problems.

e; 3.13; 2) s, m, 3) r; 82 pupils; 1.4, 3.2, 3.13; ---; ---; norm; 30 (2, 3, 4, 4, 3, 3, 3, 4, 4); EPD.

Rossman, John G. Problems in Non-Promotion. Ind. U. Sch. Ed. Bull. 3: 47-58; Apr. 1927.

Non-promotion distribution by district, buildings, new entrants, teachers, grade and achievement was presented. Wide variation in standards of promotion were found for teachers, grades, departments and buildings. New students had higher rates of non-promotion.

s; ---; 2) s, 3) a; 15,177 pupils; 1.1, 1.3, 1.6; grs. 1-12; ---;

norm, non-norm; 31 (3, 4, 3, 4, 4, 3, 4, 3, 3); NE.

Woody, Clifford. Some Investigations Resulting From the Testing Program in Arithmetic: Case Study of a Girl in Grade VIIB Who Was Doing Unsatisfactory Work in Arithmetic. Ind. U. Sch. Ed. Bull. 6: 45-49; Apr. 1930 (3rd of 3 studies). (see e-1)

Namy, Elmer. Intellectual and Academic Characteristics of Fourth Grade Gifted and Pseudogifted Students. J. Excep. Child. 34: 15-18; Sept. 1967.

No significant differences were found between gifted students and those misdiagnosed as gifted by teachers on arithmetic subtests. It is suggested that pseudogifted pupils may rely highly on memory in attaining knowledge, whereas the gifted rely also on other higher cognitive processes.

(I) gifted or pseudogifted status. (D) achievement difference scores.

F; ---; 2) s, 3) r; 64 pupils; 1.4, 2.6, 3.3; gr. 4; ---; norm;

---; NE.

Prouse, Howard L. Creativity in School Mathematics. Math. Teach. 14: 876-879; Dec. 1967. (see f-1)

Scaramuzzi, Louis E. Money is Only Imaginary. Clearing House 30: 280-283; Jan. 1956. (see c-2)

Schlinsog, George W. The Effects of Supplementing Sixth-Grade Instruction with a Study of Nondecimal Numbers. Arith. Teach. 15: 254-263; Mar. 1968. (see c-15)

Suppes, Patrick. Accelerated Program in Elementary-School Mathematics - The Second Year. Psychol. in the Sch. 3: 294-307; Oct. 1966.

Mean quantitative results for students using various materials in an accelerated program are presented.

Difference in curriculum level for top and bottom level students is noted, along with an indication of no substantial increase in difference at the end of the year.

(I) various materials and activities for enrichment. (D) mean number of responses to problems and errors.

a; ---; 2) s, 3) a; 34 pupils; 1.1, 1.4, 1.6; gr. 2; 36 wks.;

---; 26 (2, 3, 3, 4, 3, 3, 3, 3, 2); NE.

Suppes, Patrick and Ihrke, Constance. Accelerated Program in Elementary-School Mathematics - The Third Year. Psychol. in the Sch. 4: 293-309; Sept. 1967.

Materials being used in a Stanford program are described, and results are presented and discussed.

(I) accelerated program. (D) achievement scores.

a; ---; 1) only; 32 pupils; 1.1, 1.6; gr. 3; 1 yr.; ---; ---; NE.

Balow, Bruce and Curtin, James. Ability Grouping of Bright Pupils. El. Sch. J. 66: 321-326; Mar. 1966.

Homogeneity of achievement was not evident when achievement scores were compared by intelligence levels; however, no actual grouping or teaching of the children homogeneously was done.

(I) grouping by intelligence scores. (D) achievement scores.

F; ---; 2) s, 3) r; 150 pupils; 1.4, 3.2, 3.3; gr. 3; ---; ---;

---; NE.

Brewer, Emery. A Survey of Arithmetic Intraclass Grouping Practices. Arith. Teach. 13: 310-314; Apr. 1966.

Thirteen conclusions are cited, including:

1) Grouping for arithmetic is widespread and desirable.

2) Teachers with "high" academic qualifications see a greater need to individualize, while those with "very high" interest are more likely to group pupils.

3) Availability of materials, awareness of pupil ability range, interest, and time to plan are factors important in grouping.

s; ---; 1) only; 1,392 teachers; 1.6; grs. k-6; ---; non-norm;

28 (3, 3, 4, 4, 4, 3, 3, 2, 2); NE.

Crist, Robert L. Use of a Programed Multiplication Text Under Group-Paced and Individual-Paced Conditions. AV Comm. R. 14: 507-513; Winter 1966. (see d-5)

Hudgins, Bryce B. and Smith, Louis M. Group Structure and Productivity in Problem-Solving. J. Ed. Psychol. 57: 287-296; Oct. 1966. (see a-5b)

Johnson, Mauritz and Scriven, Eldon. Class Size and Achievement Gains in Seventh and Eighth Grade English and Mathematics. Sch. R. 75: 300-310; Aug. 1967. (see f-2)

Lerch, Harold H. Arithmetic Instruction Changes Pupils' Attitudes Toward Arithmetic. Arith. Teach. 7-8: 117-119; Mar. 1961.

Two groups of two classes were examined to investigate attitudes toward mathematics in a grouped vs. non-grouped situation. The results indicated no adverse attitude changes in either group.

(I) grouping vs. non-grouping. (D) scores on attitude inventory.

e; 3.21; 2) i; 4 classes; ---; gr. 4; ---; non-norm; 39 (3, 4, 4, 5, 5, 5, 5, 4, 4); EP.

Woody, Clifford. The Advantage of Ability Grouping. Ind. U. Sch. Ed. Bull. 1: 38-60; Jan. 1925.

Groups matched on intelligence showed wide variation in achievement with slightly more gain by pupils in cities of less than 10,000.

(I) intelligence scores; size of city. (D) achievement gain scores.

F; ---; 2) m; 438 pupils; 1.1, 1.3, 1.4, 1.5, 1.12; grs. 3-8; 8 months; norm; 38 (3, 4, 5, 5, 4, 4, 5, 5, 3); NE.

Blackwell, A. M. A Comparative Investigation Into the Factors Involved in Mathematical Ability of Boys and Girls. Br. J. Ed. Psychol. 10: 143-153; June 1940 (Part I); 10: 212-222; Nov. 1940 (Part II). (see g-4)

Cawley, John F. and Goodman, John O. Interrelationships Among Mental Abilities, Reading, Language Arts, and Arithmetic with the Mentally Handicapped. Arith. Teach. 15: 631-636; Nov. 1968. (see e-3)

Cleveland, Gerald Arthur and Bosworth, Dorothy L. A Study of Certain Psychological and Sociological Characteristics as Related to Arithmetic Achievement. Arith. Teach. 14: 383-387; May 1967.

Positive correlations between arithmetic achievement and a psychologically healthy personality were found.

(I) personality, attitude, sex, S.E.S., I.Q. (D) arithmetic learning levels: skills concepts, problem solving.

F; ---; 2) s; 282 pupils in 6 schools; 3.2, 3.3; gr. 6; ---; norm,

non-norm; ---; NE.

Leibowitz, Sarah L. Fryer. The Motivational Effect of Value Symbols and Competition Upon Problem-Solving Behavior in Children. J. Genet. Psychol. 108: 327-332; June 1966. (see g-5)

Ridding, L. W. An Investigation of Personality Measures Associated With Over and Under Achievement in English and Arithmetic. Br. J. Ed. Psychol. 37: 397-398; Nov. 1967.

No significant relationship was found between stability or anxiety and over- or under-achievement. Extraversion was correlated with over-achievement, and introversion with under-achievement.

r; ---; ---; 600 pupils; 3.2; age 12+; ---; ---; ---; NE.

Zaslow, Robert W. Reversals in Children as a Function of Body Orientation. J. Ed. Psychol. 57: 133-139; June 1966.

Alteration of writing position by crossing over to other side of midline with hand and arm resulted in significant corrections of reversals for both normal and brain-damaged children.

(I) writing position. (D) percent of corrections of reversals.

e; 3.21; 2) s, 3) a; 110 pupils; 1.1, 1.6, 2.6; grs. 1-3; ---;

non-norm; 22 (2, 2, 2, 3, 3, 3, 3, 2, 2); EPD.

Blackwell, A. M. A Comparative Investigation Into the Factors Involved in Mathematical Ability of Boys and Girls. Br. J. Ed. Psychol. 10: 143-153; June 1940 (Part I); 10: 212-222; Nov. 1940 (Part II). (see g-4)

Brownell, William and Carper, Doris V. Learning the Multiplication Combinations. Duke U. Studies in Ed. 7: 1-177; 1943 (6th of 10 chapters). (see c-3c)

Clark, Edward T. Sex Differences in the Perception of Academic Achievement Among Elementary School Children. J. Psychol. 67: 249-256; Nov. 1967.

Arithmetic grades did not differ significantly; less than half of each sex perceived themselves in the top half of the class.

s; ---; 2) s, 3) a; 163 pupils in 6 classes; 1.4, 1.6, 3.4;

grs. 4-6; ---; norm; 27 (2, 2, 3, 4, 4, 3, 3, 3, 3); NE.

Unkel, Esther. A Study of the Interaction of Socioeconomic Groups and Sex Factors with the Discrepancy Between Anticipated Achievement and Actual Achievement in Elementary School Mathematics. Arith. Teach. 13: 662-670; Dec. 1966. (see f-2)

Dutton, Wilbur H. Teaching Time Concepts to Culturally Disadvantaged Primary-Age Children. Arith. Teach. 14: 358-364; May 1967. (see c-8)

Evans, John W., Jr. The Effect of Pupil Mobility Upon Academic Achievement. Na. El. Prin. 45: 18-22; Apr. 1966. (see f-2)

Lehew, Charmon. The Performance of Four- and Five-Year-Old Children in Operation Head Start on Selected Arithmetic Abilities. Arith. Teach. 15: 53-59; Jan. 1968.

A mathematical inventory used for assessment of selected arithmetic abilities gave similar results of previous studies. Limitations noted were insufficient items for measuring understanding and vocabulary.

s; ---; 1) only; 52 pupils; 1.1, 1.6; ages 4-7 to 5-11;

1 administration; non-norm; 32 (2, 4, 4, 3, 4, 4, 4, 4, 3); NE.

Newman, Thomas B. and Seiser, William. The Floating Teacher - Help For the Mathematically Disadvantaged. Math. Teach. 60: 753-755; Nov. 1967.

Students given remedial help made significant gains in achievement and attitude.

(I) use of floating teacher. (D) achievement gain scores.

a; ---; ---; 1,028 pupils; ---; grs. 7-9; 1 semester; ---; ---;

NE.

Paschal, Billy J. A Concerned Teacher Makes the Difference. Arith. Teach. 13: 203-205; Mar. 1966.

This study found that disadvantaged children can learn as much as middle-class contemporaries when given opportunity and an "ego-supporting" teacher.

(I) S.M.S.G. program. (D) achievement scores.

e; 3.21; 2) s; 58 pupils; ---; gr. 1; 1 yr.; non-norm;

33 (2, 3, 4, 4, 5, 3, 5, 3, 4); EP.

Perrodin, Alex F. and Snipes, Walter T. The Relationship of Mobility to Achievement in Reading, Arithmetic, and Language in Selected Georgia Elementary Schools. J. Ed. Res. 59: 315-319; Mar. 1966. (see f-2)

Pitts, Vera L. An Investigation of the Relationships Between Two Preschool Programs on the Adjustment and Readiness of Disadvantaged Pupils. Childhd. Ed. 44: 524-525; Apr. 1968.

Length of preschool attendance: 1) was related to facilitating some dimensions of social growth; 2) was not found to be related to academic or total readiness.

(I) amount of pre-kindergarten formal school experience (0-8 weeks - 9 months); birth date and place; sex; ethnic background. (D) social growth, emotional development, academic readiness, general readiness.

F; ---; 2) m, 3) s; 87 pupils; 4.4; kdg.; ---; norm; 29 (2, 2,

3, 3, 3, 4, 4, 5, 3); NE.

Snipes, Walter T. Mobility on Arithmetic Achievement. Arith. Teach. 13: 43-46; Jan. 1966. (see f-2)

Unkel, Esther. A Study of the Interaction of Socioeconomic Groups and Sex Factors with the Discrepancy Between Anticipated Achievement and Actual Achievement in Elementary School Mathematics. Arith. Teach. 13: 662-670; Dec. 1966. (see f-2)

Ashlock, Robert B. A Test of Understandings for the Primary Grades. Arith. Teach. 15: 438-441; May 1968.

Procedures for and examples of a constructed paper-and-pencil test for first and second grade that measured understandings of selected properties of number systems with reported high reliability (.86) and content validity.

s; ---; 1) only; 1st form - 107, 2nd form - 117, pretest form - 246, final form - 490; 1.4, 6.4; grs. 1-2; ---; non-norm; ---; NE.

Ashlock, Robert B. and Welch, Ronald C. A Test of Understandings of Selected Properties of a Number System. Ind. U. Sch. Ed. Bull. 42: 1-74; Mar. 1966.

This study presented a test developed for use in measuring understandings in the first two grades.

s; ---; 1) only; 490 pupils; ---; grs. 1-2; ---; non-norm; 22 (1, 2, 3, 4, 3, 2, 3, 2, 2); NE.

Counts, George Sylvester. Arithmetic Tests and Studies in the Psychology of Arithmetic. Suppl. Ed. Monog. 1: 1-125; 1917.

This dissertation examined an arithmetic speed test which was developed and given to 834 classes in Cleveland and Grand Rapids to aid in diagnosis of arithmetic weaknesses. Comparisons were made between the two school systems and with the Courtis tests. The errors were analyzed with results: addition over ten, subtraction over ten, multiplications with zero, and division by self, were the most difficult. Errors in fractions were due to "slavish adherence to the mechanics." Comparisons of ability to age and groups showed younger superior to older in given group. Racial comparison seemed to show no differences.

s; ---; 1) only; 834 classes; ---; grs. 3-8; ---; non-norm; 19 (1, 2, 2, 3, 3, 3, 2, 2, 1); NE.

Flournoy, Frances. The Development of Arithmetic Understanding Tests for Primary and Intermediate Levels. J. Ed. Res. 62: 73-76; Oct. 1968.

This study investigated the development of arithmetic understanding through the use of a specially prepared test and found the test did discriminate such development.

s; ---; 2) s; 470 pupils; 1.3, 1.4, 1.6, 6.4; grs. 1-6; ---;

norm, non-norm; 23 (2, 2, 3, 3, 3, 2, 2, 3, 3); NE.

Goodwin, William L. Effect of Selected Methodological Conditions on Dependent Measures Taken After Classroom Experimentation. J. Ed. Psychol. 57: 350-358; Dec. 1966.

Variation of four independent variables related to collection of test data resulted in 16 treatments. Findings indicated:

1) Test notice was a significant factor for the concepts subtest but not computations subtest.

2) Experimental atmosphere seemed to favor testing results.

3) Tests administered by teachers resulted in higher class means.

4) Teachers seemed to give lower scores for higher strata students and the reverse for lower strata students.

(I) experimental atmosphere; notice of testing date; test administrator; test scorer. (D) raw scores in 1) arithmetic computation, 2) concepts, 3) application, and 4) total.

e; 2.13, 2.14; 2) r, 3) r; 1,657 pupils in 64 classes; 1.4, 3.2,

3.3; gr. 6; ---; norm; 17 (3, 1, 2, 3, 1, 2, 2, 2, 1); EPD.

Gray, Roland F. An Approach to Evaluating Arithmetic Understandings. Arith. Teach. 13: 187-191; Mar. 1966.

An individual interview inventory was developed to measure varying levels of understanding in multiplication.

d; ---; ---; ---; ---; gr. 3; ---; non-norm; ---; NE.

Hartlein, Marion L. Use of Items with Coded Numbers for Measuring Understanding of Elementary Mathematical Concepts. Arith. Teach. 13: 540-545; Nov. 1966.

A multiple choice test with matched items containing coded numbers and non-coded numbers, was designed to measure understanding of mathematical concepts; coded items discriminated as well as non-coded items.

s; ---; 1) only; 170 pupils; 2.4; grs. 5, 6; ---; non-norm;

30 (3, 3, 4, 3, 3, 4, 4, 3, 3); NE.

Henderson, George. Math Tests Analyzed. Wisc. J. Ed. 100: 16-17 and 27; May 1968.

Three mathematic tests were analyzed and items were classified for objectives tested. (No interpretation was given.)

d; ---; 2) s, 3) a; 3 tests; 1.1; grs. k-6; ---; norm; ---; NE.

Pace, Angela. Understanding of Basic Concepts of Arithmetic: A Comparative Study. J. Ed. Res. 60: 107-120; Nov. 1966. (see a-6)

Paige, Donald D. Learning While Testing. J. Ed. Res. 59: 276-277; Feb. 1966. (see g-7)

Prouse, Howard L. Creativity in School Mathematics. Math. Teach. 14: 876-879; Dec. 1967.

Correlations between achievement, I.Q., G.P.A., preferences, teacher rating, and creativity test scores were found; in an attempt to determine a procedure for identifying gifted pupils.

r; ---; 2) s; 312 pupils in 14 classes; correlations, 3.4, paired

comparisons (David); gr. 7; ---; norm, non-norm; ---; NE.

Romberg, Thomas A. A Note on Multiplying Fractions. Arith. Teach. 15: 263-265; Mar. 1968. (see c-4c)

Romberg, Thomas A. and Wilson, James W. The Development of Mathematics Achievement Tests for the National Longitudinal Study of Mathematical Abilities. Math. Teach. 61: 489-495; May 1968.

Development of tests involved: 1) a scheme for classification of components of mathematic ability; 2) selection of eleven basic content areas; 3) cognitive categorization of behaviors associated with content areas; 4) solicitation of ideas for testing understanding; 5) writing initial test items; 6) two pilot testings and editings for final form.

d; ---; 1) only; ---; ---; grs. 4-12; 5 yrs.; ---; ---; NE.

Weaver, J. Fred. Levels of Geometric Understanding Among Pupils in Grades 4, 5, and 6. Arith. Teach. 13: 686-690; Dec. 1966. (see c-11)

Welch, Ronald C. and Edwards, Charles W., Jr. A Test of Arithmetic Principles, Elementary Form. Ind. U. Sch. Ed. Bull. 41: 1-86; Sept. 1965.

This is a report on a test which attempts to measure the "meaning" aspect or principles vs. traditional concepts. Reliability and norms are provided, and are judged valid. Use of this instrument is intended to be general, even to children within a traditional program. The author recommends further use for further research into identification of levels of principle-attainment.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Woody, Clifford. Results From Successive Repetitions of Certain Arithmetic Tests. Ind. U. Sch. Ed. Bull. 1: 61-79; Jan. 1925.

Repetitious testing with different forms of two tests found: 1) achievement gain with repetition; 2) equality of forms except for small groups; and 3) the tests measured different aspects of arithmetic ability.

s; ---; 1) only; 123 pupils; 1.3, 1.4, 1.6; grs. 4-6; 2 wks.;

---; 30 (4, 3, 4, 3, 3, 4, 4, 3, 2); NE.

Brownell, William and Carper, Doris V. Learning the Multiplication Combinations. Duke U. Studies in Ed. 7: 1-177; 1943. (see c-3c)

Christensen, Donald J. The Effect of Discontinued Grade Reporting on Pupil Learning. Arith. Teach. 15: 724-726; Dec. 1968.

A campus laboratory arithmetic class, which had received letter grades the first semester, was told everyone would receive a grade of "pass" the second semester. Achievement gain was over 11 months for the second semester, though students reported dislike of not receiving grades.

(I) grade or no grade for a semester. (D) achievement scores.

e; 2.18; 2) s, 3) a; 24 pupils; 1.3, 6.4; gr. 8; 2 semesters;

norm, non-norm; 29 (2, 3, 3, 4, 5, 2, 4, 3, 3); EPD.

Counts, George Sylvester. Arithmetic Tests and Studies in the Psychology of Arithmetic. Suppl. Ed. Monog. 1: 1-125; 1917. (see f-1)

Dobbs, Virginia and Neville, Donald. The Effect of Nonpromotion on the Achievement of Groups Matched from Retained First Graders and Promoted Second Graders. J. Ed. Res. 60: 472-475; July-Aug. 1967.

Reading and arithmetic achievement gain of the promoted group was greater than that of the nonpromoted group, although both showed significant gains.

(I) promotion or non-promotion. (D) achievement gain scores.

e; 2.6; 2) s, 3) m; 60 pupils; 1.4, 1.5, 3.2, 3.4; grs. 1, 2;

2 yrs.; norm; 24 (2, 1, 3, 4, 3, 3, 3, 3, 2); EPD.

Eaton, Merrill T. A Survey of the Achievement in Arithmetic of 11,348 Sixth Grade Pupils in 486 Schools in Indiana. Ind. U. Sch. Ed. Bull. 20: 1-62; Mar. 1944.

Conclusions:

1) Three school groups (city, township, and special--parochial, lab, consolidated, etc.) all showed wide range in grade equivalent average with city schools 70% below, township 60% below, and special all above average.

2) Younger sixth graders scored higher than older.

3) Achievement tends to decrease with increase in school term.

4) Class size and school size are not determinants, nor time in arithmetic.

5) Achievement in classes with several grades was higher.

6) Achievement in nondepartmentalized classes was higher.

7) Achievement in classes in different congressional districts was different but not predictably.

s; ---; 2) s; 11,348 pupils in 486 schools; 1.4, 1.6; gr. 6;

---; norm; 22 (2, 2, 2, 2, 3, 2, 4, 3, 2); NE.

Evans, John W., Jr. The Effect of Pupil Mobility Upon Academic Achievement. Na. El. Prin. 45: 18-22; Apr. 1966.

Mobility showed no adverse effect upon achievement when grades and I.Q. scores obtained from cumulative records were used to compare a mobile and a non-mobile group of students.

(I) I.Q.; mobility. (D) achievement as indicated by converted grade scores.

F; ---; 1) only; 97 pupils; 1.3, 1.4, 6.4; grs. 5, 6; ---; norm;

34 (2, 3, 4, 5, 5, 4, 4, 4, 3); NE.

Flournoy, Frances. A Study of Pupils' Understanding of Arithmetic in the Intermediate Grades. Sch. Sci. Math. 47: 325-333; Apr. 1967.

Sample items and indices of difficulty are given for a test requiring pupils to use underlying principles. Pupils showed lack of understanding of place value, properties, and algorithms.

s; ---; 2) s; 240 pupils; 1.3, 1.6, 1.7; grs. 4-6; ---; non-norm;

31 (2, 3, 5, 5, 4, 3, 3, 3, 3); NE.

Flournoy, Frances. A Study of Pupils' Understanding of Arithmetic in the Primary Grades. Arith. Teach. 14: 481-485; Oct. 1967.

Sample items and indices of difficulty are given for a test requiring pupils to use underlying principles. On the test, third grade pupils scored somewhat below expectation in comparison with pupils in grades 1 and 2.

s; ---; 2) s; 230 pupils; 1.3, 1.6, 1.7; grs. 1-3; ---; non-norm;

31 (2, 3, 5, 5, 4, 3, 3, 3, 3); NE.

Goodwin, William L. Effect of Selected Methodological Conditions on Dependent Measures Taken After Classroom Experimentation. J. Ed. Psychol. 57: 350-358; Dec. 1966. (see f-1)

Hamza, Mukhtar. Retardation in Mathematics Amongst Grammar School Pupils. Br. J. Ed. Psychol. 22: 189-195; Nov. 1952.

Significant differences were found between groups composed of 1) students achieving normally in all subjects including mathematics, and 2) students who were achieving well in all subjects except mathematics. The group that was retarded in math achievement had significantly lower ability scores than those showing normal achievement. Factor analysis of the matrix of correlations revealed a general intelligence factor as primary. Secondary factors were "visual imagery," "number," and "attitude."

r; ---; 2) s; 272 pupils; 6.1; ages 12-14; ---; ---; ---; NE.

Hungerman, Ann D. Achievement and Attitude of Sixth Grade Pupils in Conventional and Contemporary Mathematics Programs. Arith. Teach. 14: 30-39; Jan. 1967. (see a-3)

Johnson, Mauritz and Scriven, Eldon. Class Size and Achievement Gains in Seventh and Eighth Grade English and Mathematics. Sch. R. 75: 300-310; Aug. 1967.

No significant differences due to class size were found on mathematics scores.

F; ---; ---; 135 classes; 1.4, 1.5, 4.3; grs. 7, 8; ---; norm;

---; NE.

Lee, Doris M. A Study of Specific Ability and Attainment in Mathematics. Br. J. Ed. Psychol. 25: 178-189; Nov. 1955. (see f-3)

Lynn, R. Temperamental Characteristics Related to Disparity of Attainment in Reading and Arithmetic. Br. J. Ed. Psychol. 27: 62-67; Feb. 1957.

A positive relationship was found between anxiety and the characteristic of better reading than arithmetic achievement. That is, anxious children tended to be better at reading than at arithmetic.

r; ---; 1) only; a) 80 boys & girls, b) 45 boys; 2.6; ages

a) 7-6 to 11-0, b) 14-6 to 15-6; ---; norm, non-norm; ---; NE.

Merton, Elda L. and Banting, G. O. Remedial Work in Arithmetic. Yrbk. of Dept. El. Sch. Prin. 2: 395-429; 1923. (see e-2)

Monroe, Walter S. How Pupils Solve Problems in Arithmetic. U. Ill. Bull. 44: 1-30; 1929. (see a-5b)

Perrodin, Alex F. and Snipes, Walter T. The Relationship of Mobility to Achievement in Reading, Arithmetic, and Language in Selected Georgia Elementary Schools. J. Ed. Res. 59: 315-319; Mar. 1966.

An investigation of the relationships between pupil mobility and academic achievement found the number of moves did not seem to affect academic achievement except for students from other states manifesting higher arithmetic reasoning achievement.

(I) number, recency and distance of moves; sex; age; socio-economic classification; I.Q.; retained in a grade.
(D) achievement scores.

F; ---; 2) all; 438 pupils in 6 schools; 1.4, 2.6, 3.2, 3.4;

gr. 6; ---; norm; 23 (2, 2, 3, 3, 3, 2, 3, 3, 2); NE.

Price, Edette B.; Prescott, Arthur L.; and Hopkins, Kenneth D. Comparative Achievement With Departmentalized and Self-Contained Classroom Organization. Arith. Teach. 14: 212-215; Mar. 1967. (see a-3)

Reddel, William D. and DeVault, M. Vere. In-Service Research in Arithmetic Teaching Aids. Arith. Teach. 7: 243-246; May 1960. (see d-3)

Snipes, Walter T. Mobility on Arithmetic Achievement. Arith. Teach. 13: 43-46; Jan. 1966.

An investigation of the relationship of number, duration and place of moves to arithmetic achievement found students from other states had higher arithmetic reasoning achievement.

(I) moves - number, duration, place. (D) achievement scores.

F; ---; 2) all; 483 pupils in 6 schools; 1.4, 2.6, 3.2, 3.4;

gr. 6; ---; norm; 25 (2, 3, 3, 3, 3, 2, 3, 3, 3); NE.

Unkel, Esther. A Study of the Interaction of Socioeconomic Groups and Sex Factors with the Discrepancy Between Anticipated Achievement and Actual Achievement in Elementary School Mathematics. Arith. Teach. 13: 662-670; Dec. 1966.

Statistical interactions of socio-economic status and sex with the discrepancy between anticipated and actual achievement scores was investigated. Socio-economic status was a significant factor in achievement of children of comparable mental ability. Fluctuation of discrepancy scores was greatest for arithmetic reasoning. Discrepancy scores of boys and girls followed approximately the same pattern, except for grade 6 to grade 9, when girls' discrepancy scores surpassed the boys.

(I) socio-economic level, sex. (D) difference between anticipated and actual achievement in arithmetic reasoning, fundamentals, and total.

F; ---; 2) r; 918 pupils; 3.2, 3.6; grs. 1-9; 3 wks.; norm;

28 (3, 3, 3, 3, 4, 4, 2, 3, 3); NE.

Woody, Clifford. Knowledge of Arithmetic Possessed by Young Children. Ind. U. Sch. Ed. Bull. 6: 50-85; Apr. 1930. (see f-2)

Wrigley, Jack. The Factorial Nature of Ability in Elementary Mathematics. Br. J. Ed. Psychol. 28: 61-78; Feb. 1958. (see f-3)

Yeager, John L. and Lindvall, C. M. An Exploratory Investigation of Selected Measures of Rate of Learning. J. Exp. Ed. 36: 78-81; Winter 1967.

Three possible measures of rate of learning (number of units completed, time to complete units, and amount of content mastered per day) were explored with I.P.I. materials. Results suggest that rate of learning is not a general characteristic of the learner, but seems to be specific to the learning task.

r; ---; ---; 157 pupils; 6.4; grs. 1-6; ---; norm; ---; NE.

Counts, George Sylvester. Arithmetic Tests and Studies in the Psychology of Arithmetic. Suppl. Ed. Monog. 1: 1-125; 1917. (see f-1)

Hamza, Mukhtar. Retardation in Mathematics Amongst Grammar School Pupils. Br. J. Ed. Psychol. 22: 189-195; Nov. 1952. (see f-2)

Hebron, M. E. A Factorial Study of Learning a New Number System and Its Relation to Attainment, Intelligence and Temperament. Br. J. Ed. Psychol. 32: 38-45; Feb. 1962.

A factorial study of items in a new arithmetic learning situation suggests that, although knowledge of one system is the most important single factor in learning a new one, temperamental aspects of attention and set are also relevant.

r; ---; 1) only; 90 pupils; 6.1; av. age 12-4; ---; non-norm; ---;

NE.

Lee, Doris M. A Study of Specific Ability and Attainment in Mathematics. Br. J. Ed. Psychol. 25: 178-189; Nov. 1955.

Conclusions:

1) Factor analyses did not reveal single factors corresponding to the "stages" of mathematical reasoning.

2) Mental abilities involved in working tests of math ability also entered into the working of attainment tests.

3) Correlations ranging from .13 to .57 were obtained between the tests of mathematical ability and school certificate mathematics marks at the 5th year level. Correlations between tests of math attainment and school certificate marks ranged from .45 to .74.

r; ---; ---; ---; 6.1; gr. 5 (British); ---; norm, non-norm; ---;

NE.

Lynn, R. Temperamental Characteristics Related to Disparity of Attainment in Reading and Arithmetic. Br. J. Ed. Psychol. 27: 62-67; Feb. 1957. (see f-2)

Oldham, Hilda W. A Psychological Study of Mathematical Ability, With Special Reference to School Mathematics. Br. J. Ed. Psychol. 7: 269-286; Nov. 1937 (Part I); 8: 16-27; Feb. 1938 (Part II).

Conclusions:

1) There was no indication of any large group factor in arithmetic, algebra, and geometry.

2) Significant tetrad differences indicate the specific nature of each of the three abilities.

3) Where they occur the overlapping factors between algebra and geometry appear to be functions of extraneous influences such as teaching methods.

4) Where present the group factor between arithmetic and geometry seems to be due to the application of number to geometry.

5) Where present the group factor between arithmetic and algebra may involve activities intrinsic to each such as figure sense and computational accuracy.

6) Low correlations were found between intelligence and the three abilities.

7) Arithmetic, algebra, and geometry do not seem to have a large enough group factor to justify their being placed in one class for purposes of examination.

r; ---; 1) only; 410 pupils; 6.1; ages 9-15; ---; ---; ---; NE.

Sutherland, John. An Investigation Into Some Aspects of Problem Solving in Arithmetic. Br. J. Ed. Psychol. 11: 215-222; Nov. 1941 (Part I); 12: 35-46; Feb. 1942 (Part II). (see a-5b)

Relation to achievement (f-3)

Wrigley, Jack. The Factorial Nature of Ability in Elementary Mathematics. Br. J. Ed. Psychol. 28: 61-78; Feb. 1958.

The conclusions drawn from a factor analysis of mathematical ability in grammar and technical schools were as follows:

1) High intelligence was most important single factor for success in math.

2) A math group factor was isolated.

3) Verbal, spatial, and numerical group factors were isolated.

4) Performance in geometry is connected with spatial ability as measured by the spatial factor.

5) The numerical ability factor is reflected in mechanical arithmetic performance and to a lesser extent in algebra.

6) When the influence of general ability is eliminated, verbal ability has little connection with math ability.

r; ---; 1) only; 622 pupils; 6.1; ages 13-16; ---; norm, non-norm;

---; NE.

Brownell, William and Carper, Doris V. Learning the Multiplication Combinations. Duke U. Studies in Ed. 7: 1-177; 1943 (6th of 10 chapters). (see c-3c)

Buswell, G. T. and John, Lenore. The Vocabulary of Arithmetic: Chapter 3, Group Tests of Vocabulary of Arithmetic. Suppl. Ed. Monog. 38: 15-41; 1931. (see d-6)

Cronin, Robert Emmet. The Effect of Varying Amounts of Traditional and Modern Mathematics Instruction Relative to Sex and Intellectual Ability on Both the Traditional and Modern Mathematics Achievement of Eighth Grade Pupils. Catholic Ed. R. 65: 548-549; Dec. 1967.

Confusion or interference from a change in method of instruction does actually exist; its debilitating effects are retroactive and proactive.

F; ---; 1) only; ---; ---; gr. 8; ---; ---; ---, NE.

Estes, Betsy and Combs, Ann. Perception of Quantity. J. Genet. Psychol. 108: 333-336; June 1966. (see g-6)

Scott, Ralph and Lighthall, Frederick F. Relationship Between Content, Sex, Grade, and Degree of Disadvantage in Arithmetic Problem Solving. J. Sch. Psychol. 6: 61-67; Fall 1967. (see a-5b)

Brownell, William and Carper, Doris V. Learning the Multiplication Combinations. Duke U. Studies in Ed. 7: 1-177; 1943 (6th of 10 chapters). (see c-3c)

Cronin, Robert Emmet. The Effect of Varying Amounts of Traditional and Modern Mathematics Instruction Relative to Sex and Intellectual Ability on Both the Traditional and Modern Mathematics Achievement of Eighth Grade Pupils. Catholic Ed. R. 65: 548-549; Dec. 1967. (see f-3a)

Feldhusen, John F.; Thurston, John R.; and Benning, James J. Classroom Behavior, Intelligence, and Achievement. J. Exp. Ed. 36: 82-87; Winter 1967.

Arithmetic and reading achievement of "approved" children was significantly higher than that of "disapproved" children. The difference is greater at sixth grade than at third grade.

F; ---; 2) s, 2) r; 200 pupils; 1.4, 3.2, 3.3, 3.5; grs. 3, 6;

---; norm; ---; NE.

Flournoy, Frances. The Development of Arithmetic Understanding Tests for Primary and Intermediate Levels. J. Ed. Res. 62: 73-76; Oct. 1968. (see f-1)

Freyberg, P. S. Concept Development in Piagetian Terms in Relation to School Attainment. J. Ed. Psychol. 57: 164-168; June 1966. (see g-6)

Schane, Evelyn B. Characteristic Errors in Common Fractions at Different Levels of Intelligence. Pittsburgh Sch. 12: 155-168; Mar./Apr. 1938. (see c-4)

Woody, Clifford. The Advantage of Ability Grouping. Ind. U. Sch. Ed. Bull. 1: 38-60; Jan. 1925. (see e-4)

Houston, W. Robert and DeVault, M. Vere. Mathematics In-Service Education: Teacher Growth Increases Pupil Growth. Arith. Teach. 10: 243-247; May 1963.

This study investigated the effect of four variations in presentation of in-service teacher education and found that any in-service gains made by teachers were matched by gains in their pupils.

(I) instruction in math by 1) TV, 2) TV and consultant, 3) lecture, 4) lecture and consultant. (D) achievement gain scores.

a; ---; 1) only; 1,977 pupils, 89 teachers; 1.4, 3.4, 6.4;

grs. 4-6; ---; non-norm; 37 (3, 4, 5, 5, 4, 4, 5, 4, 3); NE.

Scaramuzzi, Louis E. Money is Only Imaginary. Clearing House 30: 280-283; Jan. 1956. (see c-2)

Brownell, William A. and Moser, Harold E. Meaningful vs. Mechanical Learning: A Study in Grade III Subtraction. Duke U. Studies in Ed. 8: 1-207; 1949. (see a-3)

Gilmary, Sister. Transfer Effects of Reading Remediation to Arithmetic Computation When Intelligence is Controlled and All Other School Factors Are Eliminated. Arith. Teach. 14: 17-20; Jan. 1967.

Pupils receiving remediation (help) in both arithmetic and reading showed significantly greater gain in arithmetic computation than those who received help in arithmetic only.

(I) arithmetic and reading remediation or arithmetic only.
(D) achievement gain scores.

F; ---; 2) s, 3) s; 60 pupils; 1.1, 1.4, 3.2, 3.3, 3.5; elem.;

6 wks.; norm; ---; NE.

Hebron, M. E. A Factorial Study of Learning a New Number System and Its Relation to Attainment, Intelligence and Temperament. Br. J. Ed. Psychol. 32: 38-45; Feb. 1962. (see f-3)

Kolb, John R. Effects of Relating Mathematics to Science Instruction on the Acquisition of Quantitative Science Behaviors. J. Res. in Sci. Tchg. 5: 174-182; June 1967.

This study investigated the hierarchical capabilities of Gagne in the performance of science through transfer of mathematical instruction specially geared for such transfer and found that transfer does take place.

(I) instruction in math. (D) scores on science and math tests.

e; 3.3; 1) s, 2) s, 3) r; 8 classes; 1.4, 3.2; gr. 5; ---;

non-norm; 18 (2, 1, 2, 3, 3, 2, 2, 2, 1); EPD.

Marshall, Helen R. Transposition in Children as a Function of Age and Knowledge. J. Genet. Psychol. 108: 65-69; Mar. 1966.

This study showed that the age 4 1/2 - 5 1/2 was the age at which children could be found at all levels of knowledge of the middle size concept.

(I) middle size test items; age. (D) responses to middle size test items.

e; 3.18; 1) only; 359 pupils; 1.3, 1.4, 2.6, 3.4; pre-school; ---;

norm; 26 (2, 3, 2, 3, 3, 4, 3, 3, 3); EP.

Meconi, L. J. Concept Learning and Retention in Mathematics. J. Exp. Ed. 36: 51-57; Fall 1967. (see a-3)

Smith, Henry Lester and Eaton, Merrill Thomas. The Relation of Accuracy to Speed in Addition. Ind. U. Sch. Ed. Bull. 14: 5-23; 1938. (see c-3a)

Woody, Clifford. Some Investigations Resulting From the Testing Program in Arithmetic: An Investigation to Determine the Transfer Effects of Three Different Methods of Teaching Three Different Types of Examples in Two-Place Addition. Ind. U. Sch. Ed. Bull. 6: 39-45; Apr. 1930 (2nd of 3 studies).

The amount of transfer resulting from different methods of instruction: 1) was greatest for instruction that emphasized generalization; 2) did not differ significantly for pupils of low mental ages, pupils with higher mental ages made the greatest amount of transfer; 3) was greatest to similar problems on tests immediately after instruction.

(I) four methods of teaching; three types of examples.
(D) achievement gain scores.

e; 2.11; 2) m, 3) s; 52 classes; 1.4, 1.6; gr. 2; 2 wk. periods,

2 yrs.; norm; 31 (2, 3, 3, 5, 3, 4, 5, 3, 3); EP.

Worthen, Blaine R. Discovery and Expository Task Presentation in Elementary Mathematics. J. Ed. Psychol. 59: 1-13; Feb. 1968. (see a-3)

Worthen, Blaine R. A Study of Discovery and Expository Presentation: Implications for Teaching. J. Teach. Ed. 19: 223-242; Summer 1968. (see a-3)

Zeiler, Michael D. and Gardner, Ann M. Intermediate Size Discrimination in Seven- and Eight-Year-Old Children. J. Exp. Psychol. 71: 203-207; Feb. 1966.

Training with intermediate-sized set of stimuli previous to transposition tasks found: 1) decreasing gradient of transposition ending in transposition reversal; 2) significant transposition: a) at a 1/2 step, b) reversal with increased training - test difference; 3) verbalization seemed to fail to have an effect on transfer.

(I) differences of set stimulus areas for training.
(D) differences in frequency of transposition.

e; 2.16; 1) s, 2) s, 3) r; 176 pupils; 1.4, 2.6, 3.3; age 7-8;

---; non-norm; 28 (2, 3, 3, 4, 3, 3, 4, 3, 3); EPD.

Brownell, William A. and Moser, Harold E. Meaningful vs. Mechanical Learning: A Study in Grade III Subtraction. Duke U. Studies in Ed. 8: 1-207; 1949. (see a-3)

Meconi, L. J. Concept Learning and Retention in Mathematics. J. Exp. Ed. 36: 51-57; Fall 1967. (see a-3)

Pigge, Fred L. Analysis of Covariance in a Randomly Replicated Arithmetic Methods Experiment. J. Exp. Ed. 34: 73-83; Summer 1966. (see a-3)

Scott, Lloyd F. Summer Loss in Modern and Traditional Elementary School Mathematics Programs. Calif. J. Ed. Res. 28: 145-151; May 1967. (see a-3)

Worthen, Blaine R. Discovery and Expository Task Presentation in Elementary Mathematics. J. Ed. Psychol. 59: 1-13; Feb. 1968. (see a-3)

Worthen, Blaine R. A Study of Discovery and Expository Presentation: Implications for Teaching. J. Teach. Ed. 19: 223-242; Summer 1968. (see a-3)

Henderson, Kenneth B. and Rollins, James H. A Comparison of Three Stratagems for Teaching Mathematical Concepts and Generalizations by Guided Discovery. Arith. Teach. 14: 503-508; Nov. 1967. (see a-3)

Kyte, George C. and Fornwalt, James E. A Comparison of Superior Children with Normal Children in the Rate Mastery of the Multiplication of Fractions. J. Ed. Res. 60: 346-350; Apr. 1967. (see c-4c)

Suppes, Patrick. Mathematical Concept Formation in Children. Am. J. Psychol. 21: 139-150; Feb. 1966.

Findings of eight various experiments in areas of simple concept learning, transfer, geometric invariants of perceptual space, and mechanics of concept formation are used in relation to an all or none process of concept formation.

(I) results of eight experiments in various areas. (D) formation of concepts.

a; ---; 1) only; ---; 1.1, 2.1; ---; ---; ---; 28 (1, 2, 3, 4, 4, 4, 4, 3, 3); NE.

Beilin, Harry and Gillman, Irene S. Number Language and Numer Reversal Learning. J. Exp. Child Psychol. 5: 263-277; June 1967. (see c-1)

Blackwell, A. M. A Comparative Investigation Into the Factors Involved in Mathematical Ability of Boys and Girls. Br. J. Ed. Psychol. 10: 143-153; June 1940 (Part I); 10: 212-222; Nov. 1940 (Part II).

Results of factor analysis summarized in Part II.

Boys:

g = a general factor - capacity for selective, quantitative thinking and deductive reasoning involving ability to apply general principles to particular cases in number, symbolic and geometric work, and the power to abstract, generalize, and use the essential features of a complex situation and make deductions.

o = imagery - a mental manipulation of spatial and verbal data.

w = verbal reasoning (not purely verbal) involving the power to manipulate ideas in verbal form, to wield and classify words and make deductions from them.

Girls:

v = verbal (pure).

x = tentatively, a factor of precision and exactness.

r; ---; 1) only; 200 pupils; 6.1; ages 13-6 to 15; ---; ---; ---;

NE.

Brownell, William and Carper, Doris V. Learning the Multiplication Combinations. Duke U. Studies in Ed. 7: 1-177; 1943. (see c-3c)

Lewis, Michael. Probability Learning in Young Children: The Binary Choice Paradigm. J. Genet. Psychol. 108: 43-48; Mar. 1966.

This study showed that increases in age or intelligence do not result in superior performance in making a binary choice. The classroom implication is that binary choice is not a function of sophistication in learning or age.

(I) age comparisons; intelligence comparisons. (D) percentage responses on binary choice.

e; 2.6, 2.12; 2) s, 3) a; 83 pupils, 150 pupils; 1.6, 4.3, 4.4;

preschool - 2, 3; ---; norm; 25 (3, 3, 2, 3, 4, 3, 3, 2, 2); EPD.

Meconi, L. J. Concept Learning and Retention in Mathematics. J. Exp. Ed. 36: 51-57; Fall 1967. (see a-3)

Potter, Mary C. and Levy, Ellen I. Spatial Enumeration Without Counting. Child Develop. 39: 265-272; Mar. 1968.

The age of development of enumeration, with task variables considered, found performance positively correlated with age and ability to count.

s; ---; 1) only; 58 pupils; 1.4, 2.4, 2.5, 4.3, 4.6, 6.4; ages

2 1/2 - 4; one administration; non-norm; 29 (2, 3, 4, 3, 3, 4, 3,

4, 3); NE.

Suppes, Patrick. Some Theoretical Models for Mathematics Learning. J. Res. Develop. Ed. 1: 5-22; Fall 1967.

Recent research which led to model development is reviewed; models are presented and discussed.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Wilson, John W. The Role of Structure in Verbal Problem Solving. Arith. Teach. 14: 486-497; Oct. 1967. (see a-5b)

Yeager, John L. and Lindvall, C. M. An Exploratory Investigation of Selected Measures of Rate of Learning. J. Exp. Ed. 36: 78-81; Winter 1967. (see f-2)

Christensen, Donald J. The Effect of Discontinued Grade Reporting on Pupil Learning. Arith. Teach. 15: 724-726; Dec. 1968. (see f-2)

Kapos, Ervin; Edmund V. Mech; and William H. Fox. Schoolroom Motivation: I. Two Studies of Quantity and Pattern of Verbal Reinforcement as Related to Performance on a Routine Task. Ind. U. Sch. Ed. Bull. 33: 1-43; Jan. 1957.

This study compared groups on a routine task while varying the amount and pattern of verbal reinforcement by the teachers in two cases, massed practice and spaced practice. Varying quantities do produce significant differences in correct responses, as do varying patterns, though no optimum variation could be indicated.

(I) a) verbal stimulation by teacher, b) pattern of the verbal stimulation. (D) performance on routine task.

e; 2.9; 2) r, 3) m; 20 classes; 1.4, 3.4, 3.5; grs. 3-4; ---;

norm; 18 (1, 2, 2, 3, 3, 2, 2, 2, 1); EPD.

Kapos, Ervin; Edmund V. Mech; and William H. Fox. Schoolroom Motivation: II. Two Studies of Quantity and Pattern of Verbal Reinforcement as Related to a Measure of Drive on a Routine Task. Ind. U. Sch. Ed. Bull. 33: 1-43; Mar. 1957.

This study compared groups on a routine task while varying the amount and pattern of verbal reinforcement by the teachers in two cases, massed practice and spaced practice. Varying quantities do produce significant differences in drive level and performance, as do varying patterns, though not in massed practice cases. No optimum reinforcement variation could be selected.

(I) quantity and pattern of verbal reinforcement. (D) drive level on a routine task.

e; 2.9; 2) r, 3) m; ---; 1.4, 3.4, 3.5; ---; ---; norm; 18 (1, 2, 2, 3, 3, 2, 2, 2, 1); EPD.

Leibowitz, Sarah L. Fryer. The Motivational Effect of Value Symbols and Competition Upon Problem-Solving Behavior in Children. J. Genet. Psychol. 108: 327-332; June 1966.

This study demonstrated that the nature of an object used as a reward and social competition based on knowledge of opponents results would significantly increase motivation to succeed.

(I) subject pairing, object shifting. (D) scores on tests of problem "cup" solving.

e; 2.6; 2) s, 3) m; 78 pupils; 1.4, 3.4; kdg.; ---; non-norm;

21 (2, 2, 3, 2, 3, 3, 2, 2, 2); ED.

Scaramuzzi, Louis E. Money is Only Imaginary. Clearing House 30: 280-283; Jan. 1956. (see c-2)

Beilin, Harry and Gillman, Irene S. Number Language and Numer Reversal Learning. J. Exp. Child Psychol. 5: 263-277; June 1967. (see c-1)

Estes, Betsy and Combs, Ann. Perception of Quantity. J. Genet. Psychol. 108: 333-336; June 1966.

The development of the perception of quantity relative to the understanding of the concept "more" seemed to occur between the ages of 3 and 4 for both sexes, and was slightly affected by the type and number of stimuli.

(I) order of presentation, 2 and 3 dimensional stimuli, numerical differences in stimuli; age; sex. (D) number of correct responses.

e; 3.8; 1) only; 40 pupils; 1.4, 3.2, 3.4; ages 3-2 to 5-2;

---; non-norm; 25 (2, 2, 3, 3, 4, 3, 3, 3, 2); EPD.

Freyberg, P. S. Concept Development in Piagetian Terms in Relation to School Attainment. J. Ed. Psychol. 57: 164-168; June 1966.

An investigation of relationships between general intelligence, conceptual development and school achievement in a longitudinal study confirms previous findings that concept development is more closely linked to growth of general intellectual ability than C.A. alone.

r; ---; 1) only; 151 pupils in 4 schools; 3.3, 6.2, 6.3, 6.4;

grs. 1-4; 2 yrs.; norm, non-norm; ---; NE.

Glick, Joseph and Wapner, Seymour. Development of Transitivity: Some Findings and Problems of Analysis. Child Develop. 39: 621-638; June 1968.

Correctness and justification of answers for verbal and concrete transitivity tasks reflected: 1) increase in transitivity reasoning with age; 2) concrete tasks solicited more correct responses but fewer adequate justifications; 3) no apparent association of correct responses and adequate justifications.

(I) mode of presentation of stimulus, verbal or concrete; form of presentation of stimulus, heterotropic or isotropic.
(D) correct response justification for response.

e; 3.22; 2) s, 3) a; 320 pupils; 1.4, 1.6, 3.2; ages 8-18; 1

session; norm; 17 (2, 1, 2, 2, 3, 2, 2, 2, 1); EPD.

Goldberg, Susan. Probability Judgments by Preschool Children: Task Conditions and Performance. Child Develop. 37: 157-167; Mar. 1966.

A comparison of the reasons for correct responses to probability judgment tasks, when tasks were presented under conditions similar to Piaget's techniques and when presented under conditions identifying the decision-making procedure found for the age group, that performance is highly dependent upon task conditions.

(I) age, sex, order of conditions, conditions (2) probability judgments - 1) similar to Piaget's, 2) decision-making procedure. (D) mean number correct responses.

e; 3.25; 2) i, 3) m; 32 pupils; 2.6, 3.4; ages 3-10 to 5-1;

2-15 to 40 min. sessions; non-norm; 22 (2, 2, 2, 3, 3, 2, 2, 3 3);

EPD.

Goodnow, Jacqueline J. and Bethon, Gloria. Piaget's Tasks: The Effects of Schooling and Intelligence. Child Develop. 37: 573-582; Sept. 1966.

Previous data from unschooled Hong Kong children and data for U.S. school children matched on M.A. and C.A. were combined to investigate the effects of schooling and I.Q. on Piaget's tasks. Lack of schooling did not seem to affect conservation tasks but did seem to affect combinatorial reasoning. Among school children all tasks seemed to show a relation to M.A.

(I) I.Q.; M.A.; C.A.; schooling. (D) ability to do conservation and combinatorial reasoning tasks.

F; ---; 2) s, 3) m; ---; 1.3, 2.6, 3.2; grs. 4, 5; ---; norm,

non-norm; 27 (2, 3, 4, 2, 3, 3, 4, 3, 3); NE.

Marshall, Helen R. Transposition in Children as a Function of Age and Knowledge. J. Genet. Psychol. 108: 65-69; Mar. 1966. (see g-1)

Mays, W. Logic for Juniors. Teach. Arith.: Br. Elem. Math J. 3: 3-10; Autumn 1965.

The study asserted that a study of logic in early grades can significantly aid study of mathematics, especially in below average students, with implications of diagnostic testing, and with implications of refuting the position of Piaget regarding propositional reasoning not occurring below age 11-12.

(I) course in logic. (D) correct responses.

e; 2.2; 2) s, 3) m; 34 pupils; ---; ages 9-10; ---; non-norm;

29 (2, 2, 3, 3, 4, 3, 5, 4, 3); EPD.

Murray, Frank B. Cognitive Conflict and Reversibility Training in the Acquisition of Length Conservation. J. Ed. Psychol. 59: 82-87; Apr. 1968.

Transition from nonconservation to conservation was between 6 and 7 years of age. Nonconservers trained by a reversability and cognitive conflict procedure did significantly better than untrained nonconservers.

(I) training in length conservation. (D) ability to conserve length.

e; 3.18; 1) only; 119 pupils; 1.4, 1.6, 2.6; grs. k-2; 1 wk.;

non-norm; 25 (2, 2, 3, 3, 4, 3, 3, 3, 2); EPD.

Nicholls, R. H. Programming Piaget in Practice. Teach. Arith.: Br. Elem. Math J. 1: 24-38; Autumn 1963.

This study demonstrated that there is a wide variability among slow learners to attain developmental concepts, such as conservation of number. The writer emphasizes the need for pre-testing for these concepts before beginning courses of study.

(I) manipulation of developmental concept test materials.
(D) scores on various developmental concept tests.

e; 3.19; 2) s, 3) m; 24 pupils; ---; ages 10, 11; ---; non-norm;

35 (2, 4, 4, 4, 5, 3, 5, 4, 4); EP.

Pace, Angela. The Effect of Instruction Upon the Development of the Concept of Number. J. Ed. Res. 62: 183-189; Dec. 1968.

Findings indicated that an experimental group receiving a special training program incorporating organized experiences with sets attained a higher level of number conservation than a control group who received only the regular math program. Number conservation stage placement was more closely related to I.Q. than to C.A. Implications for instruction in elementary school math are presented.

(I) instruction; sex; age; stage placement. (D) level of conservation.

e; 2.4; 2) s, 3) r; 94 pupils; 2.6, 3.2; grs. k, 1; 5 days;

norm, non-norm; 21 (2, 2, 2, 3, 2, 3, 3, 2, 2); EPD.

Peel, E. A. Experimental Examination of Some of Piaget's Schemata Concerning Children's Perception and Thinking, and a Discussion of Their Educational Significance. Br. J. Ed. Psychol. 29: 89-103; June 1959.

Data are presented on some of Piaget's hypotheses regarding spatial relationships in drawing and on two areas of judgment: logical and moral. The general finding in each case was that certain sequences of phases outlined by Piaget were, in varying degrees, confirmed. Piaget's age placements for these phases were only mildly supported. Educational implications are discussed.

s; ---; 1) only; 60 pupils; 6.4; ages 7-7 to 15-0; ---; non-norm;

29 (2, 3, 4, 5, 3, 3, 3, 3, 3); NE.

Pick, Herbert L., Jr. and Pick, Anne D. A Developmental and Analytic Study of the Size-Weight Illusion. J. Exp. Child Psychol. 5: 362-371; Sept. 1967.

The developmental trends in magnitude of size-weight illusions may reflect differences in inter- and intra-modal integration, rather than age.

(I) age; weight of bottles; size. (D) intervals of uncertainty; subjective equality.

e; 3.19; 2) s, 3) r; 328 pupils; 1.4, 3.2; ages 4-16; adults;

---; ---; 23 (4, 1, 2, 2, 4, 2, 2, 3, 3); EPD.

Pratoomraj, Sawat and Johnson, Ronald C. Kinds of Questions and Types of Conservation Tasks as Related to Children's Conservation Responses. Child Develop. 37: 343-353; June 1966.

Piaget's theory of development of concept of conservation was supported when four age groups of subjects were presented with five tasks and asked questions about prediction, judgment and explanation with the phrasing of questions varied in four ways. Kind of question and sex was not significant. Age was significant at all levels. Type of task was significant for the four and five year olds. With increase in age, symbolic or specific explanation increased and perceptual explanation decreased.

(I) kind of question, type of conservation task, age; sex.
(D) maturity of responses.

e; 2.16; 2) s, r, 3) r; 128 pupils; 1.4, 1.6, 3.2, 3.7; ages 4-7;

mean of 25 mins.; non-norm; 20 (2, 2, 3, 2, 2, 2, 3, 2, 2); EPD.

Rimoldi, H. J. A.; Aghi, M.; and Burder, G. Some Effects of Logical Structure, Language, and Age in Problem Solving in Children. J. Genet. Psychol. 112: 127-143; Mar. 1968.

This study investigated language and age difference in problem solving and found that problem solving "logic" increased with age and interacted (not independent from) with language.

s; ---; 1) s, 1) s; 120 pupils; 1.4, 3.2; ages 7, 9, 11, 13;

---; non-norm; 22 (2, 2, 3, 3, 2, 3, 2, 3, 2); NE.

Satterly, David. Perceptual, Representational and Conceptual Characteristics of Primary School Children. Br. J. Ed. Psychol. 38: 78-82; Feb. 1968.

Identification of analytic or synthetic attitude preference in relation to performances in perceptual, representational and conceptual variable tasks:

1) Older children tended to be more analytic.

2) Boys tended to be more analytic, also performing better in tests having a spatial component.

3) Analytic children did significantly better in mechanical arithmetic.

4) Data supports theory that three dimensional perception of pictorial material is gradually acquired between 7 and 12 years.

(I) preference for analytic or synthetic perception.
(D) performance of tasks involving perceptual operations, representational operations, conceptual operations.

F; ---; 2) i, 3) s; 200 pupils; 1.5, 2.6, 3.2, 3.4, 6.4; ages

7-11; ---; norm; 26 (2, 3, 3, 2, 4, 3, 3, 3, 3); NE.

Sawada, Daiyo and Nelson, L. Doyal. Conservation of Length and the Teaching of Linear Measurement: A Methodological Critique. Arith. Teach. 14: 345-348; May 1967.

Data showed that nearly 100% of children between ages 7-2 and 8-0 were conservers of length. Nearly 70% of those between 6-3 and 7-1 were conservers; and about 60% of those between 5-4 and 6-2 were conservers. Hence, the threshold age for conservation of length appears to lie between ages 5 and 6 when assessment procedures follow the non-verbal technique used in this study. Such a finding is in contradiction to the results of other work including Piaget's in which conservation of length occurred between 7 and 8. There are procedural differences between this study and those of Piaget.

s; ---; 2) r; 62 pupils; 1.6; ages 5-4 to 8-0; 16 trials (1 day);

non-norm; 26 (2, 2, 4, 3, 3, 3, 3, 3, 3); NE.

Shantz, Carolyn Uhlinger and Smock, Charles D. Development of Distance Conservation and the Spatial Coordinate System. Child Develop. 37: 943-948; Dec. 1966.

Piaget's hypothesis that the concept of distance conservation is a prerequisite for the concept of a coordinate system was tested. The differential effects of two and three dimension stimuli on performance were compared. Data generally supported Piaget's hypothesis. Presentation of objects before drawings tended to facilitate more current responses than the reverse order.

(I) two or three dimension, filled or empty space, direction of movement, horizontal tasks, vertical tasks. (D) number of current responses for distance conservation and coordinate system.

e; 3.19; 2) i, 3) r; 20 pupils; 1.6, 2.6, 3.2; gr. 1; ---; non-

norm; 23 (2, 2, 3, 3, 4, 2, 3, 2, 2); EPD.

Sharples, Aneita; Sutton-Smith, B.; Exner, J.; and Rosenberg, B. G. Logical Analysis and Transitivity. J. Genet. Psychol. 112: 21-25; Mar. 1968.

This study investigated seriation among above-average 2nd and 4th graders and found no significant difference.

s; ---; 1) s, 2) s; 32 pupils; 3.15; grs. 2, 4; ---; non-norm;

25 (2, 2, 3, 4, 3, 3, 3, 3, 2); NE.

Silverman, Irwin and Schneider, Dale S. A Study of the Development of Conservation by a Nonverbal Method. J. Genet. Psychol. 112: 287-291; June 1968.

Testing for conservation of quantity without dependency upon a child's statement of "more" or "less" produced results confirming Piaget's theory that acquisition of conservation occurs between seven and eight years of age.

(I) change in appearance of containers. (D) ability to conserve quantity.

F; ---; 1) only; 147 pupils; 1.1, 1.6, 2.3; ages 4-10; ---;

non-norm; 28 (2, 3, 2, 4, 4, 3, 4, 3, 3); NE.

Skemp, Richard R. Reflective Intelligence and Mathematics. Br. J. Ed. Psychol. 31: 45-55; Feb. 1960.

An instrument was devised to test the transition from sensori-motor to reflective intelligence. Correlations and reliabilities with mathematics achievement were high. Conclusions were that reflective ability is necessary for understanding mathematics and the transition from sensori-motor to reflective intelligence is a gradual process.

s; ---; 2) s, 3) a; 138 pupils; 6.4; grs. 4, 5; 1 yr.; norm, non-

norm; 28 (2, 3, 3, 4, 4, 3, 4, 3, 2); NE.

Smith, Ian D. The Effects of Training Procedures Upon the Acquisition of Conservation of Weight. Child Develop. 39: 515-526; June 1968.

This study compared the addition/subtraction method of Smedslund with the verbal instruction method of Beilin, with results favoring Beilin, in the measuring of conservation of weight. Study was also made of the influence of the training on learning conservation and on the resistance of conservation to counter-suggestion.

(I) addition/subtraction, verbal, and perceptual training; pre-pre-test sorting scores. (D) achievement gain scores.

e; 2.15; 2) s, 3) r; 130 pupils; 1.4, 3.2, 3.4; av. age 6-7;

1 wk.; non-norm; 22 (2, 2, 2, 3, 3, 4, 2, 2, 2); EPD.

Steffe, Leslie P. The Relationship of Conservation of Numerousness to Problem-Solving Abilities of First-Grade Children. Arith. Teach. 15: 47-52; Jan. 1968.

A random sample of 132 children in four groups, determined by four pre-tested levels of conservation of numerousness and I.Q., were given 18 problems involving transformation or not and those results compared. Some statistical data has been omitted. The results indicate that items with transformation are easier at all levels, and the 33 in lowest level performed significantly less well.

(I) I.Q.; level of conser.ation as measured. (D) achievement scores.

e; 2.9; 2) r, 3) r; 132 students; 1.4, 6.4; gr. 1; ---; non-norm;

23 (2, 2, 3, 3, 1, 3, 4, 2, 3); EPD.

Wallach, Lise; Wall, Jack A.; and Anderson, Lorna. Number Conservation: The Roles of Reversibility, Addition-Subtraction, and Misleading Perceptual Cues. Child Develop. 38: 425-442; Mar. 1967.

Children were induced to conserve number by experiences with reversibility, while experience with addition and subtraction had no effect. The reversibility training, however, may be successful because it led pupils to stop using misleading perceptual cues.

(I) reversibility training and addition-subtraction training (conservatism or nonconservatism; dolls or liquid); stages of conservatism. (D) criterion scores; transfer.

e; 3.18; 2) s, 3) i; 56 pupils; 1.1, 1.4, 2.6; ages 6, 7; 1 day;

---; 23 (2, 2, 3, 3, 3, 2, 3, 2, 3); EPD.

Winer, Gerald A. Induced Set and Acquisition of Number Conservation. Child Develop. 39: 195-205; Mar. 1968.

Study attempted to test a hypothesis that practice in addition/subtraction or in evaluating length change would induce a set to respond in the practiced manner to a conflict between them. This, as well as a second experiment, attempted to test a hypothesis that this training would lead to conservation. The results confirmed the former and no conclusion on the latter.

(I) training in: 1) tasks of addition/subtraction, 2) tasks of length changes, 3) no training conflict trials (2nd experiment). (D) conservation by achievement gain scores.

e; 2.16; 1) i, 2) s, 3) r; 42 pupils; 2.1, 2.3; kdg.; 3 days;

non-norm; 23 (2, 3, 2, 3, 3, 3, 2, 3, 2); EPD.

Zeiler, Michael D. and Gardner, Ann M. Intermediate Size Discrimination in Seven- and Eight-Year-Old Children. J. Exp. Psychol. 71: 203-207; Feb. 1966. (see g-1)

Doherty, Anne and Wunderlich, Richard A. Effect of Secondary Reinforcement Schedules on Performance of Problem-Solving Tasks. J. Exp. Psychol. 77: 105-108; May 1968.

Extinction of performing problem-solving tasks may be extended by increasing the rate of secondary reinforcement.

(I) age; I.Q.; arithmetic achievement; variation in interval of secondary reinforcement schedules paired with primary reinforcement. (D) mean number of problems completed.

e; 3.5; 2) m, 3) i; 90 pupils; 3.2, 3.4; grs. 7, 8; ---; norm;

22 (2, 2, 2, 3, 4, 2, 3, 2, 2); EPD.

Meconi, L. J. Concept Learning and Retention in Mathematics. J. Exp. Ed. 36: 51-57; Fall 1967. (see a-3)

Paige, Donald D. Learning While Testing. J. Ed. Res. 59: 276-277; Feb. 1966.

Immediate reinforcement after a testing situation resulted in significantly higher achievement scores.

(I) immediate or delayed reinforcement. (D) retention difference scores.

e; 2.6; 2) m, 3) r; 62 pupils; 1.4, 3.15, 6.4; gr. 8; 4 wks.

(retention after 3 wks.); non-norm; 22 (3, 3, 2, 2, 2, 4, 1, 2, 3);

EPD.

Clark, Leonard H. The Curriculum for Elementary Teachers in Sixty-eight State Teachers Colleges. J. Teach. Ed. 6: 114-117; June 1955.

This study analyzed college catalogs to form a "typical" teacher college and concluded that "typical" is not "excellence," and comes slowly. But teachers' colleges' curriculum is changing.

d; ---; 1) only; 68 catalogs; ---; item; ---; ---; ---; NE.

Combs, Louise. Summary of Study of Certification Requirements in Mathematics for Elementary Teachers in the 50 States. Am. Math. Mon. 70: 428-433; Apr. 1963.

State requirements for elementary certification varied in that, of the 50 agencies: 1) 21 required college mathematics; 2) 10 identified specific mathematics courses.

s; ---; 1) only; 50 states; 1.1; elem.; ---; non-norm;

30 (3, 3, 2, 2, 3, 4, 4, 5, 4); NE.

Committee on the Undergraduate Program in Mathematics. Preparation in Mathematics for Elementary School Teachers. Arith. Teach. 14: 198-199; Mar. 1967.

An increase in the number of colleges requiring mathematics for prospective teachers is reported.

s; ---; 1) only; 887 colleges; ---; college; ---; ---;

26 (1, 3, 4, 3, 4, 2, 4, 2, 3); NE.

Creswell, John L. The Competence in Arithmetic of Prospective Georgia Elementary Teachers. Arith. Teach. 11: 248-250; Apr. 1964.

This study tested preteachers in Georgia and seemed to conclude that these students were above-average in arithmetic competency.

(I) competence in arithmetic. (D) scores on M.A.T. advanced math. form AM.

s; ---; 2)s; 313 students; 1.6; college; ---; norm; 36 (3, 4,

4, 5, 4, 3, 4, 5, 4); NE.

Creswell, John L. How Effective are Modern Mathematics Workshops? Arith. Teach. 14: 205-208; Mar. 1967. (see t-2)

Dutton, Wilbur H. Attitudes of Prospective Teachers Toward Arithmetic. El. Sch. J. 52: 84-90; Oct. 1951.

Students' statements of favorable and unfavorable attitudes towards arithmetic showed: 1) majority of statements unfavorable, emotional, and related to lack of understanding, disassociation from life, boring and fear of mistakes; 2) a minority (26%) of favorable statements related to enjoyment due to proficiency, good teachers and appreciation.

s; ---; 1) only; 211 students; 1.1, 1.6; college; ---; ---;

28 (2, 3, 4, 4, 3, 4, 4, 2, 2); NE.

Dutton, Wilbur H. Measuring Attitudes Toward Arithmetic. El. Sch. J. 55: 24-31; Sept. 1954.

Development of a Thurstone scale and its use with students, plus students' open-end responses found:

1) The instrument reliable and useful.

2) Feelings towards arithmetic are developed in all grades, but more so in grades 3 through 7.

3) Importance, enjoyment and challenge were most frequent favorable responses.

4) Insecurity, fear, lack of understanding and difficulty were most frequent unfavorable responses.

5) Like of some aspects, dislike of other aspects.

s; ---; 1) only; 289 students; 1.1, 1.6; college; ---; non-norm;

21 (1, 2, 3, 3, 3, 2, 3, 2, 2); NE.

Dutton, Wilbur H. University Students' Comprehension of Arithmetical Concepts. Arith. Teach. 8: 60-64; Feb. 1961.

Significant gain in understanding of concepts was made after a lower division mathematics course. Attitudes reflected a growing appreciation of arithmetic.

s; ---; 2) m, 3) i; 55 students; 1.1, 1.4, 3.4; lower division

college; 1 semester; non-norm; 25 (1, 3, 3, 4, 2, 3, 3, 3, 3);

NE.

Dutton, Wilbur H. Attitude Change of Prospective Elementary School Teachers Toward Arithmetic. Arith. Teach. 9: 418-424; Dec. 1962.

Measurement of attitudes towards arithmetic showed: 1) both favorable and unfavorable attitudes expressed by individuals; 2) unfavorable feelings concerned being unsure, fear, boring work and lack of understanding. Comparison of 1962 attitudes with 1954 attitudes showed a very slight increase in favorable attitudes, but generally attitudes remained the same, with the same aspects liked and disliked.

s; ---; 1) only; 127 students; 1.1, 1.3, 1.6, 1.8; juniors,

seniors; ---; non-norm; 23 (1, 2, 4, 4, 3, 2, 3, 2, 2); NE.

Dutton, Wilbur H. Prospective Elementary School Teachers' Understanding of Arithmetical Concepts. J. Ed. Res. 58: 362-365; Apr. 1965.

Pre- and post-test results for a methods course for teaching arithmetic showed: 1) improvement in understanding of concepts; 2) a slight increase in positive attitude.

(I) course on teaching of arithmetic. (D) score on test of understanding, attitude scale.

a; ---; 1) only; 160 students in 3 sections; 1.3, 1.6, 1.8;

college; 1 semester; non-norm; 24 (1, 2, 3, 4, 3, 3, 4, 2, 2);

NE.

Dutton, Wilbur H. Individualizing Instruction in Elementary School Mathematics for Prospective Teachers. Arith. Teach. 13: 227-231; Mar. 1966.

Individualizing instruction by having prospective elementary school teachers identify their areas of weakness and giving them directed guidance for studying these areas, plus programmed instruction on fractions resulted in definite progress in mastery of mathematical concepts.

(I) individualized instruction using tests and programmed materials. (D) achievement gain scores.

a; ---; 2) m; 80 students; 1.3, 1.4, 3.4; college; semester;

non-norm; 33 (2, 3, 3, 5, 4, 5, 4, 4, 3); NE.

Dutton, Wilbur H. and Cheney, Augustine P. Pre-Service and In-Service Education of Elementary School Teachers in Arithmetic. Arith. Teach. 11: 192-198; Mar. 1964.

Results of groups tested with one of two arithmetic comprehension tests found:

1) Intermediate-grade teachers scored significantly better than primary-grade teachers.

2) Elementary school teachers lacked understanding in many areas of arithmetic.

3) Lower-division college students made progress in understandings as a result of a mathematics course but still showed evidence of misunderstandings.

4) Upper-division college students made significant gains after an arithmetic curriculum and methods course but inadequacies were still evident.

s; ---; 1) only, 120 teachers, 134 students; 1.1, 1.3, 1.4,

1.6, 3.4; teachers; college; ---; non-norm; 24 (2, 2, 4, 3,

3, 3, 3, 2, 2); NE.

Fisher, John J. Extent of Implementation of C.U.P.M., Level I Recommendations. Arith. Teach. 14: 194-197; Mar. 1967.

The amount of mathematics required for preservice education of elementary school teachers has increased significantly since 1960, but it is still far below minimum C.U.P.M. standards. Courses on the structure of the real number system have been added, but little attention is being given to courses in algebra and geometry.

s; ---; 2) r; 78 colleges; 1.1, 1.4, 3.4, college; ---; non-norm,

26 (3, 2, 3, 2, 3, 4, 3, 3, 3); NE.

Fulkerson, Elbert. How Well Do 158 Prospective Elementary Teachers Know Arithmetic? Arith. Teach. 7: 141-146; Mar. 1960.

Prospective elementary teachers enrolled in an arithmetic methods course:

1) Had insufficient knowledge of arithmetic.

2) Did significantly better when they had teaching experience.

3) Had improved performance with years of college.

4) Had improved performance with increased mathematics preparation.

s; ---; 1) only; 158 students; 1.1, 1.4, 1.6; college; ---; non-

norm; 31 (3, 4, 4, 4, 3, 4, 3, 3, 3); NE.

Glennon, Vincent J. A Study of Needed Redirection in the Preparation of Teachers of Arithmetic. Math. Teach. 42: 389-396; Dec. 1949.

The degree to which students and in-service teachers have basic mathematical understandings and meanings was investigated with a test, resulting in:

1) No differences for college freshmen and seniors.

2) No differences between seniors who had course work in psychology and teaching arithmetic and ones who did not have the courses.

3) No differences for in-service teachers who had similar graduate work and ones who did not.

General performance was considered poor, indicating a lack of understanding of arithmetic processes.

s; ---; 1) only; 476 students and teachers; 1.1, 1.6; college

and teachers; ---; non-norm; 26 (2, 2, 4, 4, 3, 4, 3, 2, 2);

NE.

Groff, Patrick J. Self-Estimates of Ability to Teach Arithmetic. Arith. Teach. 10: 479-480; Dec. 1963.

This study investigated the preteacher's response to questions regarding his preparations and concluded that programs of teacher-training were adequate.

(I) self-confidence. (D) reports on questionnaire about training.

s; ---; 2) s; 645 student teachers; 1.6; college; ---; non-norm;

39 (3, 4, 4, 4, 5, 5, 5, 5, 4); NE.

Grossnickle, Foster E. Methods of Estimating the Quotient in Long Division Used by Teacher-training Students. El. Sch. J. 35: 448-453; Feb. 1935.

Instructors questioned classes as to methods of estimating quotient used: 1) 48%, regardless of the value of the units' figure of the divisor, the tens' figure remained unchanged ("apparent method"); 2) 21% used no fixed method for deciding on quotient, the divisor is considered in full. 29% of the instructors preferred using "when the units' figure is any number from 1 to 5, inclusive, the tens' figure remaining unchanged ("increase-by-one method").

s; ---; 1) only; 66 classes; 1.1, 1.6; college; ---; ---;

32 (3, 3, 4, 4, 5, 4, 4, 3, 2); NE.

Grossnickle, Foster E. Growth in Mathematical Ability Among Prospective Teachers of Arithmetic. Arith. Teach. 9: 278-279; May 1962.

This study examined the mathematics skill of college seniors, with at least six hours of mathematics, with their high school skill using same test and found significant increases.

(I) 4 years in college. (D) test scores.

F; ---; 1) only; 954 students; 1.4, 1.5; seniors; 4 yrs.; non-

norm; 27 (2, 2, 3, 4, 4, 3, 3, 3, 3); NE.

Hamilton, E. W. Number Systems, Fad or Foundation? Arith. Teach. 8: 242-245; May 1961.

1) Teachers who used imaginary names and symbols performed better on posttests of base ten than control group.

2) Attitudes towards experience, when teachers were in the field, were positive.

(I) studying place values, number systems by imaginary names and symbols or traditional number system. (D) gain scores on a base ten arithmetic test attitude towards learning imaginary.

e; 2.9; 2) s, 3) m; 270 students in 3 classes; 1.4, 3.2; college;

1 yr. +; non-norm; 29 (3, 2, 3, 3, 3, 4, 4, 3, 4); EPD.

Hardgrove, Clarence E. and Jacobson, Bernard. CUPM Report on the Training of Teachers of Elementary School Mathematics. Arith. Teach. 11: 89-93; Feb. 1964.

Summary of requirements and conclusions of the ten Level I (1962) conferences is given.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Hicks, Randall C. Elementary Series and Texts for Teachers - How Well Do They Agree? Arith. Teach. 15: 266-270; Mar. 1968. (see d-1).

Inskeep, James E., Jr. Pre-Service Preparation to Teach Elementary School Mathematics. Sch. Sci. Math. 68: 43-51; Jan. 1968.

Methods classes were taught by three different approaches, all viewing a televised demonstration. The types of approaches did not seem to differ in effectiveness.

(I) approach to teaching methods: generalization, anecdotal, demonstration. (D) effectiveness of approach: 1) students' lesson plans, 2) student evaluation of instruction, 3) student evaluation of own teaching.

e; 3.4, 2) a, 3) i; 76 students in 3 classes; 1.1, 1.4, 1.5;

college; ---; non-norm, 36 (2, 3, 4, 5, 4, 5, 4, 5, 4); EP.

Kane, Robert B. Attitudes of Prospective Elementary School Teachers Toward Mathematics and Three Other Subject Areas. Arith. Teach. 15: 169-175; Feb. 1968.

Rank order of four subject fields in terms of enjoyment, worth, competency and prospective teaching was used to assess attitudes and found prospective teachers tended to have a favorable attitude toward mathematics.

s; ---; 1) only; 58 students; 1.1, 1.6; college; ---; non-norm;

24 (2, 2, 3, 3, 2, 4, 3, 3, 2); NE.

Layton, W. I. Mathematical Training Prescribed by Teachers Colleges in the Preparation of Elementary Teachers. Math. Teach. 44: 551-556; Dec. 1951.

Review of college catalogs revealed the following for teacher training:

1) 1/4 specified mathematics as a requirement.

2) Art, geography and English requirements were 2 1/2 to 7 times the requirements for mathematics.

3) Graduate programs did not require mathematics courses.

d; ---; ---; 85 catalogs; 1.4, 1.6; ---; ---; ---; ---; NE.

Nelson, L. Doyal and Worth, Walter H. Mathematical Competence of Prospective Elementary Teachers in Canada and in the United States. Arith. Teach. 8: 147-151; Apr. 1961.

This study investigated mathematics skill in prospective teachers in Alberta with skill of prospective teachers in Boston and Illinois and found significant differences favoring the Alberta group.

(I) national status and resulting difference in arithmetical background. (I) class in college. (D) scores on tests.

F; ---; 1) only; 468 Canadian, 410 American students; college;

---; non-norm; 40 (4, 4, 5, 5, 5, 5, 5, 4, 3); NE.

Phillips, Clarence. Background and Mathematical Achievement of Elementary Education Students in Arithmetic for Teachers. Sch. Sci. Math. 53: 48-52; Jan. 1953.

Background and competencies of students entering an arithmetic for teachers course were:

1) Representation of wide range of community sizes.

2) Their attitudes had been influenced by methods of presentation, opportunities for achievement, teacher personalities and types of problems, negative attitudes increasing in intermediate grades.

3) Most had algebra and geometry in high school.

4) Low achievement in meaning and understanding.

5) Low achievement in mechanical aspects of fractions, decimal fractions, percent.

s; ---; 1) only; 268 students, 1.1, 1.6; college; ---; non-norm;

31 (2, 3, 4, 4, 4, 4, 4, 3, 3); NE.

Phillips, Clarence. The Relationship Between Arithmetic Achievement and Vocabulary Knowledge of Elementary Mathematics. Arith. Teach. 7: 240-242; May 1960.

Degree of relationship between arithmetic achievement and vocabulary knowledge possessed by prospective elementary teachers was:

1) Significant between achievement and vocabulary.

2) Low but significant relationship between achievement and mental maturity.

3) No significant relationship between vocabulary and mental maturity.

r, ---; 1) only; 52 students; 1.6, 6.4; college; ---; norm,

non-norm; ---; NE.

Phillips, Clarence. Approach to the Training of Prospective Elementary Mathematics Teachers. J. Teach. Ed. 19: 293-297; Fall 1968.

The class of students who were taught mathematics and education content had significantly higher means on the three dependent variables. It was concluded that the combined-content teaching approach would offer best organization for teacher education.

(I) mathematics education taught as 1) mathematics content, 2) mathematics and education content. (D) achievement in operational skill, meaning and understanding, and vocabulary.

e; 3.22; 2) s, 3) a; 73 students; 1.4, 3.4; college; 3 1/2

months; non-norm; 22 (1, 2, 2, 4, 4, 2, 3, 2, 2); EPD.

Porterfield, O. V. Ambiguities in Teaching Arithmetic. Arith. Teach. 12: 348-351; May 1965.

This study tested preteachers with a test of language ambiguity in mathematics and concluded that there was no significant difference in understanding compared with inservice teachers.

(I) understanding of test item language. (D) scores on 20 item test.

s; ---; 2) s; 178 students in 2 groups; ---; college; ---;

non-norm; 37 (3, 3, 4, 5, 5, 4, 5, 4, 4); NE.

Rappaport, David. Preparation of Teachers of Arithmetic. Sch. Sci. Math. 58: 636-643; Nov. 1958.

A review of studies related to teacher training with author's conclusions and recommendations that all prospective teachers are required to have adequate course work in mathematics and methods.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Reys, Robert E. Are Elementary School Teachers Satisfied with Their Mathematics Preparation? Arith. Teach. 14: 190-193; Mar. 1967. (see t-2).

Reys, Robert E. Mathematical Competencies of Elementary Education Majors. J. Ed. Res. 61: 265-266; Feb. 1968.

After methods and content courses, mathematical knowledge of elementary education majors remained below the norm for eight-and ninth-grade pupils.

(I) methods or content course. (D) achievement gain difference score.

F; ---; 1) only, 234 students; 1.4, 3.4, 3.15; college; 1 term;

norm; 28 (2, 3, 3, 4, 4, 2, 4, 3, 3); NE.

Reys, Robert E. Mathematical Competencies of Preservice Elementary School Teachers. Sch. Sci. Math. 68: 302-308; Apr. 1968.

Mathematics scholarship of elementary education majors was measured in relation to mathematics preparation;

1) 55% scored below the 8th and 9th grade median.

2) Real number system, mathematical statements, and functions and graphs proved to be the most difficult categories.

3) Significant gains in achievement resulted after elementary mathematics education course work.

s; ---; 1) only; 252 students; 1.4, 1.5, 1.6, 3.4, 3.15; college;

---; norm; 25 (2, 3, 3, 3, 3, 2, 4, 3, 2); NE.

Reys, Robert E. and Delon, Floyd G. Attitudes of Prospective Elementary School Teachers Towards Arithmetic. Arith. Teach. 15: 363-366; Apr. 1968.

Attitudes of prospective elementary teachers towards arithmetic became slightly more positive upon completion of one of three mathematics preparatory courses.

s; ---; 1) only; 385 students; 1.6, 1.9; college; ---; non-norm;

28 (2, 3, 3, 4, 4, 3, 3, 3, 3); NE.

Riedesel, C. Alan and Suydam, Marilyn N. Computer-assisted Instruction: Implications for Teacher Education. Arith. Teach. 14: 24-29; Jan. 1967.

This study compared results for two groups, who received instruction from a) teacher or b) C.A.I. program. The results showed no significant differences. Implications regarding further study are advanced.

(I) instruction by teacher or by C.A.I. (D) achievement scores.

e; 2.6; 2) r, 3) m; 20 students in 2 classes; 1.4, 3.4; freshmen;

10 wks.; non-norm; 20 (2, 1, 2, 3, 2, 2, 3, 3, 2); EPD.

Sassenrath, Julius M. and Welch, Ronald C. Teacher Preparation and Teaching Tasks. Calif. J. Ed. Res. 19: 112-120; May 1968.

Methods courses were taught by guided discovery or directed practice, and incentive for MTT. performance was assigned by inferring scores would be used for hiring. After student teaching experiences, subjects were remeasured. Findings were: 1) no difference for method of teaching methods courses; 2) effect of teacher placement incentive and grade level taught on MTT scores was significant.

(I) guided or directed teaching in methods courses, teacher-placement incentive; size of school-community for student teaching, grade level taught. (D) gain in mathematics teaching tasks (MTT).

e; 3.4; 2) s, 3) a; 149 students; 1.4, 3.4, 3.5; seniors;

1 yr.; non-norm; 21 (1, 2, 2, 3, 4, 3, 2, 2, 2); EPD.

Scrivner, A. W. and Urbanek, R. The Value of "Teacher-Aide" Participation in the Elementary School. Arith. Teach. 10: 84-87; Feb. 1963.

Differences significant at .08 level indicated that juniors who participated as teacher aides improved slightly in arithmetic understanding and skill.

(I) participation as teacher aides. (D) achievement scores.

e; 2.2; 2) r, 3) m; 46 students; 3.4; juniors; 10 wks.; norm;

24 (2, 3, 2, 4, 1, 3, 3, 3, 3); EPD.

Shryock, Jerry. A Mathematics Course for Prospective Elementary School Teachers. Arith. Teach. 10: 208-211; Apr. 1963.

Examination of eight recent pre-service textbooks for topics found agreement in fields of arithmetic, number theory and approximate computation, with least agreement for presenting topics from the fields of algebra, statistics, elementary logic and informal geometry.

d; ---; ---; 8 texts; ---; college; ---; ---; ---; NE.

Skypek, Dora Helen. A Comparison of the Mathematical Competencies of Education and Non-education Majors Enrolled in a Liberal Arts College. Am. Math. Mon. 72: 770-773; Sept. 1965.

This study compared upper level teacher candidates to non-education peers and found the prospective teachers significantly lower in mathematical proficiency than non-education majors at Emory University.

F; ---; 1) only; 282 students; ---; junior, senior; ---; norm,

non-norm; 31 (2, 3, 3, 4, 4, 3, 5, 3, 4); EP.

Smith, Frank. Prospective Teachers' Attitudes Toward Arithmetic. Arith. Teach. 11: 474-477; Nov. 1964.

This survey investigated preteachers attitudes toward mathematics and found too many prospective elementary teachers with negative attitudes toward arithmetic, which they were preparing to teach.

s; ---; 2) s; 123 students; 1.6; college; ---; non-norm;

32 (3, 3, 4, 4, 4, 3, 4, 4, 3); NE.

Smith, Frank. How Well Are Colleges Preparing Teachers for Modern Mathematics? -- An Answer. Arith. Teach. 14: 200-202; Mar. 1967.

Prior to a methods course, test scores were similar to those of Melson's study; on the posttest, scores were significantly higher.

(I) methods course. (D) achievement gain scores.

a; ---; 1) only; 80 students in 2 classes; 1.6; seniors;

1 semester; non-norm; ---; NE.

Smith, Lehi T. Curricula for Education of Teachers. Am. Math. Mon. 70: 202-203; Feb. 1963.

Survey of mathematic departments found:

1) 41% require one to no courses for prospective elementary teachers.

2) 56% offer no special courses for prospective secondary teachers.

3) 77% offer no special courses for graduate work of teachers.

s; ---; 2) r; 110 colleges; ---; college; ---; ---; 37 (3, 4,

4, 4, 4, 5, 4, 5, 4); NE.

Stipanowich, Joseph. The Mathematical Training of Prospective Elementary school Teachers. Arith. Teach. 4: 240-248; Dec. 1957.

Questionnaire responses of seventy mathematics-education specialists were:

1) 92% favored 2 years of high school math as prerequisite.

2) 66% favored requiring a level of proficiency.

3) 57% favored a different curriculum for grades K-6 and 7 and 8.

4) 100% favored requiring some mathematics subject matter training.

5) 54% favored presenting mathematics subject matter and methods in separate courses.

6) 90% of 68 educators agreed on 26 topics for an initial college course.

s; ---; 2) s; 70 specialists; 1.1, 1.6; adult; ---; non-norm;

25 (2, 2, 4, 4, 3, 4, 2, 2, 2); NE.

Taylor, E. H. The Preparation of Teachers of Arithmetic in Teachers Colleges. Math. Teach. 30: 10-14; Jan. 1937.

This study decries the trend toward less mathematics education for teacher-trainees who are lacking in mathematics understanding.

s; ---; 1) only; 2097 students; ---; freshmen, ---; norm;

34 (3, 4, 4, 4, 5, 3, 4, 4, 3); NE.

Taylor, E. H. Mathematics for a Four-Year Course for Teachers in the Elementary School. Sch. Sci. Math. 38: 499-503; May 1938.

This study examined 333 freshmen for arithmetic skill and found severe misunderstandings, especially for prospective elementary teachers.

s; ---; 1) only; 333 students; ---; freshmen; ---; ---; 37 (3, 4, 4, 5, 4, 4, 5, 4, 4); NE.

Waggoner, Wilbur. Improving the Mathematical Competency of Teachers in Training. Arith. Teach. 5: 84-86; Mar. 1958.

Report proposed that a mathematics remedial course in teachers college would increase skill and attitude. Scores indicated that a college remedial mathematics course improved future teachers' competency in mathematics.

(I) study of Mathematics 151 (no control). (D) achievement gain scores.

a; 3.18; 2) i; 132 students; 1.4, 1.6, college; ---; non-norm; 37 (3, 4, 5, 5, 5, 3, 4, 4, 4); EP.

Weaver, J. Fred. A Crucial Problem in the Preparation of Elementary School Teachers. El. Sch. J. 56: 255-261; Feb. 1956.

Administration of Glennon's Test of Basic Mathematical Understanding to four groups of students substantiated Glennon's findings of lack of mathematical understanding. One group, upon completion of a professional mathematics education course, showed significant improvement.

s; ---; 1) only; 348 students; 1.4, 1.6, 3.2 3.4; college; ---; non-norm; 27 (2, 2, 4, 4, 3, 4, 3, 2, 3); NE.

Barnes, Kenneth; Cruickshank, Raymond; and Foster, James. Selected Educational and Experience Factors and Arithmetic Teaching. Arith. Teach. 7: 418-420, 430; Dec. 1960.

Comparison of principals' evaluations with teachers' self-ratings, high school and college mathematics course work, attitudes towards mathematics and experience: 1) teachers judged superior tended to under rate themselves, had a more positive attitude towards high school mathematics, and were more experienced generally; 2) teachers judged fair tended to over rate themselves, completed general mathematics in high school more frequently, had a more negative attitude towards high school mathematics and had less experience generally.

s; ---; 1) only; 66 principals, 102 teachers; 1.6; gr. 4; ---;

---; 29 (1, 2, 3, 4, 4, 5, 4, 3, 3); NE.

Bean, John E. Arithmetical Understandings of Elementary-School Teachers. El. Sch. J. 59: 447-450; May 1959.

1) Teachers' self-perceptions of competence before taking a mathematical understanding test changed significantly after the test to less competent.

2) Experience, college preparation and grades taught had direct bearing on scores.

3) Highest mean score was on decimal notation.

4) Lowest mean score was on basic understandings of rationale of computation.

s; ---; 2) s, 3) a; 450 teachers; 1.4, 1.6, 2.6; elem.; ---; non-

norm; 31 (2, 4, 4, 4, 4, 4, 3, 3, 3); NE.

Brown, Gerald W. An In-Service Program in Arithmetic. El. Sch. J. 66: 75-80; Nov. 1965.

This study evaluated an approach to in-service mathematics programs and found that much more work is needed to re-educate teachers to curriculum changes.

s; ---; 1) only; 75 teachers in 5 schools; ---; teachers; ---;

---; 27 (1, 2, 3, 4, 4, 3, 4, 3, 3); NE.

Brueckner, L. J. A Diagnostic Chart for Determining the Supervisory Needs of Teachers of Arithmetic. El. Sch. J. 30: 96-103; Oct. 1929.

Steps in development, purpose of and copy of chart for supervisors to use during observation of teachers.

d; ---; ---; ---; ---; ---; ---; ---; ---; NE.

Corle, Clyde G. Estimates of Quantity by Elementary Teachers and College Juniors. Arith. Teach. 10: 347-352; Oct. 1963.

Teachers and college students are more nearly accurate in estimation than 5th and 6th grade pupils, but did not differ from each other.

s; ---; 1) only; 368 teachers, 96 students; 1.1, 1.6; elem.;

---; non-norm; 27 (3, 3, 3, 4, 3, 4, 3, 2, 2); NE.

Creswell, John L. How Effective are Modern Mathematics Workshops? Arith. Teach. 14: 205-208; Mar. 1967.

On a 120-item test on modern mathematics, in-service teachers achieved a mean of 56.31, sixth graders, 65.25; prospective teachers, 93.9. (In-service training did not appear to be sufficiently effective.)

(I) mathematics courses. (D) achievement scores.

F; ---; 1) only; 1075 teachers, 124 pupils, 53 prospective

teachers; 1.1, 1.6; gr. 6, teachers, students; ---; non-norm;

30 (2, 3, 3, 4, 4, 4, 4, 3, 3); NE.

DeVault, M. Vere; Houston, W. Robert; and Boyd, C. Claude. Do Consultant Services Make a Difference? Sch. Sci. Math. 63: 285-290; Apr. 1963.

Classroom consultant services for an in-service program for teachers were correlated with teacher and pupil changes, teacher factors and attitudes: 1) Teachers with less experience tended to utilize consultant services more; 2) amount of time spent with teachers was positively related to teacher achievement and attitude.

r; ---; 1) only, 43 teachers; 1.1, 1.4, 6.4; teachers; ---; norm,

non-norm; ---; NE.

Dutton, Wilbur H. and Cheney, Augustine P. Pre-Service and In-Service Education of Elementary School Teachers in Arithmetic. Arith. Teach. 11: 192-198; Mar. 1964. (see t-1)

Dutton, Wilbur H. and Hammond, H. Reginald. Two In-Service Mathematics Programs for Elementary School Teachers. Calif. J. Ed. Res. 17: 63-67; Mar. 1966.

Two in-service workshops (one using a college professor as an instructor and a regular textbook, meeting 10 two hour periods, the other using district staff as instructors, a variety of instructional materials, and meeting 10 one hour periods) were compared for increase in understanding of mathematical concepts and change in attitudes toward arithmetic.

(I) structure of class; materials used. (D) achievement gain scores; change in attitude toward arithmetic.

a; ---; 1) only; 92 teachers in 2 classes; 1.4, 1.5; elem.; 10

sessions; non-norm; 35 (2, 4, 4, 5, 4, 4, 4, 5, 3); NE.

Folsom, Mary. Teachers Look at Arithmetic Manuals. Arith. Teach. 7: 13-18, Jan. 1960.

Observations of 22 teachers found one-half following the textbook, not manual procedures, with most exposing all pupils to the same material with little use of concrete and semi-concrete materials suggested by manuals. Teachers responses to questionnaires concerning manuals found unanimous approval of the format that combines manual and textbook, with a high percentage following the manual outlined testing program and found the manual helpful:

1) In planning lessons

2) In suggestions for improving problem solving ability, and

3) In providing pre-book lessons.

s; ---; 1) only; 22 teachers; 1.6; gr. 6; ---; ---; 23 (2, 1, 3, 4, 4, 3, 3, 2, 1); NE.

Glennon, Vincent J. A Study in Needed Redirection in the Preparation of Teachers of Arithmetic. Math. Teach. 42: 389-396; Dec. 1949. (see t-1)

Gorman, Frank H. The Arithmetic Vocabulary of the Elementary-School Teacher. El. Sch. J. 38: 373-379; Jan. 1938.

This study showed the lack of mathematical vocabulary of 92 teachers and recommended a course be taught as requirement for teachers.

s; ---; 1) only; 92 teachers; ---; elem.; ---; ---; 31 (3, 3, 3, 4, 5, 3, 4, 3, 3); NE.

Guiler, Wlater Scribner. Computational Errors Made By Teachers of Arithmetic. El. Sch. J. 33: 51-58; Sept. 1932.

This study investigated the computational errors made by teachers, and tabulated the findings.

s; ---; 1) only; 37 teachers; ---; teachers; ---; ---; 33 (3, 3, 3, 5, 4, 3, 4, 4, 4); NE.

Harper, E. Harold. Elementary Teachers' Knowledge of Basic Arithmetic Concepts and Symbols. Arith. Teach. 11: 543-546; Dec. 1964.

This study compared teachers for mathematics understanding based on college hours and a course in modern mathematics. It was shown that understanding, as measured, increased with training.

(I) a) course in modern mathematics, b) six hours college mathematics. (D) score on "test of basic concepts . . ."

F; ---; 2) i; 396 teachers; 1.4, 3.4; elem.; ---; non-norm;

30 (2, 3, 4, 4, 5, 3, 3, 3, 3); EP.

Hicks, Randall C. and Perrodin, Alex F. Topics in Mathematics for Elementary School Teachers. Sch. Sci. Math. 47: 739-744; Nov. 1967.

A composite list of mathematical topics appearing in four relevant sources was compiled and rated; recommendations for content to be included in preparing teachers are made.

d; ---; ---; ---; ---; elem.; ---; ---; ---; NE.

Hollingsworth, Mary R.; Lacey, Joy M.; and Shannon, J. R. School Subjects Which Elementary School Teachers Find Most Difficult and Those Which They Find Easiest to Teach. Ed. Meth. 10: 75-83; Nov. 1930.

Results of questionnaire as to most difficult and easiest subject to teach, and open end responses for reasons, found:

1) Primary and intermediate teachers differed.

2) Intermediate teachers were more in agreement.

3) Arithmetic and reading were reported as easiest by both groups, reasons being the same:
   a) personal liking
   b) thorough knowledge and training
   c) adequate texts and organized courses.

4) Reasons for difficulty of some subjects varied.

s; ---; 1) only; 569 teachers; 1.1; elem.; ---; non-norm; 34 (3, 3, 4, 5, 4, 4, 5, 3, 3); NE.

Houston, W. Robert; Boyd, Claude C.; and DeVault, M. Vere. An In-service Mathematics Education Program for Intermediate Grade Teachers. Arith. Teach. 8: 65-68; Feb. 1961.

This study attempted to evaluate in-service teacher education by discovering attitudes and innovations of teachers.

s; ---; 1) only; 252 teachers; ---; primary & intermediate

teachers (each 43%); ---; ---; 29 (2, 3, 2, 4, 4, 4, 4, 3, 3);

NE.

Huettig, Alice and Newell, John M. Attitudes Toward Introduction of Moddern Mathematics Program by Teachers with Large and Small Number of Years' Experience. Arith. Teach. 13: 125-130; Feb. 1966.

Attitudes of teachers towards modern mathematics in a school system recently introduced a modern mathematics program were measured by scaled positive and negative responses.

1) Teachers with more experience (10 years plus) were less positive.

2) Positive statements increased with amount of training in modern mathematics.

3) No differences for grade levels taught.

s; ---; 1) only; 115 teachers; 1.1, 2.6; elem.; ---; non-norm;

25 (2, 2, 3, 3, 3, 4, 3, 3, 2); NE.

Kennedy, Leonard M. and Alves, Robert. In-Service Education for Elementary School Mathematics Teachers: Responses to Nine Questions. Arith. Teach. 11: 506-509; Nov. 1964.

This study presented the responses to a list of questions about arithmetic curriculum and concluded that curriculum and teacher training be based on those responses.

s; ---; 1) only; 58 teachers; ---; teachers; ---; non-norm;

40 (3, 4, 5, 5, 5, 5, 5, 4, 4); NE.

Kenney, Russell A. Mathematical Understandings of Elementary School Teachers. Arith. Teach. 12: 431-442; Oct. 1965.

This study developed a test of math for teachers to discover the areas of teacher misunderstanding. The areas of weakness are: 1) whole number concepts; 2) decimal fractions; 3) percent concepts. Further analysis indicates no improvement in understanding through teaching experience.

s; ---; 1) only; 356 teachers; 1.3, 1.8; elem.; ---; non-norm;

32 (3, 3, 4, 5, 4, 3, 4, 3, 3); NE.

Kipps, Carol. Elementary Teachers' Ability to Understand Concepts Used in New Mathematics Curricula. Arith. Teach. 15: 367-370; Apr. 1968.

Textbook series were analyzed and a diagnostic test developed to measure teachers' comprehension. Investigation of mean scores found teachers of grades 4-6 significantly higher.

s; ---; 1) only; 310 teachers; 1.4, 3.4; elem.; ---; non-norm;

30 (2, 3, 4, 3, 3, 4, 4, 4, 3); NE.

LeBaron, Walter A. A Study of Teachers' Opinions in Methods of Teaching Arithmetic in the Elementary School. J. Ed. Res. 43: 1-9; Sept. 1949.

Declarative statements based on specific research findings were marked true, false or uncertain. Of the 1,577 responses: 1) 50% of teachers' judgments were in agreement with research findings; 2) 29% of judgments were not in agreement; 3) 20% of judgments expressed uncertainty.

s; ---; 2) s, 3) a; 22 teachers; 1.6; elem.; ---; non-norm;

26 (1, 2, 4, 5, 3, 4, 3, 2, 2); NE.

Melson, Ruth. How Well Are Colleges Preparing Teachers for Modern Mathematics? Arith. Teach. 12: 51-53; Jan. 1965.

This study tested teachers on modern mathematics and concluded that college training in mathematics should be reanalyzed!

s; ---; 2) s; 41 teachers; ---; elem.; ---; non-norm; 35 (2, 3, 4, 5, 4, 4, 5, 4, 4); NE.

Orleans, Jacob S. and Wandt, Edwin. The Understanding of Arithmetic Possessed by Teachers. El. Sch. J. 53: 501-507; May 1953.

Responses of teachers to a multiple choice test for understanding of processes, concepts and relationships showed: 1) mathematics teachers had slightly better understanding than other teachers; 2) few processes, concepts or relationships were understood by the majority of teachers; 3) difficulty in verbalizing explanations for open-end questions.

s; ---; 2) s, 3) a; 322 teachers; 1.1, 1.4, 1.6; elem.; ---; non-norm; 29 (1, 3, 4, 4, 4, 4, 3, 3, 3); NE.

Porterfield, O. V. Ambiguities in Teaching Arithmetic. Arith. Teach. 12: 348-351; May 1965. (see t-1)

Rausch, Oscar P. The Retention by Teachers of Computational Skills in Arithmetic. Math. Teach. 40: 178-179; Apr. 1947.

This study showed that teachers' skill in computation is not retaining if not used.

s; ---; 1) only; 169 teachers; 1.4; teachers; ---; norm; 26 (3, 3, 2, 2, 4, 3, 4, 2, 3); NE.

Reddel, William D. and DeVault, M. Vere. In-Service Research in Arithmetic Teaching Aids. Arith. Teach. 7: 243-246; May 1960. (see d-3)

Reys, Robert E. Are Elementary School Teachers Satisfied With Their Mathematics Preparation? Arith. Teach. 14: 190-193; Mar. 1967.

Only 12% of recent graduates surveyed rated a content course of considerable value; 35% rated it of little or no value. An undergraduate methods course was rated of considerable value by 27%; of little or no value by 40%. Half rated a senior methods class of value; 11%, of little or no value. The preparation provided by the mathematics program did not satisfy about one-third of recent graduates; more than three-fourths desired additional training, especially methods courses.

s; ---; 2) s; 218 teachers; 1.6; elem.; ---; non-norm;

36 (4, 4, 4, 4, 3, 5, 5, 4, 3); NE.

Richtmeyer, Cleon C. Functional Mathematical Needs of Teachers. J. Exp. Ed. 6: 396-398; June 1938.

Analysis of mathematical needs as reported on a checklist by teachers was related to college curriculum.

(I) frequency of use, difficulty of learning, general importance.
(D) college course content needed.

s; ---; 1) only; 389 teachers; 1.3, 1.9; teachers; ---; non-norm;

37 (3, 4, 4, 4, 5, 4, 5, 4, 4); NE.

Robinson, Arthur E. Are We Teaching Arithmetic Effectively? A Summary of a Recent Study. Math. Teach. 28: 215-222; Apr. 1935.

Survey of teachers' examination papers, observations of elementary arithmetic classes, conferences with teachers and review of professional instructors' education experiences and instructional materials led to the conclusions:

1) Teachers lacked knowledge of fundamental principles and application to problems.

2) Teachers lacked in ability many fundamental principles of teaching.

3) Teachers of teachers were not prepared to teach arithmetic teaching preparation courses.

4) Limited instructional materials were used in such courses.

s; ---; 2) s, 3) s; approx. 600; 1.6; elem.; ---; non-norm;

30 (2, 2, 3, 4, 3, 4, 5, 4, 3); NE.

Sparks, Jack N. Arithmetic Understandings Needed by Elementary-School Teachers. Arith. Teach. 8: 395-403; Dec. 1961.

This study applied itself to four questions:

1) What math should teachers have?

2) What math do teachers have?

3) What math training do teachers get?

4) What math training should teachers get?

The study listed and discussed the literature on these points.

d; ---; ---; ---; ---; elem.; ---; ---; ---; NE.

Stephens, J. M. and Lichtenstein, Arthur. Factors Associated With Success in Teaching Grade Five Arithmetic. J. Ed. Res. 40: 683-694; May 1947.

Using a measure of "class efficiency," available data was analyzed to find relationships of teacher background to achievement level. Few relationships were marked: class efficiency was higher with heterogeneous classes and with experienced teachers, though a negative correlation was found with maturity. For younger teachers, class efficiency correlated negatively with intelligence, knowledge of arithmetic, and reading comprehension. (Data was noted to be unreliable.)

F; ---; 1) only; 86 teachers; 1.4, 6.4; gr. 5; ---; ---;

36 (3, 3, 4, 4, 5, 5, 5, 4, 3); NE.

Stoneking, Lewis W. and Welch, Ronald C. Teachers' and Students' Understanding of Arithmetic. Ind. U. Sch. Ed. Bull. 37: 1-56; Sept. 1961.

This survey studied arithmetic achievement in students and teachers and found the following:

1) Older group had higher level of understanding than younger group of students; opposite for teachers.

2) Teachers with less than three years experience scored higher than those with more.

3) Students in grade 12 scored higher than teaching students.

4) Student teachers scored higher than teachers.

5) Subjects with post-grad work scored higher.

6) Neither age, nor teaching experience, but preparation in arithmetic gives higher score.

s; ---; 1) only; 1,066 teachers & students; 1.4, 3.2, 3.4;

grs. 8 & 12; teachers; ---; non-norm; 20 (2, 1, 2, 3, 3, 2, 3,

2, 2); NE.

Sueltz, Ben A. Mathematical Understanding and Judgments Retained by College Freshmen. Math. Teach. 44: 13-19; Jan. 1951.

This study surveyed the mathematical understandings of teachers and students and found weaknesses at both levels.

s; ---; 1) only; 3,000 students; 1.6; jr. high, college; ---;

non-norm; 30 (2, 3, 3, 4, 4, 3, 4, 4, 3); NE.

Todd, Robert M. A Mathematics Course for Elementary Teachers: Does It Improve Understanding and Attitude? Arith. Teach. 13: 198-202; Mar. 1966.

Data obtained from 16 sections of a course, "Mathematics for Teachers," showed an increase in understanding of, and favorable attitude towards, arithmetic. Teaching experience was not a significant factor.

(I) course work, teaching experience. (D) attitude and achievement gain.

F; ---; 1) only; 287 teachers; 1.1, 1.3, 1.4, 3.2, 3.4, 6.4;

elem.; 45 class hours; non-norm; 27 (2, 3, 3, 4, 4, 3, 3, 2, 3);

NE.

Turner, Richard L. and Fattu, Nicholas A. Skill in Teaching, Assessed on the Criterion of Problem Solving. Ind. U. Sch. Ed. Bull. 37: 1-30; May 1961.

The results of the development of instruments to measure problem solving skills in teaching arithmetic and reading were:

1) Distinguished teachers from untrained and inexperienced persons.

2) Significant association with intelligence.

3) Some power to differentiate among teachers with respect to training and experience.

4) Low but positive association between performance in arithmetic and reading problem solving skills.

s; ---; 2) s, 3) m; ---; 1.4, 1.6, 3.2, 3.3, 3.4, 6.4; grs. k-6

(teachers and college students); ---; norm, non-norm; 22 (2, 2,

2, 3, 3, 3, 3, 2, 2); NE.

Turner, Richard L. and others. Skill in Teaching, Assessed on the Criterion of Problem Solving: Three Studies. Ind. U. Sch. Ed. Bull. 39: 1-30; Jan. 1963 (1st of 3).

The validity of the mathematics teaching tasks test (M.T.T.) as a measure of professional skills of teachers was investigated in relation to pupil achievement in arithmetic for paired teachers and supervisor ratings of teachers' arithmetic teaching skills. Results indicated: 1) Teachers rated higher by supervisors had significantly higher mean scores on the M.T.T.; 2) Pupils taught by high-scoring teachers on the M.T.T. had significantly greater achievement than pupils taught by low-scoring teachers.

F; ---; 2) s, 3) m; 18 teachers, 150 pupils in 1 school system;

1.4, 3.2, 3.4, 3.5; grs. 4, 5; ---; norm, non-norm; 20 (2, 2, 2,

3, 3, 2, 2, 2, 2); NE.

Turner, Richard L. and others. Skill in Teaching, Assessed on the Criterion of Problem Solving: Three Studies. Ind. U. Sch. Ed. Bull. 39: 10-15; Jan. 1963 (2nd of 3).

Scores obtained at the conclusion of student teaching for reading problems, mathematics teaching tasks and teacher attitude were compared for immobile teachers who remained in the same school system a second year and mobile teachers who changed jobs or quit. Teachers mobile after the first year: 1) had a significantly lower mean score on reading tasks; 2) approached a significantly lower mean score on mathematics teaching tasks; 3) had a significantly higher score on the M.T.A.I. The findings were interpreted to mean that teachers who remain on a job after the first year are good problem solvers and are nonpermissive.

F; ---; 2) s, 3) s; 61 teachers; 1.1, 1.4, 3.4; grs. 3-6, teachers; 1 yr.; norm, non-norm; 25 (2, 2, 3, 3, 3, 3, 3, 4, 2); NE.

Turner, Richard L. and others. Skill in Teaching, Assessed on the Criterion of Problem Solving: Three Studies. Ind. U. Sch. Ed. Bull. 39: 16-30; Jan. 1963 (3rd of 3).

The problem-solving processes and abilities of teachers scoring high and low on a mathematics problem-solving test (M.T.T.) were investigated with block-design problems. It was concluded that: 1) High scorers on the M.T.T. performed better in terms of speed and accuracy in working block-design problems; 2) No differences in strategy or techniques for the two groups were found.

(I) score on mathematics problem-solving skill test. (D) speed, accuracy, total strategy, and initial beginning in block-design problems.

F; ---; 2) s, 3) a; 142 students; 1.3, 1.4, 1.6, 2.6, 3.4; grad. students; ---; non-norm; 21 (3, 2, 2, 3, 3, 2, 2, 2, 2); NE.

Weaver, J. Fred. Levels of Geometric Understanding: An Exploratory Investigation of Limited Scope. Arith. Teach. 13: 322-332; Apr. 1966.

Exploratory use of a diagnostic form of a geometric understanding inventory with subgroups of teachers having differences in in-service exposure to informal geometry found exposure improved performance.

(I) amount of in-service education, class work spent on informal geometry. (D) mean correct responses: 1) per item or category, 2) total.

a; ---; 2) s, 3) i; 106 teachers; 1.1, 1.4, 1.6; teachers; ---;

non-norm; 30 (3, 3, 3, 4, 4, 3, 4, 3, 3); NE.

Weaver, J. F. Nonmetric Geometry and the Mathematical Preparation of Elementary-School Teachers. Am. Math. Mon. 73: 1115-1121; Dec. 1966.

A general pattern showed an increase of correct responses with higher grade level taught. Suggested implications were misconceptions and a low level of understanding of geometric content.

s; ---; 1) only; 45 teachers; 1.4; grs. k-6; ---; non-norm;

27 (2, 3, 3, 4, 3, 4, 2, 3, 3); NE.

Whitman, Nancy C. In-Service Education and the Learning of Conceptual Mathematics. Arith. Teach. 13: 149-151; Feb. 1966.

Teachers participating in a mathematics workshop increased their conceptual knowledge of arithmetic as measured by the author's pre- and post-test.

(I) workshop. (D) achievement gain score.

a; ---; 1) only; 22 teachers; 1.4, 3.4; elem.; 3 wks.; non-norm;

37 (2, 4, 5, 5, 5, 4, 4, 5, 3); NE.

Carson, T. E. and Wheeler, L. R. Rehabilitation in Arithmetic With College Freshmen. Peabody J. Ed. 8: 24-27; July 1930.

43% of the freshmen were below eighth grade arithmetic standards and had remedial work: 1) after four weeks 65% of them reached criterion; 2) after the term (quarter) the majority reached criterion.

a; ---; 2) s, 3) a; 163 students; 1.1, 1.3, 1.6, 1.8; freshmen;

1 college quarter; non-norm; 38 (4, 4, 5, 5, 4, 5, 5, 3, 3); NE.

Cooke, Dennis H. and Whitmore, B. E. Subject Combinations in Departmentalized Elementary Schools. El. Sch. J. 34: 526-532; Mar. 1934.

Opinions of 68 education experts were compared to actual practices of subject combinations taught and placement for time of day. There was some, but limited, consistency between opinion and practice.

s; ---; 2) s, 3) i; 566 teachers; 1.1; elem.; ---; ---; 39 (4, 4,

5, 5, 4, 5, 5, 4, 3); NE.

Durflinger, Glenn W. The Fundamentals Forgotten by College Students. J. Ed. Res. 49: 571-579; Apr. 1956.

Percent of errors and omissions for achievement test subtopics showed: 1) retention of reading skill; 2) certain mathematical fundamentals at below ninth grade top quartile especially abstract numbers, fraction and decimal operations; 3) English fundamentals of parts and kinds of sentences and speech not mastered.

s; ---; 1) only; 600 tests (300 students); 1.6; soph., juniors.;

---; norm; 31 (3, 4, 4, 5, 3, 2, 4, 3, 3); NE.

Judd, Charles Hubbard. Psychological Analysis of the Fundamentals of Arithmetic. Suppl. Ed. Monog. 32: 16-36; Feb. 1927 (2nd of 6 parts).

1) There were great individual differences in the ability to count.

2) A given individual shows wide differences in ability in different counting experiences.

3) Competency and speed in counting short series of less than ten is greater than for long series.

4) There is a close relation between rates of oral and silent counting.

5) It seemed that silent counting involved inner articulation of number names.

6) Differences in articulation of the tens digit showed: a) Inarticulation resulted in faster but less exact counting; b) Poor articulation resulted in slower but most exact counting; c) Exact articulation resulted in the slowest counting.

(I) presentation of series of sounds, flashes of light, and tactual experiences, counting orally and silently. (D) speed and number of errors in counting.

F; ---; 2) s, 3) i; 40 students; 1.1, 1.4; grad. students; ---;

---; 27 (3, 3, 3, 2, 4, 2, 5, 3, 2); NE.

Judd, Charles Hubbard. Psychological Analysis of the Fundamentals of Arithmetic. Suppl. Ed. Monog. 32: 53-70; Feb. 1927 (4th of 6 parts).

1) Type of reported inner articulation had little relation to number or kind of errors.

2) Abilities in adding, subtracting, multiplying and dividing seemed distinct from counting abilities.

3) Training in discrimination did not increase the mastery of the series of number names.

4) Counting process was analyzed into 3 phases: a) possession of subjective series of number names; b) discrimination of individual items of objective series; c) application of number name to each item for a one-to-one correspondence.

(I) self-reports of inner articulation, presentation of series of sounds, flashes of light. (D) number of errors and relationship to actual total scores on Cleveland Survey Arithmetic Test.

F; ---; 2) s, 3) i; 20 students; 1.1; grad. students; 44 and 66 wk. retention; norm; 27 (2, 3, 4, 2, 4, 2, 5, 3, 2); NE.

Orleans, Jacob S. and Sperling, Julia L. The Arithmetic Knowledge of Graduate Students. J. Ed. Res. 48: 177-186; Nov. 1954.

Elementary educational statistic students' computation work sheets were examined, showing various arithmetic inadequacies.

s; ---; 1) only; 73 students in 2 classes; 1.1; grad. students; ---; non-norm; 34 (2, 4, 4, 5, 4, 4, 5, 3, 3); NE.

Smith, Henry Lester and Eaton, Merrill Thomas. The Relation of Accuracy to Speed in Addition. Ind. U. Sch. Ed. Bull. 14: 5-23; 1938.

Problems presented mechanically, with speed of presentation uniformly increased, to three ability levels of adders, found in terms of accuracy:

1) Individuals had optimum rates.

2) Homogeneous groups had optimum rates.

3) Accuracy was reduced when speed was above optimum.

4) Accuracy was not reduced when speed was below optimum.

5) Optimum rate varied with length of problems.

(I) speed of presentation of problems. (D) accuracy scores.

e; 3.8; 2) s, 3) a; 24 students; 1.1, 1.4, 1.6; college; ---; non-norm; 28 (3, 2, 3, 3, 3, 4, 4, 3, 3); ED.

Terry, Paul Washington. How Numerals Are Read: An Experimental Study of the Reading of Isolated Numerals and Numerals in Arithmetic Problems. Suppl. Ed. Monog. 18: 1-110; 1922 (2nd of 11 parts).

Graduate students described experiences while reading and rereading problems. Reading was to discover the conditions of the problem, re-reading was to perceive numerals correctly. The findings were:

1) Whole and partial first reading occurred.

2) Longer numerals received partial reading more frequently, first numerals of 3 to 7 digits usually were read in whole the first reading.

3) The more sets of numerals, the more partial reading.

4) Subjects differed greatly in habits but persistently re-read numerals for computation.

s; ---; 2) s, 3) a; 10 students; 1.1, 1.6; grad. students; ---;

non-norm; 33 (3, 3, 5, 5, 4, 4, 4, 3, 2); NE.

Terry, Paul Washington. How Numerals Are Read: An Experimental Study of the Reading of Isolated Numerals and Numerals in Arithmetic Problems. Suppl. Ed. Monog. 18: 1-110; 1922 (3rd of 11 parts).

Immediate recall of numerals after reading arithmetic word problems showed: 1) Some digit, digit length, and short numerals were recalled; 2) The 1st and sometimes 2nd digit of long numerals were usually recalled; 3) It appeared the first reading was to learn the problem conditions.

s; ---; 2) s, 3) a; 7 students; 1.1; grad. students; ---;

non-norm; 31 (3, 2, 5, 5, 4, 3, 4, 3, 2); NE.

Terry, Paul Washington. How Numerals Are Read: An Experimental Study of the Reading of Isolated Numerals and Numerals in Arithmetic Problems. Suppl. Ed. Monog. 18: 1-110; 1922 (4th of 11 parts).

Subjects reported that re-reading of arithmetic problems was for: 1) Numerals; 2) Copying numerals for computation; 3) One re-reading was usually sufficient; 3) Re-reading usually took less time.

s; ---; 2) s, 3) a; 4 students; 1.1; grad. students; ---; non-norm; 33 (3, 3, 5, 5, 4, 4, 4, 3, 2); NE.

Terry, Paul Washington. How Numerals Are Read: An Experimental Study of the Reading of Isolated Numerals and Numerals in Arithmetic Problems. Suppl. Ed. Monog. 18: 1-110; 1922 (5th of 11 parts).

Subjects copied numerals and articulated them from columns.

1) They consistently grouped numerals in one, two or three digits.

2) Several digit-lengths are read in main group patterns.

3) Various numerical-language patterns are used.

4) Punctuation encourages use of three-digit groups.

s; ---; 2) s, 3) a; 4 students; ---; grad. students; ---;

non-norm; 33 (3, 2, 5, 5, 4, 4, 5, 3, 2); NE.

Terry, Paul Washington. How Numerals Are Read: An Experimental Study of the Reading of Isolated Numerals and Numerals in Arithmetic Problems. Suppl. Ed. Monog. 18: 1-110; 1922 (7th of 11 parts).

Movement of eyes in reading arithmetic problems was recorded by means of photographs. The numerals made greater demands upon the attention of readers.

1) Smaller number of digits included in a pause than average number of letters.

2) Also longer pauses.

3) More regressive pauses.

4) 1,000 is regularly read as a word.

5) Whole readers gave longer numerals whole first readings.

6) Faster readers used partial reading for longer numerals.

s; ---; 2) s, 3) a; 6 students; 1.1, 1.4; grad. students; ---;

non-norm; 28 (2, 3, 5, 5, 2, 2, 4, 3, 2); NE.

Terry, Paul Washington. How Numerals Are Read: An Experimental Study of the Reading of Isolated Numerals and Numerals in Arithmetic Problems. Suppl. Ed. Monog. 18: 1-110; 1922 (8th of 11 parts).

Movement of eyes in re-reading and computation of arithmetic problems were recorded by means of photography.

1) Two types of re-reading, one for verification and one for copying, were distinguishable.

2) Re-reading depended upon individual habits.

3) Proceeding with numerals after first reading was distinguished as to immediate computation or copying.

4) One numeral was taken at a time for computation.

s; ---; 2) s, 3) a; 6 students; 1.1; grad. students; ---;

non-norm; 31 (3, 3, 5, 5, 3, 2, 5, 3, 2); NE.

Terry, Paul Washington. How Numerals Are Read: An Experimental Study of the Reading of Isolated Numerals and Numerals in Arithmetic Problems. Suppl. Ed. Monog. 18: 1-110; 1922 (9th of 11 parts).

Movement of eyes in reading one to seven digits in length indicated:

1) Two types of pauses, reading and guiding pauses.

2) Reading time and pauses increased with number of digits.

3) Familiarity reduced pauses.

4) Two methods were employed, large number of short pauses or few long pauses.

5) Number of digits per pause varied as to reading habits.

s; ---; 2) s, 3) a; 5 students; 1.1, 1.4; grad. students; ---;

---; 31 (3, 3, 5, 5, 3, 2, 5, 3, 2); NE.

Summaries of Dissertations, 1966-1968

This list includes all studies on elementary school mathematics which were found in Dissertation Abstracts for 1966 through 1968. This extends the previous compilation, which included dissertations from 1900 through 1965. Each dissertation is summarized, and categorized by major mathematical topic. (The list of mathematical topics is included in Appendix D.)

Summaries of Dissertations, 1966-1968

Anderson, Rosemary C. A Comparison of Two Procedures for Finding the Least Common Denominator in the Addition of Unlike, Unrelated Fractions. (University of Iowa, 1965.) Dis. Abst. 26: 5901; Apr. 1966. (c-4a)

No significant difference was found between students using either the method of rows of equivalent fractions or the procedure of factoring denominators.

Andrews, Ernest Edgar. An Analysis of the Role of Geometry at the Pre-Deductive Level in School Mathematics Programs. (Oklahoma State University, 1966.) Dis. Abst. 27A: 4148-4149; May/June 1967. (d-1, c-11)

A tabular analysis of text content, a subjective analysis of teachers' guides, and generalizations and comparisons of six series are included.

Anselmo, Fe Gaddi. An Investigation of the Nature and Development of Time Concepts in Elementary School Children. (Michigan State University, 1967.) Dis. Abst. 28A: 2088; Dec. 1967. (c-8)

Positive relationships were found between time concept scores and I.Q., M.A. and C.A. S.E.S. was not related, but there was a significant difference in favor of boys.

Anttonen, Ralph George. An Examination Into the Stability of Mathematics Attitude and Its Relationship to Mathematics Achievement From Elementary to Secondary School Level. (University of Minnesota, 1967.) Dis. Abst. 28A: 3011-3012; Feb. 1968. (a-4)

A questionnaire to measure mathematics attitude was developed. No significant relationship was found between attitude scores and mathematics achievement from elementary through secondary school.

Armstrong, Jenny Rose. The Relative Effects of Two Forms of Spiral Curriculum Organization and Two Modes of Presentation on Mathematical Learning. (University of Wisconsin, 1968.) Dis. Abst. 29: 141; July 1968. (a-3)

Results indicated that the spiral organization and mode representation facilitated various types of learning. The area-spiral form of curriculum organization better facilitated mathematical learning at the knowledge level whereas the topical spiral form produced better learning at the evaluation level. The inductive mode of presentation fostered the learning of operations while the deductive mode resulted in greater learning of mathematical properties.

Arnold, Richard Dean. The Relationship of Teachers' Sex to Assigned Marks and Tested Achievement Among Upper Elementary Grade Boys and Girls. (University of Minnesota, 1966.) Dis. Abst. 27A: 2265; Jan./Feb. 1967. (f-5)

Girls received higher marks than boys did in arithmetic, reading, spelling, and language; S.E.S. was not related to marks.

Arvin, Charles Lee. An Experimental Study of Programed Instruction in Multiplication of Fractions (Research Study No. 1). (Colorado State College, 1965.) Dis. Abst. 26: 7109; June 1966. (c-4c, d-5)

No significant difference was found between the achievement of pupils taught by means of programed instruction and those taught by controlled classroom approach. However, programed textbooks were found to be a more efficient approach when time-saving is important.

Ashlock, Robert B. A Test of Understandings of Selected Properties of a Number System: Primary Form. (Indiana University, 1965.) Dis. Abst. 27A: 321-322; July/Aug. 1966. (f-1, c-2)

A paper and pencil test with high validity and reliability which is suitable for first and second grade students was developed which does measure understanding of the number system.

Austin, Gilbert Raymond. A Study of Programmed Instruction Response Styles and Reinforcement Schedules for Teaching Multiplication of Fractions. (University of Connecticut, 1965.) Dis. Abst. 26: 5218; Mar. 1966. (d-5, g-7, c-4c)

No significan- difference in gain score was found between a text which uses recall and one which uses multiple-choice responses. No interaction between the type of texts used, reinforcement level, and time of testing was found. However, the program requiring constructed responses and giving only 50% reinforcement took a significantly longer time to complete than other types of booklets.

Bartel, Elaine Vetter. A Study of the Feasibility of an Individualized Instructional Program in Elementary School Mathematics. (University of Wisconsin, 1965.) Dis. Abst. 26: 5284; Mar. 1966. (e-4)

No difference in achievement between pupils in the individualized program and those in the traditional one was indicated when standardized arithmetic achievement was used. However, pupils in the individualized program scored consistently higher than pupils in the traditional program when the Concept Test was used.

Bassler, Otto Call. A Comparison of Two Types of Exercises in Teaching Mathematical Concepts to Prospective Elementary School Teachers. (University of Maryland, 1966.) Dis. Abst. 27A: 978; Sept./Oct. 1966. (t-1)

The two methods of instruction investigated resulted to be equally effective, also treatments were equally effective with regard to the different ability levels of the students when achievement was measured by post-tests.

Baumann, Reemt Rikkelds. Children's Understanding of Selected Mathematical Concepts in Grades Two and Four. (University of Wisconsin, 1965.) Dis. Abst. 26: 5219-5220; Mar. 1966. (c-2, c-3a)

Attainment of the concepts of commutativity, closure, and identity was found difficult for the tasks selected for evaluation.

Beers, George S. Some Effects of the Use of Supervised Study With Off-Campus In-Service Classes in Mathematics for Teachers. (University of Florida, 1967.) Dis. Abst. 29: 827; Sept. 1968. (t-2)

Achievement gains in a class using the three-hour-discussion were greater than gains in experimental groups. Changes in attitude seemed to favor the class using supervised study.

Beggs, Donald Lee. Uniformity of Growth in the Basic Skills Throughout the School Year and During the Summer. (The University of Iowa, 1966.) Dis. Abst. 27A: 2866-2867; Mar./Apr. 1967. (f-2)

Substantial loss occurs in arithmetic skills during the summer months. The theory of uniform growth is open to question.

Behr, Merlyn James. A Study of Interactions Between "Structure-of-Intellect" Factors and Two Methods of Presenting Concepts of Modulus Seven Arithmetic. (Florida State University, 1967.) Dis. Abst. 28A: 1698; Nov. 1967. (g-4, c-15)

Significant interaction was found between the two methods of instruction and (a) one figural factor and (b) four verbal factors.

Benson, Francis Arthur Mitchell. An Examination Over an Eight Month Period of Piaget's Concept of Number Development and the Presence or Absence of Certain Interrelated Tasks in a Group of First Grade Children. (University of Oregon, 1966.) Dis. Abst. 27A: 3300; Mar./Apr. 1967. (g-6)

Support is found for Piaget's contention that the development of the "logical" operations of class and seriation (for cardinal and ordinal numbers) is required for number conceptualization.

Bernabei, Raymond. A Logical Analysis of Selected Achievement Tests in Mathematics. (Western Reserve University, 1966.) Dis. Abst. 27A: 4121-4122; May/June 1967. (f-1)

Analysis of standardized achievement tests using Bloom's Taxonomy and a comparison with goals of the S.M.S.G. program was presented.

Bidwell, James King. A Comparative Study of the Learning Structures of Three Algorithms for the Division of Fractional Numbers. (University of Michigan, 1968.) Dis. Abst. 29A: 830; Sept. 1968. (c-4d)

The inverse operation method was found superior to the complex fraction method and the common denominator method in both learning structure and computational skills.

Binkley, Marvin Edward. First Grade Entrance Variables Related to Achievement and Personality, a Study of Culturally Deprived Fourth Graders. (University of Tennessee, 1967.) Dis. Abst. 28A: 2065-2066; Dec. 1967. (b-2, e-7)

Significant differences between levels of readiness were found on all nine analyses of achievement adjustment and on six of nine analyses of personality adjustment. Race differences were found on all achievement analyses but no personality analyses. Some sex differences and one age difference were noted.

Bradley, Richard Moore. An Experimental Study of Individualized Versus Blanket-Type Homework Assignments in Elementary School Mathematics. (Temple University, 1967.) Dis. Abst. 28A: 3874; Apr. 1968. (a-5e)

Significant differences favoring the individualized method were found relative to achievement in mathematics.

Brinke, Dirk Pieter Ten. Homework: An Experimental Evaluation of the Effect on Achievement in Mathematics in Grades Seven and Eight. (University of Minnesota, 1964.) Dis. Abst. 27A: 4176; May/June 1967. (a-5e)

Significant superior achievement relative to homework in contrast to supervised study was not found for classes as a whole. There was an indication that homework was more productive for upper-ability students while supervised study was more productive for low-ability students.

Brodlie, Jerome Flagg. An Examination of the Relevance of Piaget's Theory of "Logical Multiplication" to Modern Elementary School Mathematics. (Columbia University, 1966.) Dis. Abst. 27B: 2154-2155; Nov./Dec. 1966. (g-6)

Children in new mathematic curriculum did consistently but not significantly better than those in the conventional program. The greatest difference between children in the two groups appeared after the ninth year. Apparently at this age children first develop the cognitive capacities to profit from lessons on set intersection.

Bruni, James Vincent. A Study of Mathematical Education in the Public Elementary and Secondary Schools of Italy. (Columbia University, 1967.) Dis. Abst. 28B: 3368-3369; Feb. 1968. (a-6)

Recent Italian experimentation has been similar to American in the modern mathematic content being introduced; however, the extent of experimentation has been discouraged by lack of funds, influence of the ministry of public education, and lack of concern of pedagogy.

Buchanan, Van Dyk. Beginning Instruction in Writing Numerals in Kindergarten. (University of California, Los Angeles, 1966.) Dis. Abst. 27A: 3217; Mar./Apr. 1967. (a-5h)

Pupils were able to learn to write numerals legibly, but this did not facilitate arithmetic conceptualization.

Buck, Crayton LaRue. Mathematics Teaching Behavior of Selected Intermediate Grade Teachers Utilizing the OScAR (EM) for Systematic Observation. (The Pennsylvania State University, 1967.) Dis. Abst. 28A: 3525; Mar. 1968. (t-3)

Observations of teachers' behaviours did not reveal differences in teaching procedures when mathematics achievement or classroom experience was considered.

Buckeye, Donald Andrew. The Effects of a Creative Classroom Environment on the Creative Ability of Prospective Elementary Mathematics Teachers. (Indiana University, 1968.) Dis. Abst. 29A: 1801; Dec. 1968. (t-1)

Analysis of covariance indicated that the creative classroom had a significant effect on the student's creative ability as measured by a test developed by the author.

Butt, Dil-Nawaz. The Development and Application of Selected Criteria for Writing Elementary School Mathematics Textbooks. (Indiana University, 1966.) Dis. Abst. 28A: 46-47; July 1967. (d-1)

A list of criteria to establish guidelines for writing and producing elementary mathematics textbooks was developed and validated.

Callahan, Leroy G. A Study of Knowledge Possessed by Elementary School Teachers, In-Service and In-Training, of the Cultural, Psychological, and Mathematical Foundations of the Elementary School Mathematics Program. (Syracuse University, 1966.) Dis. Abst. 27A: 4149-4150; May/June 1967. (t-2, t-1)

Tests were developed for measurement of "professional knowledge" and "content knowledge." Scores improved on professional knowledge between freshman and senior year, while scores declined on mathematics knowledge.

Castaneda, Alberta Maxine Mondor. The Differential Effectiveness of Two First Grade Mathematics Programs for Disadvantaged Mexican-American Children. (The University of Texas, 1967.) Dis. Abst. 28A: 3878-3879; Apr. 1968. (e-7)

Students taught by special program on selected mathematics concepts and activities showed greater gains in mathematics achievement than those taught by the textbook-oriented mathematics program. Better provision for individual differences was found in the special program.

Chase, Charles Hughes. An Investigation of the Contribution of Selected Curriculum Development Activities to the Teaching of Elementary Mathematics. (Columbia University, 1967.) Dis. Abst. 28A: 2474-2475; Jan. 1968. (t-2)

Teachers were better able to report changes in instruction and more aware of newer approach. Significant gains in achievement were not found.

Child, Clyde Compton. A Study of the Effects of Summer School Programs on Student Achievement. (Brigham Young University, 1967.) Dis. Abst. 28A: 2475; Jan. 1968. (f-2)

Students enrolled in summer programs made greater gains in initial achievement than those not enrolled. Effects of enrollment in a subject and achievement in another should be studied.

Clark, John Ferguson. A Study of the Relative Effectiveness of Some In-Service Programs in Modern Mathematics on Second and Seventh Grade Teachers in Nine Northeastern California Counties. (University of California, Berkeley, 1967.) Dis. Abst. 28A: 2578-2579; Jan. 1968. (t-2)

In-service programs were indicated as being of great help in learning content of modern mathematics.

Collins, Fred Esly. A Study of the Relative Importance of Certain Factors in Prediction of Successful Performance in Seventh Grade Mathematics. (Oklahoma State University, 1967.) Dis. Abst. 29: 118; July 1968. (f-3)

The best single predictor of success was found to be arithmetic problem solving and concepts, followed by numerical, arithmetic computation, and reading and language usage as determined by a regression procedure.

Connolly, Austin Jay. An Instrument of Measurement to Appraise the Arithmetic Abilities of Educable Mentally Retarded Children Ages Thirteen Through Sixteen. (Colorado State College, 1968.) Dis. Abst. 29A: 1034; Oct. 1968. (f-1, e-2)

An individual test was developed and tested for reliability and consistency. The analysis of the instrument indicated that it provides a practical and valid measurement of arithmetic abilities.

Cottrell, Raymond Sheary, Jr. A Study of Selected Language Factors Associated With Arithmetic Achievement of Third Grade Students. (Syracuse University, 1967.) Dis. Abst. 28B: 4193-4194; Apr. 1968. (d-7)

High relationship was found among reading, psycholinguistic, mental and related arithmetic factors.

Covington, Richard John Lee. An Analysis of Readability of Third and Fourth Grade Modern Mathematics Textbooks Using the Cloze Procedure. (University of California, Los Angeles, 1966.) Dis. Abst. 27A: 3219; Mar./Apr. 1967. (d-6, d-1)

Analysis revealed that, except for word problems, the reading level of a series of modern mathematics textbooks was too difficult for third and fourth grade pupils.

Coxford, Arthur Frank, Jr. The Effects of Two Instructional Approaches on the Learning of Addition and Subtraction Concepts in Grade One. (University of Michigan, 1965.) Dis. Abst. 26: 6543-6544; May 1966. (c-3a, c-3b)

1) The control approach (based on the removal of a set from a set with no explicit use made of the relationship between addition and subtraction) led to greater immediate proficiency in solving subtraction sentences than did the experimental approach (based on finding the part of a set when a set and one of its subsets were given, with explicit use made of the relationship between addition and subtraction). However, the experimental approach tended to facilitate solutions of applications of subtraction to a greater extent than did the control approach in the higher ability group.

2) Delayed symbolization led to greater transfer and applicability of subtraction than did immediate symbolization when the experimental approach was employed in the lower ability group.

Crabtree, Joseph Farris, II. An Investigation of the Ability of Specially Selected Children in Grades K-2 to Learn Certain Concepts, Operations and Applications of Directed Numbers. (University of Virginia, 1965.) Dis. Abst. 26: 5907-5908; Apr. 1966. (c-9, e-3)

Most of the children could learn to construct a number line, to arrange whole numbers in order and some properties of addition using a number line. Difficulty was found in arr--nging nonconsecutive whole numbers, and in subtraction using the number line. Understanding and ability apparently correlated with age and grade level.

Crandell, Edwin Whitney. An Experimental Study: Team Teaching Compared With the Self-Contained Classroom Organization in Upper Elementary School Grades. (Wayne State University, 1966.) Dis. Abst. 27A: 2300-2301; Jan./Feb. 1967. (a-3)

Children assigned to self-contained classrooms achieved better in arithmetic than those taught by team teaching.

Cronin, Robert Emmet. The Effect of Varying Amounts of Traditional and Modern Mathematics Instruction Relative to Sex and Intellectual Ability on Both the Traditional and Modern Mathematics Achievement of Eighth Grade Pupils. (The Catholic University of America, 1967.) Dis. Abst. 28A: 2551; Jan. 1968. (a-3, e-6, f-3b)

Confusion or interference exist as a result of change in method of instruction, its effect are both retroactive and proactive.

Crowder, Alex Belcher, Jr. A Comparative Study of Two Methods of Teaching Arithmetic in the First Grade. (North Texas State University, 1965.) Dis. Abst. 26: 3778; Jan. 1966. (a-3)

Pupils using the Cuisenaire program learned more conventional subject matter and more mathematical concepts and skills than pupils taught by a conventional program. Socio-economic status was found to be an important factor in pupils' achievement.

Currey, Charles Kitchen. A Research Study of the Effect of Review of Prior Concepts and Vocabulary Upon the Facility of Learning New Concepts in Mathematics. (University of California at Los Angeles, 1966.) Dis. Abst. 27A: 1701; Nov./Dec. 1966. (d-6, a-5f)

First grade children of low socio-economic background appeared to be confused by the new mathematic terminology and do best working with a vocabulary limited to names for numbers. Middle socio-economic group appeared to benefit from a review of mathematic terms.

Dain, Helene Mieses. Elementary School Mathematics Textbooks Used in California and in Four European Countries. (University of Southern California, 1967.) Dis. Abst. 28A: 48; July 1967. (d-1, a-6)

Elementary school mathematics textbooks used in California compared favorably with books from Germany, France, Britain, and the U.S.S.R.

Deep, Donald. The Effect of an Individually Prescribed Instruction Program in Arithmetic on Pupils at Different Ability Levels. (University of Pittsburgh, 1966.) Dis. Abst. 27A: 2310-2311; Jan./Feb. 1967. (e-4)

No significant differences in computation or problem-solving scores were found between different ability groups using the I.P.I. program when pretest performance was taken into consideration.

Dezelle, Walter, Jr. A Comparative Study of the Changes in Personality in Academically Able Seventh-Grade Children Assigned or Not Assigned to an Accelerated Class in Mathematics Upon Entering Junior High School. (University of Houston, 1965.) Dis. Abst. 26: 4438-4439; Feb. 1966. (e-3, e-5)

Observations suggested that earlier maturational changes in personality were associated with assignment to one of the accelerated classes in mathematics.

Dickens, Charles Henderson. Effect of In-Service Training in Elementary-School Mathematics on Teachers' Understanding and Teaching of Mathematics. (Duke University, 1966.) Dis. Abst. 27A: 1684-1685; Nov./Dec. 1966. (t-2)

The in-service training in elementary-school mathematics was found effective in bringing about increased teacher understanding of the topics included in the course. No discernible effects on the teaching of mathematics by the teachers enrolled in the course was observed.

Doherty, Joan. Level of Four Concepts of Probability Possessed by Children of Fourth, Fifth, and Sixth Grades Before Formal Instruction. (University of Missouri, 1965.) Dis. Abst. 27A: 1703; Nov./Dec. 1966. (c-16)

Children in the study were acquaintanced with the four concepts selected and had ability to deal with them before formal instruction. Difference in familiarity of concepts varied with grade, mental age, arithmetic level and average achievement levels of the students.

Drachenberg, Cecil. Nongraded Materials and Programming of Modern Mathematics for the Primary School. [with] Modern Mathematics for the Primary School, A Nongraded Mathematics Program for Grades K-3. (University of Houston, 1964.) Dis. Abst. 28A: 3358-3359; Mar. 1968. (a-3, d-5)

Improvement in primary mathematics program has been found; however, current textbooks have been classified as transitional. Suggested content of desirable programs was outlined by national study group A; following these recommendations, nongraded materials were developed.

Early, Joseph Franklin. A Study of Children's Performance on Verbally Stated Arithmetic Problems With and Without Word Clues. (University of Alabama, 1967.) Dis. Abst. 28A: 2889; Feb. 1968. (a-5b)

Pupils performed better in selecting correct processes for solving verbal problems with word clues. Awareness on use of clues and understanding of problem situation is recommended.

Edwards, Andrew Soule. A Statistical Analysis of the Internal Properties of Three Elementary School Mathematics Tests. (University of Georgia, 1965.) Dis. Abst. 26: 6546; May 1966. (f-1)

The analysis of items indicated that each item made a positive contribution to the internal consistence of the test. Reliability coefficients obtained fall between the range of acceptance. Discrimination index indicates degree to which each item discriminates between an upper group and a lower group defined by the same criterion.

Ekman, Lincoln George. A Comparison of the Effectiveness of Different Approaches to the Teaching of Addition and Subtraction Algorithms in the Third Grade. (Volumes I and II). (University of Minnesota, 1966.) Dis. Abst. 27A: 2275-2276; Jan./Feb. 1967. (c-3a, c-3b)

Use of simple and inexpensive manipulative materials with pupils learning addition and subtraction ideas resulted in increased understanding and transfer ability over the use of pictures or algorithms only.

El-Naggar, Mohamed Abu-Khalil. A Comparative Study of Mathematics Programs in Egypt and the United States (Grades 7, 8, and 9). (Indiana University, 1965.) Dis. Abst. 27A: 326-327; July/Aug. 1966. (a-6)

Similar mathematics topics are included in both mathematics programs in the junior high school. Topics differ in the elementary school programs in both countries as a result of the introduction of modern mathematics topics at that level in the U.S.

Eroh, Agnes Ruth. Development and Evaluation of a Structured Program Compared With an Unstructured Program for Measurement Experiences in Grade I. (Boston University School of Education, 1964.) Dis. Abst. 28A: 141; July 1967. (c-8, a-3)

Children who had a structured measurement program made more significant gains than those in an informal program.

Etuk, Elizabeth Eme Samson. The Development of Number Concepts: An Examination of Piaget's Theory With Yoruba-Speaking Nigerian Children. (Columbia University, 1967.) Dis. Abst. 28A: 1295; Oct. 1967. (g-6, a-6)

Piaget's theory was generally upheld. That seriation, conservation, and classification develop simultaneously was partially supported.

Fedon, John Peter. A Study of the Cuisenaire-Gattegno Method as Opposed to an Eclectic Approach for Promoting Growth in Operational Technique and Concept Maturity With First Grade Children. (Temple University, 1966.) Dis. Abst. 27A: 3771-3772; May/June 1967. (d-3)

Teaching of mathematical concepts was more effectively developed when the approach utilized a multiplicity of experiences with a maximum emphasis on manipulation. Little difference in the methods of teaching was found related with visual apprehension of concrete number. However, an apparent trend in achievement that favors the Eclectic group's performance over the Cuisenaire group was found.

Ferguson, Nelda Unterkircher. The Frostig - An Instrument for Predicting Total Academic Readiness and Reading and Arithmetical Achievement in First Grade. (University of Oklahoma, 1967.) Dis. Abst. 28A: 2090; Dec. 1967. (b-2, f-1)

Children of average intelligence who have a Frostig P.Q. score below 90 would not be expected to be working up to first grade level in arithmetic and reading at the end of first grade.

Fisher, Jack R. An Investigation of Three Approaches to the Teaching of Mathematics in the Elementary School. (University of Pittsburgh, 1967.) Dis. Abst. 28: 4947; June 1968. (a-3)

No significant differences in arithmetic achievement were found between pupils on the standardized tests. However, the author and other participants observed advantages of an individually prescribed instructional curriculum over the other approaches in the test results.

Fisher, Victor Lee, Jr. The Relative Merits of Selected Aspects of Individualized Instruction in an Elementary School Mathematics Program. (Indiana University, 1966.) Dis. Abst. 27A: 3366; Mar./Apr. 1967. (e-4)

No significant difference in achievement was found between groups that (a) worked independently and checked their own work, (b) had group instruction and checked their own work, and (c) had group instruction with the teacher checking their work. Group (a) was able to complete more work.

Fleckman, Bessie. Improvement of Learning Division Through Use of the Discovery Method. (University of Georgia, 1966.) Dis. Abst. 27A: 3366-3367; Mar./Apr. 1967. (c-3d, a-3)

Materials and procedures devised for teaching concepts and computation via a guided-discovery method were more effective in teaching the concepts and did not hinder computational learnings.

Foley, Jackie Lee. Effectiveness of Instruction for Teachers of Elementary School Mathematics in Large Groups With Small Discussion Groups. (University of Florida, 1965.) Dis. Abst. 26: 4329; Feb. 1966. (t-2)

Students in the large class compared favorably in terms of mathematical gains and favorable changes in attitudes with students in each of the regular size classes. No substantial correlation was shown to exist between mathematical competency and attitudes towards mathematics.

Gallian, Richard Donald. A Content Validation Study of the Arithmetic Test Items of Four Arithmetic Achievement Tests Compared With the Content of Six Arithmetic Series at the Intermediate Level. (University of Missouri, Columbia, 1967.) Dis. Abst. 28A: 3361-3362; Mar. 1968. (f-1)

Tests studied were found to be similar in content and to cover a limited number of skills and concepts presented in textbooks.

Gee, Burton Cleon. Attitudes Toward Mathematics and Basic Mathematical Understanding of Prospective Elementary School Teachers at Brigham Young University. (Oregon State University, 1966.) Dis. Abst. 26: 6528; May 1966. (t-1)

Significant improvement in attitudes toward mathematics and basic mathematical understanding was found while the students were enrolled in the mathematics course.

Gibbons, Philip Edward. A Comparative Analysis of the Impact of Various Methods of Instruction on Achievement and Understanding in Mathematics for Elementary Teachers. (Oklahoma State University, 1967.) Dis. Abst. 28: 4932; June 1968. (t-1)

Results indicated that the Lecture-Program-Discussion group and the Program-Lecture-Discussion group scored significantly higher on the posttest than the Lecture-Textbook group. The Lecture-Program-Discussion group scored higher than the Program-Lecture-Discussion group.

Gilbert, Virginia Terlinden. The Relationship of Certain Educational Experiences to the Understanding of Arithmetic by Prospective Elementary Teachers. (Arizona State University, 1966.) Dis. Abst. 27A: 981; Sept./Oct. 1966. (t-1)

Strong background in high school mathematics produced a significantly higher level of understanding of arithmetic than a weaker background. Students indicating a more positive attitude toward mathematics also seemed to exhibit fuller understanding.

Goebel, Laurence Gayheart. An Analysis of Teacher-Pupil Interaction When Programed Instructional Materials Are Used. (University of Maryland, 1966.) Dis. Abst. 27A: 982; Sept./Oct. 1966. (d-5)

Teachers using programed instruction materials devoted 68% of their time to work with individual pupils, while teachers of conventional classes devoted only 3% of their time to the individual. A greater level of directiveness was found in the behavior of the programed instruction teacher than in the control teacher as measured by Flander's interaction technique. In general, the programed instruction teachers liked working with the materials and reported to have more opportunity to know their pupils.

Grafft, William Davis. Cognitive Outcomes of the S.M.S.G. Mathematics Program in Grades Four, Five, and Six. (University of California, 1966.) Dis. Abst. 27A: 992; Sept./Oct. 1966. (a-3, f-2)

Significant differences favoring students taught by the S.M.S.G. program were obtained in understanding principles of multiplication. Differences were higher at the high and average intelligence and achievement levels.

Graham, Glenn Thomas. Sequentially Scaled Mathematics Achievement Tests: Construction Methodology and Evaluation Procedures. (University of Pittsburgh, 1966.) Dis. Abst. 27A: 3308; Mar./Apr. 1967. (f-1)

Use of Guttman's "scalogram analysis" was made in constructing tests in five areas of arithmetic achievement.

Gran, Eldon Edward. A Study to Determine Whether the Negative-Number Subtraction Method Can Be Learned and Used by Elementary Pupils. (University of South Dakota, 1966.) Dis. Abst. 27A: 4165-4166; May/June 1967. (c-9, c-3b)

Pupils learned the negative-number subtraction method with speed and accuracy superior to those taught by decomposition. Pupils demonstrated ability to apply a negative-number method to common and decimal fractions. Follow-up revealed that pupils failed to continue to use the method as their habitual method of subtraction.

Gravel, Hector. Teaching Mathematical Relations at the Grade-Six Level. (Columbia University, 1968.) Dis. Abst. 29A: 1473; Nov. 1968. (c-2)

Results showed that it is possible for children at the sixth grade level to learn certain types of mathematical relations. Also positive correlation was found between pupils' scores on the standardized tests and their scores in experimental tests.

Greathouse, Jimmie Joe. An Experimental Investigation of Relative Effectiveness Among Three Different Arithmetic Teaching Methods. (The University of New Mexico, 1965.) Dis. Abst. 26: 5913; Apr. 1966. (a-3)

Pupils taught by individual-oriented meaningful method achieved greater residual criterion gains than pupils taught by other methods. Meaningful method achieved equal or better computational skill than did the drill-computation method. Computational ability and reasoning ability did not correlate significantly.

Greatsinger, Calvin. An Experimental Study of Programed Instruction in Division of Fractions. (Colorado State College, 1966.) Dis. Abst. 27A: 2442; Jan./Feb. 1967. (d-5, c-4d)

There was no significant difference between the programmed instruction group and the textbook instruction group. The P.I. groups were more efficient, spending one-half as much time.

Green, George F., Jr. The Effectiveness of a Correspondence-Study Method for Teaching Mathematics to In-Service Elementary School Teachers Using Programed Instruction and Television. (The Florida State University, 1967.) Dis. Abst. 28A: 2580-2581; Jan. 1968. (t-2)

No significant difference in the effectiveness of the methods was found. A combination of both methods was suggested.

Griffin, John Duncan. North Carolina Elementary School Teachers' Understanding of Contemporary Arithmetic. (Duke University, 1966.) Dis. Abst. 27A: 3616; May/June 1967. (t-2)

A sixty-item test was developed. Data analyzed for more than 1,000 teachers revealed that, in general, teachers understood less than half of the topics and only one-third of the modern topics. Teachers with in-service work and/or six hours of mathematics obtained higher scores.

Groen, Guy Joseph. An Investigation of Some Counting Algorithms for Simple Addition Problems. (Stanford University, 1967.) Dis. Abst. 28A: 4478-4479; May 1968. (c-3a, c-1)

One of the five models considered in the solution of addition problems based on counting resulted to be the most adequate when regression analysis on the mean latency on a successful response was made.

Grooms, Henrietta Hill. Pupil Achievement and Social Development in Intermediate Grade Departmental and Self-Contained Classrooms. (University of Georgia, 1967.) Dis. Abst. 28A: 4374-4375; May 1968. (a-3)

No significant differences in achievement were shown, although students in self-contained classrooms achieved better in some specific areas, departmentalization was more accepted by students than by teachers.

Hale, Jack. A Study of the Relationships Between Selected Factors of Organizational Climate and Pupil Achievement in Reading, Arithmetic, and Language. (University of Alabama, 1965.) Dis. Abst. 26: 5817; Apr. 1966. (a-4)

No significant differences were obtained between climate and reading, arithmetic, and language achievement as measured by the California Achievement Tests and by the Organizational Climate Description Questionnaire.

Hall, Donald Eugene. The Ability of Intermediate Grade Children to Deal With Aspects of Quantitative Judgment. (Boston University School of Education, 1966.) Dis. Abst. 27A: 2730; Mar./Apr. 1967. (b-4)

There were no sex differences found. Ability varied by grades. Quantitative judgment was more than intelligence and computational ability.

Hall, E. Leona. Methods and Materials of a Mathematics Program for the Disadvantaged and Underachieving Child. (Michigan State University, 1966.) Dis. Abst. 28A: 154-155; July 1967. (e-7, e-2)

Teaching by a concept method was more effective for fifth graders than fourth, while attitude changed positively for both groups.

Hall, Kenneth Dwight. An Experimental Study of Two Methods of Instruction for Mastering Multiplication Facts at the Third-Grade Level (Duke University, 1967.) Dis. Abst. 28A: 390-391; Aug. 1967. (c-3c)

No significant differences were found between groups taught by procedures emphasizing the commutative property and ordered pairs with practice on uncommuted combinations or by emphasis on the traditional approach with practice on commuted combinations.

Hampton, Homer F. A Comparative Study of Selected Factors of Mathematics Achievement in Homogeneous Groups of Fifth Grade Pupils Using Discovery. (Oklahoma State University, 1967.) Dis. Abst. 28: 4934; June 1968. (a-3, e-4)

No significant difference was found between the performances of two groups relative to successes by student or by sessions. A significant correlation between performance in discovery episodes, past achievement in traditional arithmetic, and achievement test scores was found favoring the high ability group.

Hanna, Joe Edwin. The Determination of the Steps That Should Be Taken in the Initiation of Development of a Modern Mathematics Curriculum in the Omaha Public Schools. (University of Nebraska Teachers College, 1965.) Dis. Abst. 26: 5785-5786; Apr. 1966. (t-2)

Basic steps determined in the study included involvement of teachers in the selection and development of new materials, a strong in-service education program, and constant appraisal of the staff's willingness to accept and utilize modern mathematics in their teaching.

Hand, Edith Frances. Evaluation of a Large-Scale Mathematics In-Service Institute for Elementary Teachers. (University of Georgia, 1967.) Dis. Abst. 28A: 2118-2119; Dec. 1967. (t-2)

Number of years of teaching experience was found to be significant for participant achievement, and the group taught by public school instructors achieved significantly more than the group taught by college instructors or graduate students.

Hanson, Lawrence Eugene. Inductive Discovery Learning, Reception Learning, and Formal Verbalization of Mathematical Concepts. (Florida State University, 1967.) Dis. Abst. 28A: 1731-1732; Nov. 1967. (a-3)

No significant differences were found between eighth-grade groups taught by verbalized discovery, nonverbalized discovery, or reception methods. Differences favored the discovery method at the college level.

Harris, Gary Reeves. A Study of the Academic Achievement of Selected Negro and White Fifth-Grade Pupils When Educational Ability is Held Constant. (The University of North Carolina at Chapel Hill, 1967.) Dis. Abst. 28A: 4375-4376; May 1968. (e-5)

White pupils generally performed better on achievement tests; differences were found to be greater in reading, language arts, and science than in social studies and arithmetic.

Hartlein, Marion Louise. Construction and Evaluation of a Test to Measure Elementary Mathematical Understandings. (University of Maryland, 1965.) Dis. Abst. 26: 5915-5916; Apr. 1966. (f-1)

No statistically significant differences between difficulty and discriminatory ability of items using number words as well as numerals and items using numerals only was found. Significant difference was found between the difficulty of items using coded numbers and items using no coding. A reliability coefficient of .83 was obtained for the Test of Elementary Mathematical Understandings using Pearson's Product Moment Correlation Coefficient.

Haukebo, Gerhard Karroll. An Investigation of the Effect of the Study of Numeration Systems in the Mathematics Preparation of Future Elementary Teachers. (University of Minnesota, 1967.) Dis. Abst. 28A: 2119-2120; Dec. 1967. (t-1)

The group studying nondecimal numeration systems did not score significantly higher in achievement, attitude, or transfer than the group studying the decimal system.

Hayes, Edward John. Relationships Between Self-Concept of Arithmetic Ability and Arithmetic Achievement in a Selected Group of Sixth Grade Students. (Michigan State University, 1967.) <u>Dis</u>. <u>Abst</u>. 28A: 3999; Apr. 1968. (f-2, e-5)

Exploratory study relative to arithmetic self-concept showed significant and positive results related to arithmetic achievement.

Heimgartner, Norman Louis. Selected Mathematical Abilities of Beginning Kindergarten Children. (Colorado State College, 1968.) <u>Dis</u>. <u>Abst</u>. 29: 406-407; Aug. 1968. (b-1)

This study indicated that children possess a great deal of mathematical ability before entering school; they did better with number recognition in a series than in isolation. The chronologically older children did better than younger children.

Heisey, Daniel Joseph. A Characterization of Provers and Nonprovers in an Axiomatic Geometry Course for Elementary Education Majors: A Discriminate Analysis. (Purdue University, 1966.) <u>Dis</u>. <u>Abst</u>. 27A: 413-414; July/Aug. 1966. (t-3)

A discriminate analysis of data showed that the six instruments used to measure factors associated with the proof-writing task [P.T. (Profundity Test), Conditional Reasoning Test, Educational Testing Service's (L.S.I.), and (F.C.I.) tests, the Taylor Manifest Anxiety Scale, and the Sarason Test Anxiety Scale] can effectively classify the two groups.

Herbst, Leonard Alfred. The Effect of Teaching Coordinate Geometry on the Understandings of Selected Geographic Concepts in the Fifth Grade. (University of California, Berkeley, 1967.) <u>Dis</u>. <u>Abst</u>. 28A: 2599-2600; Jan. 1968. (c-11)

Instruction in coordinate geometry appeared to benefit students in high I.Q. range as it relates to geographic understandings being measured.

Hervey, Margaret Anne. Second Grade Children's Responses to Two Types of Multiplication Problems. (University of Wisconsin, 1965.) <u>Dis</u>. <u>Abst</u>. 27A: 602-603; Sept./Oct. 1966. (c-3c)

Addition of equal addends problems were found less difficult for the children to conceptualize, to solve correctly, to think about them, and required less time to solve.

Hicks, Randall Clarke. A Program of Study in Mathematics for Elementary School Teachers Based Upon Exhibited and Derived Needs. (University of Georgia, 1966.) Dis. Abst. 27A: 3341-3342; Mar./Apr. 1967. (t-2)

A program was developed based on: 1) needs exhibited in the experimental studies, 2) needs derived from the recommendations of mathematics educators and organizations, and 3) concepts derived from textual materials in mathematics background and children's textbooks.

Hoeltke, Gary Martin. Effectiveness of Special Class Placement for Educable Mentally Retarded Children. (The University of Nebraska Teachers College, 1966.) Dis. Abst. 27A: 3311; Mar./Apr. 1967. (e-2)

Pupils enrolled in regular classes achieved better in arithmetic, reading, and spelling. Special classes had better self-image. Both groups reflected the same attitude toward their teacher.

Hogg, Carmen Claire. A Study to Determine the Extent to Which Student Teachers Can be Conditioned to Work With the Culturally Disadvantaged. (Oklahoma State University, 1967.) Dis. Abst. 28: 4934; June 1968. (t-1)

Prior to student teaching, students in the special program expressed greater annoyance with the behavior described in a questionnaire than did students in the regular program. Student teaching in culturally disadvantaged schools appeared to be related to the student teachers' confidence in their ability to handle the behavior problems described.

Hollander, Elaine Kind. The Effects of Various Incentives on Fifth and Sixth Grade Inner-City Children's Performance of an Arithmetic Task. (The American University, 1968.) Dis. Abst. 29A: 1130; Oct. 1968. (g-5, e-7)

Verbal praise and candy reward resulted to be more effective in accuracy and speed performance than no incentive or verbal reproof.

Hopkins, Charles David. An Experiment on Use of Arithmetic Time in the Fifth Grade. (Indiana University, 1965.) Dis. Abst. 26: 5291-5292; Mar. 1966. (b-6, a-5a)

Replacement of time spent on drill by informal investigation of problems involving mathematical concepts resulted in equivalent proficiency in arithmetic computations and understanding of basic arithmetic principles.

Hughes, Eugene Morgan. The Impact of Selected Experimental Curriculum Projects On Commercially Published Elementary School Mathematics Textbooks. Dis. Abst. 29B: 2115-2116; Dec. 1968. (d-1, a-3)

Analysis of textbook series indicated that S.M.S.G. series had had a greater impact on past 1960 commercially published textbook than the Greater Cleveland Mathematics Project.

Hungerman, Ann Dorothy. A Study of the Achievement and Attitude of Sixth-Grade Pupils in Conventional and Contemporary Mathematics Programs. (University of Michigan, 1965.) Dis. Abst. 27A: 414-415; July/Aug. 1966.

Achievement data favored the control group in the area of conventional arithmetic and the experimental group in the area of contemporary mathematics. Attitude toward mathematics was similar for both treatment groups. Socio-economic level demonstrated little relationship to either achievement or attitude.

Hurd, Raymond Wilbur. Use of Finite Mathematical Systems in Teaching Mathematics for Elementary Teachers. (Ohio State University, 1967.) Dis. Abst. 28: 4935; June 1968. (t-1)

The use of finite systems did not provide greater gains in understanding the structure of the real number system as measured by the author's test.

Hurst, Doyle. The Relationship Between Certain Teacher Related Variables and Student Achievement in Third Grade Arithmetic. (Oklahoma State University, 1967.) Dis. Abst. 28: 4935-4936; June 1968. (f-5)

A significant relationship was found between student achievement gain on problem solving and concepts, and recency of mathematics courses and mathematics education courses taken by their teachers.

Jackson, Robert Loring. Numeration Systems: An Experimental Study of Achievement on Selected Objectives of Mathematics Education Resulting From the Study of Different Numeration Systems. (University of Minnesota, 1965.) Dis. Abst. 26: 5292-5293; Mar. 1966. (c-15)

Pupils receiving instruction in nondecimal numeration systems did significantly better in tests measuring understanding and problem solving skills than those studying the decimal system. However, those receiving instruction in the decimal system did better in computational skills than those receiving instruction in non-decimal systems.

James, Jim Butler. A Comparison of Performance of Sixth-Grade Children in Three Arithmetic Tasks: Typical Textbook Verbal Problems; Revised Verbal Problems Including Irrelevant Data; and Computational Exercises. (University of Alabama, 1967.) Dis. Abst. 28B: 2030; Nov. 1967. (a-5b)

Problems with extra data were more difficult than problems without extra data. Routine computation was easier than either type of problem.

Jenkins, Offa Lou Harris. A Study of the Effect of Three Methods of Teaching Arithmetic to Mentally Handicapped Pupils. (University of Virginia, 1967.) Dis. Abst. 28A: 3074; Feb. 1968. (e-2)

Programed arithmetic materials appeared to be more effective than social approach or conventional textbook manner for teaching arithmetic concepts.

Jensen, Ove William. The Development and Standardization of a Test of Understandings of the Real Number System. (University of Miami, 1967.) Dis. Abst. 28A: 988; Sept. 1967. (t-1)

Lack of mathematical background was found among many prospective elementary teachers; however, a methods course increased background.

Johnson, Gordon Floyd. An Investigation of Programed Procedures in Teaching Addition and Subtraction to Educable Mentally Retarded Subjects. (University of Oregon, 1966.) Dis. Abst. 27A: 4132; May/June 1967. (d-5, e-2, c-3a, c-3b)

Findings suggest that programmed techniques, when used in conjunction with teaching plans, are more effective than conventional instruction.

Johnson, Sonia Ann Harris. Some Selected Classroom Variables and Their Relationship to Mathematics Achievement in Central Minnesota and the Greater London Area. (Rutgers - The State University, 1966.) Dis. Abst. 27A: 139-140; July/Aug. 1966. (a-6)

Intelligence as measured by the Raven Progressive Matrices Test, student attitude, and homework were found to be most closely related to mathematics achievement. In both amount of homework and positive student attitude toward mathematics, the American groups had a significantly higher mean. Frequent testing, tutoring, drill and special assignments, although correlated with achievement in a case or two, were not found to be generally covariable with mathematics achievement.

Jonsson, Harold Alfred. Interaction of Test Anxiety and Test Difficulty in Mathematics Problem-Solving Performance. (University of California, Berkeley, 1965.) Dis. Abst. 26: 3757-3758; Jan. 1966. (f-1, a-5b, e-5)

Levels of test anxiety were found to interact with test version. This interaction was more detectable for groups from opposite ends of the score distribution of Test Anxiety Scale for Children (i.e. high test-anxious students selected the more difficult version). The effect for boys was higher than for girls.

Keating, Barbara Jean. A Study of the Effect of a Reading Improvement Program on Achievement in Reading and Arithmetic in Grades Four, Five, and Six. (University of Kansas, 1967.) Dis. Abst. 28A: 4379-4380; May 1968. (f-2)

No significant gains in achievement were obtained. Recommendations were made for improvement of program.

Kilpatrick, Jeremy. Analyzing the Solution of Word Problems in Mathematics: An Exploratory Study. (Stanford University, 1967.) Dis. Abst. 28A: 4380; May 1968. (a-5b)

Processes used in solution of word problems resulted to be unrelated to other kinds of problems.

Knowlden, Gayle Elizabeth. Teaching English Language and Mathematical Symbolism to Verbally Disadvantaged Kindergarten Children. (University of California, Los Angeles, 1966.) Dis. Abst. 27A: 3623-3624; May/June 1967. (b-2, e-7)

Four treatments were used: (a) teacher and lesson plan; (b) teacher with plan and filmstrip; (c) teacher with plan and video tape; and (d) teacher with plan, video tape, and filmstrip. Treatment (d) produced the greatest average gain.

Lampela, Roland Mitchell. An Investigation of the Relationship Between Teacher Understanding and Change in Pupil Understanding of Selected Concepts in Elementary School Mathematics. (University of California, Los Angeles, 1966.) Dis. Abst. 27A: 1548-1549; Nov./Dec. 1966. (f-5)

No significant relationship was found between change in pupil understanding of elementary school mathematics and teacher understanding of elementary school mathematics. Recommendations for further study were made.

Lanier, Perry Eugene. A Study of Creativity, Intelligence and Discovery Teaching as Related to Performance in Elementary School Mathematics. (University of Oklahoma, 1967.) Dis. Abst. 28A: 1004-1005; Sept. 1967. (e-5, a-3)

A significant relationship between performance ratings by teachers and five categories of intelligence were found, with structure and problem solving found to be related to creativity.

Lawson, John Berry. Achievement Differences in Fourth Grade Under Two Time Allotments and Two Sequences for Introducing Multiplication Facts. (University of California, Berkeley, 1966.) Dis. Abst. 27A: 995-996; Sept./Oct. 1966. (b-6, c-3c)

Differences in fundamental arithmetic skills were found in favor of the (60 minute regular group) as compared to the (40 minute regular group). Higher achievement in fundamental arithmetic skills was found in favor of the (40 minute concentrated group) as compared to the (40 minute regular group).

LeBlanc, John Francis. The Performance of First Grade Children in Four Levels of Conservation of Numerousness and Three I.Q. Groups When Solving Arithmetic Subtraction Problems. (University of Wisconsin, 1968.) Dis. Abst. 29A: 67; July 1968. (g-6, c-3b)

Children in the first level performed better than children in the third and fourth levels in conservation of numerousness. There were significant differences among the performances of children in the three I.Q. groups; also among the groups of children formed by levels and I.Q. groups. Children in low levels of conservation and the low I.Q. group were more dependent on aids and transformations in solving subtraction problems than higher I.Q. groups.

LeJeune, Stanley Joseph. The Development of an Instrument to Determine Achievement in Modern Mathematics in Grades Four, Five, and Six. (The University of Mississippi, 1967.) Dis. Abst. 28A: 4383-4384; May 1968. (f-1)

Test, based on selected textbook material, appeared to be a highly reliable instrument for measuring mathematics achievement.

Levin, Alvin Irving. The Use of Taxonomic Programming As Applied to the Teaching of Fractions in Grade Five. (University of California, Los Angeles, 1968.) Dis. Abst. 29: 1782-1783; Dec. 1968. (c-4, d-5)

Programmed texts produced favorable effects on the experimental group compared to the control group of students that did not use a programmed textbook. The regular programmed text produced favorable results compared to the random order programmed text.

Lindell, Verlyn LeRoy. An Evaluation of an In-Service Program for Elementary School Mathematics Teachers Conducted by the Colorado State Department of Education. (University of Denver, 1966.) Dis. Abst. 27A: 3346; Mar./Apr. 1967. (t-2)

Some teachers improved in content background, and some changed their teaching behavior. Most liked mathematics better.

Lindgren, Richard Francis. A Comparison of Team Learning With Learning Through Conventional Teaching as Methods in Teaching Arithmetic Reasoning in Grades Four and Five. (The University of Connecticut, 1965.) Dis. Abst. 28A: 3369; Mar. 1968. (a-3)

No significant difference in arithmetic reasoning was found between students who had used team learning and those who had used conventional teaching.

Lindsay, Charles McCown. An Experimental Investigation of Two Methods Used in the In-Service Education of Teachers of Arithmetic. (George Peabody College for Teachers, 1965.) Dis. Abst. 26: 5219-5220; Mar. 1966. (t-2)

Both methods (the lecture-discussion method and the scrambled book method) were found to be effective means of conducting in-service mathematics workshops for teachers.

Litwiller, Bonnie Helen. Enrichment: A Method of Changing the Attitudes of Prospective Elementary Teachers Toward Mathematics. (Indiana University, 1968.) Dis. Abst. 29A: 1808-1809; Dec. 1968. (t-1)

Significant differences were found between attitudes and achievement of students who considered enrichment problems and those who did not.

Lucas, James Stanley. The Effect of Attribute-Block Training on Children's Development of Arithmetic Concepts. (University of California, Berkeley, 1966.) Dis. Abst. 27A: 2400-2401; Jan./Feb. 1967. (d-3)

Attitude-block training was compared with the Greater Cleveland program. Attitude-block subjects were: (a) better conservers, (b) better at conceptualization of addition and subtraction, (c) not as good in computation, (d) no better on verbal problems, and (e) slightly better at multiplication.

McCarty, Theron Phillip. The Relative Effectiveness of Introducing Percentage in Grades Four, Five and Six. (University of California, Berkeley, 1966.) Dis. Abst. 27A: 3628-3629; May/June 1967. (c-6)

Pupils in these grades were able to learn concepts associated with ratio and percentages.

McConnell, Dorothy Fraiser. Basic Concepts in Modern Mathematics for Elementary Schools in Texas. (Baylor University, 1967.) Dis. Abst. 28A: 399; Aug. 1967. (d-1)

Considerable agreement on grade placement, sequence, and techniques of presentation of basic topics was found in several textbook series, though a wide divergence of total concepts existed.

McPherson, Ann Wesley. A Curriculum Study Based on the Application of Historical Materials in Elementary School Mathematics. (The University of Tennessee, 1967.) Dis. Abst. 28A: 3565-3566; Mar. 1968. (a-1)

Curriculum historical materials can facilitate comprehension of selected mathematical concepts.

Maertens, Norbert William. An Analysis of the Effect of Arithmetic Homework Upon the Arithmetic Achievement of Third Grade Pupils. (University of Minnesota, 1967.) Dis. Abst. 28A: 4535; May 1968. (a-5e)

Arithmetic homework appeared not to have educational significant effect upon arithmetic achievement or attitudes development.

Martin, Bernard Loyal. Spatial Visualization Abilities of Central Washington State College Prospective Elementary and Secondary Teachers of Mathematics. (Oregon State University, 1966.) Dis. Abst. 27A: 2427-2428; Jan./Feb. 1967. (t-1)

Secondary school teachers had more skill in spatial visualization. Spatial visualization ability was not found to be related to scholastic ability.

Mayes, Thomas A. A Study of the Effects of a Parent Education Program on Third Grade Arithmetic Achievement Levels. (Michigan State University, 1965.) Dis. Abst. 26: 4417; Feb. 1966. (f-4)

Achievement gains of eight months for one school, six months for two schools and two months for the fourth school over their control group was indicated for children whose parents participated in the program.

Meconi, LaVerne Joseph. An Experimental Study of Concept Learning and Retention in Mathematics. (The Ohio State University, 1966.) Dis. Abst. 27A: 2740-2741; Mar./Apr. 1967. (g-4, g-2, d-5)

A program of number sequences was developed with three approaches: 1) rule and example, 2) guided discovery, and 3) discovery. Differences in achievement were not significant; however, the discovery program appeared to be most effective in terms of time.

Mehl, Michelle Vallette. Differences in the Grade Placements of Arithmetic Concepts, in the Methods Employed to Teach the Concepts, and in the Achievement Attained by Students in French and in American Schools. (Montana State University, 1964.) Dis. Abst. 26: 3703-3704; Jan. 1966. (a-6, b-5)

Grade placement of the concepts of most arithmetic topics in French arithmetic textbook series differ significantly and appear sooner from grade placement of the same concepts in American textbook series. Lessons on problem solving techniques occupy almost half on French fifth grade textbooks, whereas they occupy a smaller portion of American fifth grade textbooks. The arithmetic achievement of French fifth graders was found significantly superior to that of American fifth graders due to a higher score on arithmetic problem solving; it was also found that the French schools spent 3-15 minutes more per day on arithmetic instruction.

Miller, Joe Hal. The Relationship Between School Mobility and Academic Achievement of Sixth Grade Students of Culturally Disadvantaged and Middle Socio-Economic Neighborhoods. (Indiana University, 1966.) Dis. Abst. 27A: 3231-3232; Mar./Apr. 1967. (e-7, f-2)

Mobility did not seem to play a significant role in the academic achievement of culturally disadvantaged students. The influence of mobility on middle socioeconomic students seemed limited to language and arithmetic concepts.

Moody, William Braun. An Investigation of the Relationship Between Fifth Grade Student and Teacher Performance on Selected Tasks Involving Non-metric Geometry. (University of Maryland, 1968.) Dis. Abst. 29A: 1827; Dec. 1968. (f-5, c-11)

Students who read materials on their own did not perform as well as those having teachers explaining and interpreting the content for them. Those students, whose teachers scored higher upon selected mathematical tasks, performed at the same level as teachers on these tasks.

Moray, Joseph. Effects of Curriculum Reform on Mathematics Achievement in Grade Six. (University of California, Berkeley, 1967.) Dis. Abst. 28A: 4538; May 1968. (a-3)

Unfavorable effects were found on achievement in traditional arithmetic material. Uncertain effects on achievement were found in modern mathematics but appeared to be unfavorable for experimental group.

Morrison, Roderick Ruel, Jr. A Study of the Effects of Departmental Organization on Academic Achievement in the Sixth and Seventh Grades. (University of Georgia, 1966.) Dis. Abst. 27A: 3270-3271; Mar./Apr. 1967. (a-3)

The self-contained classroom students in middle socio-economic class schools performed better on arithmetic reasoning and computation than did the departmental students.

Murray, Frank Brush. Some Factors Related to the Conservation of Illusion-Distorted Length by Primary School Children. (The Johns Hopkins University, 1966.) Dis. Abst. 27A: 3320; Mar./Apr. 1967. (g-6)

A study was made of 1) length conservation, 2) illusion strength, 3) phenomenal-real discrimination, 4) operational length conservation, and 5) conservation training. Implications of the findings for education are discussed.

Nabors, Cecil Thomas. The Effect of Individualized Verbal Problem Assignments on the Mathematical Achievement of Fifth-Grade Students. (University of Houston, 1968.) Dis. Abst. 29A: 1168; Oct. 1968. (a-5b, e-4)

Students using individualized problem-solving assignments made significantly greater score gains than those using regular mathematics textbook materials.

Namkin, Sidney. The Stability of Achievement Test Scores: A Longitudinal Study of the Reading and Arithmetic Subtests of the Stanford Achievement Test. (Rutgers - The State University, 1965.) Dis. Abst. 27A: 398-399; July/Aug. 1966. (f-1, f-2)

Relatively high level of stability between successive achievement tests was found. A steady increase on variability occurred with increasing grade levels. Differences in patterns appeared between reading and arithmetic subtests, among subtests themselves, and also by sex.

Nealeigh, Thomas Richard. Development and Validation of a Non-Verbal Attitude and Achievement Index for Mathematics. (The Ohio State University, 1967.) Dis. Abst. 28A: 3567; Mar. 1968. (f-1)

Positive correlation was found between tendency to select one of two pictures involving mathematical concepts and successful achievement or positive attitude toward mathematics.

Neill, Robert Dudley. The Effects of Selected Teacher Variables on the Mathematics Achievement of Academically Talented Junior High School Pupils. (Columbia University, 1966.) Dis. Abst. 27A: 997-998; Sept./Oct. 1966. (f-5, a-3, e-3)

Although teacher attributes were found to contribute little to pupil performance, teacher's length of academic preparation appeared to contribute most to variance of pupils performance on all criterion measures. Pupils performance scores were significantly higher in classes taught by men.

Nelson, Nancy Zebraskey. The Effect of the Teaching of Estimation on Arithmetic Achievement in the Fourth and Sixth Grades. (University of Pittsburgh, 1966.) Dis. Abst. 27A: 4172; May/June 1967. (a-5c)

The sixth-grade estimation group significantly surpassed the control group on concepts and estimation. The fourth-grade control group score was significantly better on computation, the experimental group on estimation.

Neufeld, K. Allen. Differences in Personality Characteristics Between Groups Having High and Low Mathematical Achievement Gain Under Individualized Instruction. (The University of Wisconsin, 1967.) Dis. Abst. 28A: 4540; May 1968. (e-5, e-4)

Achievement, personality, and intelligence tests were administered to fourth, fifth and sixth graders; analysis indicated difference in some personality variables.

Newman, Claire M. The Qualifications and Role of the Mathematics Specialist in the Elementary School. (Columbia University, 1965.) Dis. Abst. 26: 4342; Feb. 1966. (t-3)

The role of the specialist is viewed as a curriculum planner, a teacher aid in classroom teaching for testing techniques and as an aid in arranging or presenting in-service courses in mathematics and pedagogy. College training programs at the graduate level are suggested for elementary and high school teachers with strong background in mathematics, and administrators with mathematics teaching as their main interest.

Northey, James Howard. The Lecture and Discussion Use of Class Time in a Pre-Service Mathematics Class for Elementary Teachers. (University of Michigan, 1967.) Dis. Abst. 28A: 2125-2126; Dec. 1967. (t-1)

No significant differences were found between groups receiving varied proportions of lecture and discussion.

O'Brien, Thomas C. An Experimental Investigation of a New Approach to the Teaching of Decimals. (New York University, 1967.) Dis. Abst. 28A: 4541-4542; May 1968. (c-5)

Students in the numeration approach scored lower than those in the two other approaches. Suggestions for revision of the coverage of division in the experimental text are made.

Osborn, Kenneth Hugh. A Longitudinal Study of Achievement in and Attitude Toward Mathematics of Selected Students Using School Mathematics Study Group Materials. (University of California, Berkeley, 1965.) Dis. Abst. 26: 7119; June 1966. (a-3, a-4)

The introduction of S.M.S.G. materials and their subsequent study for increasing periods of time have no significant effect on arithmetic skills, algebraic skills, and mathematical reasoning skills. A decrease in positive attitude toward mathematics was found from study of S.M.S.G., apparently due to increase in abstraction of the curriculum.

Osborne, Alan Reid. The Effects of Two Instructional Approaches on the Understanding of Subtraction by Grade Two Pupils. (University of Michigan, 1966.) Dis. Abst. 28A: 158; July 1967. (c-3b)

A set-partitioning-without-removal approach to subtraction resulted in significantly greater understanding than the take-away model.

Paige, Donald Dean. A Comparison of Team Versus Traditional Teaching of Junior High School Mathematics. (Indiana University, 1966.) Dis. Abst. 27A: 1717-1718; Nov./Dec. 1966. (a-3)

No significant difference was found in mathematical achievement, in the retention of mathematical achievement or in the relearning ability of seventh and eighth grade students, whether taught by the team teaching method or the traditional method. In addition student attitudes about helping each other, attending homogeneous classes, and moving from class to class, were not affected by the instructional technique.

Payne, John Finley, Jr. An Experimental Study on the Effectiveness of Instruction in Mental Computation in Grade V. (Research Study No. 1). (Colorado State College, 1966.) Dis. Abst. 27A: 608-609; Sept./Oct. 1966. (a-5d)

Pupils taught mental computation using a specified time allotment within the arithmetic curriculum and a step-by-step planned sequence of material performed better than those using an intermittent presentation in the textbook as measured by the Kramer Mental Computation Test.

Peel, Nancy Dale. An Analysis of the Mathematics Taught in Grades One Through Eight as Applied to Selected Industrial Occupations. (Indiana University, 1967.) Dis. Abst. 28A: 4028; Apr. 1968. (a-2, b-5)

Employees' perception of the mathematics used in their work differed from the employers' perception and from the mathematics emphasis in school program.

Perkins, Ruth Marion. Ways of Providing for Individual Differences in Elementary Mathematics. (University of Michigan, 1967.) Dis. Abst. 28: 4937; June 1968. (t-3)

A teacher-assistant with a mathematics background can effectively change practices of elementary teachers with regard to providing for individual differences in mathematics.

Pethtel, Richard Dean. A Comparative Analysis of the Effect of Television Instruction on Achievement in a College Mathematics Course for Elementary Teaching Course for Elementary Teaching Majors. (Indiana University, 1967.) Dis. Abst. 28A: 2142; Dec. 1967. (t-3)

Students enrolled in television courses in mathematics seem to achieve as well as and retain as much as students in traditional lecture classes.

Phillips, Darrell Gordon. An Investigation of Possible Hierarchical Dependency of Four Piaget-Type Tasks Under Two Methods of Presentation to Third-, Fifth-, and Seventh-Grade Children. (The Florida State University, 1967.) Dis. Abst. 28A: 2564; Jan. 1968. (g-6)

Significant differences in task attainment between grade levels were found, but no significant differences between the two types of presentation (object and graphic).

Pinegar, Rex Dee. A Comparison of a Conventional Teaching Technique With a Programed Instruction Technique as Applied to Teaching Basic Arithmetic Addition and Subtraction Combinations to Normal and Educable Mentally Retarded Boys. (University of Southern California, 1967.) Dis. Abst. 28A: 3571; Mar. 1968. (e-2, a-3, d-5)

Programed materials resulted more effective with retardates and normals than conventional approaches. Significant results in time saving were found.

Plunkett, Betty Kiser. Symbol - Referent Discrimination by Fourth Grade Students. (University of Illinois, 1967.) Dis. Abst. 28: 4957; June 1968. (c-2, c-1)

Significant differences between ability level groups were found concerning performance of students in making an appropriate distinction between symbols and referents as related to their general ability. Most of the students contacted by the experimenter were awared of a distinction between symbols and referents.

Post, Thomas Robert. The Effects of the Presentation of a Structure of the Problem-Solving Process Upon Problem-Solving Ability in Seventh Grade Mathematics. (Indiana University, 1967.) Dis. Abst. 28A: 4545; May 1968. (a-5b)

Special instruction in structure of problem solving appeared not to significantly improve problem solving ability. Intelligence was a significant factor.

Pritchett, Edward Milo. An Instrument of Measurement to Appraise the Arithmetic Abilities of Educable Mentally Retarded Children Ages Six Through Nine. (Research Study No. 1). (Colorado State College, 1965.) Dis. Abst. 26: 7120; June 1966. (e-2, f-1)

An individual method of testing arithmetic achievement was found to be highly reliable as it was compared with the Arithmetic Concepts and Skills Section of the Metropolitan Achievement Tests.

Pyatte, Jeff Alvin. An Experimental Study of the Effects of Structuring a Unit on Achievement and Transfer for Upper Elementary School Students of High, Middle, and Low Basic Ability. (University of Virginia, 1967.) Dis. Abst. 28A: 3516-3517; Mar. 1968. (g-1, c-8, f-3b)

Mode of program was not found to affect achievement or transfer. However, students of high basic ability achieved higher in structure version while those with low basic ability tended to perform better in unstructured units; older students were better able to transfer concepts.

Quick, Alton David. Number and Related Concepts for Arithmetic for the Educable Mentally Retarded. (University of Alabama, 1966.) Dis. Abst. 27A: 2953-2954; Mar./Apr. 1967. (e-2, g-6)

Piaget's stages occurred in the mentally retarded. There was a lag of the stages in M.A. as well as C.A.

Rasmussen, Dean Stewart. Urban Junior High School Mathematics Curricula at the Seventh and Eighth Grade Levels. (University of Southern California, 1968.) Dis. Abst. 29A: 1688; Dec. 1968. (e-7)

Investigation found that curricular and instructional aspects of mathematics programs are interrelated with emphasis given to teaching for understanding and drill and other activities are used to reinforce concepts. Districts are in a transitional period in regard to many current trends related to these programs; an increase in in-service activities for teachers pertaining to general urban and mathematics education was also found.

Ray, Marilyn Miller. The Preparation of Teachers of Elementary School Mathematics in Louisiana. (University of Oklahoma, 1967.) Dis. Abst. 28A: 2127; Dec. 1967. (t-1)

Analysis of course content revealed adequate coverage of all areas except geometry and graphs.

Reed, Mary Katherine Stevens. Vocabulary Load of Certain State-Adopted Mathematics Textbooks, Grades One Through Three. (University of Southern California, 1965.) Dis. Abst. 26: 3706; Jan. 1966. (d-1, d-6)

Little agreement was found to exist between vocabularies introduced in the state-adopted mathematics textbooks and those introduced in the state-adopted basic reading series. Greater agreement was found between math text vocabularies and three standard word lists.

Reile, Harry Charles. The Status of Modern Mathematics in Nebraska Elementary Schools. (The University of Nebraska Teachers College, 1967.) Dis. Abst. 28A: 3381A: Mar. 1968. (a-3)

Lack of teacher preparation and training in mathematics was found. Recommendations were made for evaluation of certification requirements, revision of textbooks, and training in the use of modern mathematics materials.

Reys, Robert Edward. A Study of the Mathematics Preparatory Program for Elementary School Teachers of the University of Missouri at Columbia. (University of Missouri, Columbia, 1966.) Dis. Abst. 27A: 2926-2927; Mar./Apr. 1967. (t-1)

Results and analysis of scores on a battery of tests administered to elementary education majors and a questionnaire sent to former graduates are reported.

Rickard, Esther E. Sidwell. An Inventory of the Number Knowledge of Beginning First Grade School Children, Based on the Performance of Selected Number Tasks. (Indiana University and Indiana State College, 1964.) Dis. Abst. 28A: 406; Aug. 1967. (b-1)

It was found that children have acquired considerable number knowledge before entering first grade. Girls were consistently a little more successful than boys.

Riggs, Corinne Whitlow. The Construction and Evaluation of a Programmed Text on the Interpretation of Graphs for Grade Five. (University of California, Los Angeles, 1966.) Dis. Abst. 27A: 2748; Mar./Apr. 1967. (d-5, c-16)

The program was effective under two experimental treatment conditions.

Robe, Harry Robert. Effects of the Presence of an Observer Upon Problem-Solving Behavior for Boys Who Vary in Test Anxiety. (Indiana University, 1966.) Dis. Abst. 27A: 3322; Mar./Apr. 1967. (a-5b, e-5)

The presence or absence of an inactive observer did not affect problem-solving behavior of "normal" boys.

Robinson, Inez Cooper. The Acquisition of Quantitative Concepts in Children. (University of Southern California, 1967.) Dis. Abst. 28A: 3038; Feb. 1968. (b-4)

Significant relationship was found between child's ability to conserve, to seriate and to classify and his level of achievement in mathematics. Deeper exploration on number concept was recommended.

Rollins, James Hendrix. A Comparison of Three Stratagems for Teaching Mathematical Concepts and Generalizations by Guided Discovery. (University of Illinois, 1966.) Dis. Abst. 27A: 711-712; Sept./Oct. 1966. (a-3)

Results of the study provide little support for a position that any one of the stratagems studied is more effective than the others in promoting awareness of mathematical generalizations by high, average, or low ability students.

Roughead, William George, Jr. A Clarification of Part of the Discovery Versus Exposition Discussion in Mathematics. (The Florida State University, 1966.) Dis. Abst. 27A: 2452-2453; Jan./Feb. 1967. (a-3)

In an attempt to ascertain the effects of three strategies (rule and example, guided discovery, and discovery), seventh and eighth graders failed to meet the proficiency criterion. A further study with a college population did produce significant findings.

Rouse, William Morrison, Jr. A Study of the Correlation Between the Academic Preparation of Teachers of Mathematics and the Mathematics Achievement of Their Students in Kindergarten Through Grade Eight. (Michigan State University, 1967.) Dis. Abst. 28A: 4031; Apr. 1968. (f-5)

Low positive correlation between student's achievement and teacher's experience and high school preparation were found. Also a low negative correlation between teacher college mathematics preparation and total mathematics preparation, and student achievement.

Rutherford, John Alby. The Effect of Student Teaching Upon Pupil Achievement in Selected Fourth Grade Classrooms. (University of Virginia, 1967.) Dis. Abst. 28A: 2919; Feb. 1968. (f-5, t-1)

No significant increase or decrease in pupil achievement was found as the result of placing student teachers in classrooms.

Sandefur, Earl Wilton. Experimental Study of Two Methods of Drill for Mastering Addition and Subtraction Facts. (Duke University, 1965.) Dis. Abst. 26: 4401; Feb. 1966. (a-5a, c-3a, c-3b)

Treatment using frames resulted to be more effective in mastering addition and subtraction facts than treatment which did not use frames, when all subjects were considered. No significant differences were found when subjects were grouped according to levels of intelligence. Varying the type of drill work appeared to create more interest on the part of teachers and students.

Scanlon, Robert G. Factors Associated With a Program for Encouraging Self-Initiated Activities by Fifth and Sixth Grade Students in a Selected Elementary School Emphasizing Individualized Instruction. (University of Pittsburgh, 1966.) Dis. Abst. 27A: 3376; Mar./Apr. 1967. (e-4)

Self-initiation can be improved by providing specific techniques and procedures to be used in the classroom.

Schacht, Elmer James. A Study of the Mathematical Errors of Low Achievers in Elementary School Mathematics. (Wayne State University, 1966.) Dis. Abst. 28A: 920-921; Sept. 1967. (e-2)

A consistent pattern of errors in six areas was found among all low achievers studied, with less difficulty occurring with fundamentals than with concepts involving reasoning.

Schlinsog, George William. The Effects of Supplementing Sixth Grade Arithmetic Instruction With a Study of Other Number Bases. (University of Oregon, 1965.) Dis. Abst. 26: 5307; Mar. 1966. (c-15)

No significant differences were found between students studying other number bases and those not engaging in such study. Implications for further study and research in this topic are made.

Schmidt, Mary Merle. Effects of Teaching the Commutative Laws, Associative Laws, and the Distributive Law of Arithmetic on Fundamental Skills of Fourth Grade Pupils. (University of Mississippi, 1965.) Dis. Abst. 26: 4510-4511; Feb. 1966 (c-2)

Change in pupils' ability to apply the fundamental processes of arithmetic to examples and problems was noted.

Schrankler, William Jean. A Study of the Effectiveness of Four Methods for Teaching Multiplication of Whole Numbers in Grade Four. (University of Minnesota, 1966.) Dis. Abst. 27A: 4055; May/June 1967. (c-3c)

Conclusions on the four treatments vary. Methods using general ideas based on the structure of the number system were more successful.

Scrivens, Robert William. A Comparative Study of Different Approaches to Teaching the Hindu-Arabic System to Third-Graders. (University of Michigan, 1968.) Dis. Abst. 29: 839-840; Sept. 1968. (c-14)

Significant differences in place value concepts favored the decimal numeration and Egyptian numeration treatments over the base five numeration. Differences in arithmetic achievement were found in the extremes of socio-economic backgrounds. Attitude toward place value favored Egyptian numeration over decimal numeration system.

Searle, Robert Eli. Mathematical Abilities Possessed by Kindergarten Children From Disadvantaged Communities. (University of California, 1968.) Dis. Abst. 29: 1735-1736; Dec. 1968. (b-1, e-7)

Children from advantaged communities possessed a significantly greater amount of mathematical information than did children from disadvantaged areas. Pre-school training, sex and age influence levels of performance, but especially age in ability to manipulate quantitative relationships.

Sherer, Margaret Turner. An Investigation of Remedial Procedures in Teaching Elementary School Mathematics to Low Achievers. (The University of Tennessee, 1967.) Dis. Abst. 28A: 4031-4032; Apr. 1968. (e-2)

Pupils taught by author-developed material showed significantly greater gain in arithmetic achievement than those taught by traditional procedure. Also tutors manifested a more favorable attitude toward arithmetic by special method.

Sibilia, Sister Anita Marie. An Axiomatic Analysis of the Fundamental Concepts of the Arithmetic of Natural and Rational Numbers as Presented in Textbooks From the Colonial Period to the Present Day. (The Pennsylvania State University, 1967.) Dis. Abst. 28B: 2535; Dec. 1967. (a-1, d-1)

Textbooks have never changed very radically, but presentations have changed according to the thinking of the times. Axiomatic development of numbers was not found to be monotonically increasing.

Simmons, Sadie V. A Study of Two Methods of Teaching Mathematics in Grades Five, Six, and Seven. (University of Georgia, 1965.) Dis. Abst. 26: 6566-6567; May 1966. (a-3)

Students receiving instruction under a program of modern math scored higher than those instructed under a traditional program, when achievement was measured by standardized tests designed to determine traditional achievement.

Skypek, Dora Helen. The Relationship of Socio-Economic Status to the Development of Conservation of Number. (University of Wisconsin, 1966.) Dis. Abst. 28A: 1012-1013; Sept. 1967. (g-6, e-7)

The Relationship of socio-economic status to concept-test scores was highly significant in favor of middle-class children.

Smith, Howard Kenneth. The Effects of Instruction in Set Theory Upon the Logical Reasoning of Seventh-Grade Students and Subsequent Effects Upon Their Learning to Solve Percentage Problems. (Arizona State University, 1968.) Dis. Abst. 28: 4963; June 1968. (c-12, c-6)

Students who received instruction in set theory showed significant superiority in logical reasoning than those who were taught traditional mathematics for the same period. No significant differences in ability to solve percentage problems were observed between groups.

Smith, Lee A. A Comparison of the Contents of State Adopted Arithmetic Textbooks With Contents of the Arithmetic Sections of Selected Standardized Achievement Batteries. (University of Oklahoma, 1965.) Dis. Abst. 26: 3785; Jan. 1966. (d-1, f-1)

Test batteries examined seem to compare favorably in most of the areas covered by textbooks; however, there are certain areas as geometry and numeration which are insufficiently covered by tests as compared to coverage given by textbooks.

Smith, Malcolm Augustus. Development and Preliminary Evaluation of a Unit on Probability and Statistics at the Junior High School Level. (University of Georgia, 1966.) Dis. Abst. 27A: 1723; Nov./Dec. 1966. (c-16)

Some topics in probability and statistics seemed to be appropriate for most seventh-grade students. Also, there were indications that high students could profit from instruction in additional topics, in independent events, sampling and measures of variations.

Smith, Seaton Elliott, Jr. Transfer Effect on Fourth Grade Pupils' Understanding of a Decimal System as a Result of Studying Non-Decimal Systems Using Programed Instruction. (Ohio University, 1968.) Dis. Abst. 29: 422; Aug. 1968. (g-1, c-14, c-15, d-5)

A study of nondecimal numeration produced a greater understanding of nondecimal numeration system immediately and four weeks after completion of instruction than did a comparable study of decimal numeration. A study of decimal numeration resulted in improvement of understanding of the decimal numeration system only immediately after completion of the program.

Snyder, Henry Duane, Jr. A Comparative Study of Two Self-Selection - Pacing Approaches to Individualizing Instruction in Junior High School Mathematics. (University of Michigan, 1966.) Dis. Abst. 28A: 159-160; July 1967. (a-3)

No significant differences were found in achievement or characteristics of pupils who selected either independent work approach, though gains were greater than for control classes.

Spencer, James Edward. Intertask Interference in Primary Arithmetic. (University of California, Berkeley, 1967.) Dis. Abst. 28A: 2570-2571; Jan. 1968. (g-2, c-3a, c-3b)

Reproactive, proactive and associative effects in learning a set of addition and a set of subtraction combinations in sequence were studied, findings support to the occurrence of some intertask interference and some facilitator. Further investigation is needed.

St. Clair, Irene Zercher. A Study of the Development of the Concept of Symmetry by Elementary School Children. (University of Texas, Austin, 1968.) Dis. Abst. 29A: 1329; Dec. 1968. (c-11, g-6)

A description of procedure using an instructional unit to develop the concept of symmetry and its implications is related to general learning behavior.

Steffe, Leslie Philip. The Performance of First Grade Children in Four Levels of Conservation of Numerousness and Three I.Q. Groups When Solving Arithmetic Addition Problems. (University of Wisconsin, 1966.) Dis. Abst. 28A: 885-886; Aug. 1967. (g-6)

Excellent prediction of relative success in solving addition problems and learning addition facts for children entering first grade was found using tests of numerousness.

Stevens, Deon Orlo. Analysis of Change: A Comparative Study of Mathematics Textbooks Published for Elementary School Children for the Eight Year Period 1956 to 1964. (University of Oregon, 1965.) Dis. Abst. 26: 5139-5140; Mar. 1966. (d-1)

It was found that with the exception of grade three, the total vocabulary load for each grade level has been increased by more than forty per cent (in grade three there was found a decrease in total vocabulary load when traditional criterion terminology was compared with contemporary terminology). Up to 63 per cent of the contemporary criterion topics were found to be completely new, also shifts have been found in grade placement of terms and topics. The most obvious shift was the appearance of traditional criterion terms and topics from intermediate grades to contemporary criterion terms and topics in primary grades.

Stevenson, Robert Louis. The Achievement Gains in Mathematics of Seventh Grade Pupils When Achievement Grouping and Flexible Scheduling are Employed in a Team Teaching Program. (New York University, 1966.) Dis. Abst. 27A: 3785-3786; May/June 1967. (a-3, e-4)

Achievement gains were more related to group level than mathematical ability. Little difference was found between changers and nonchangers on computation and appreciation. Changers were significantly better on concepts.

Stommel, Lewis John. The Prediction of First Grade Achievement in Arithmetic by an Instrument Based on Piaget's Theory of the Formation of Number Concept. (University of California, Berkeley, 1966.) Dis. Abst. 27A: 2457; Jan./Feb. 1967. (g-6, b-1)

Results generally agreed with Piaget's developmental stages for number concept. There was great variability from child to child in the consistency of responses made.

Stuart, Alvin James. Effects Upon Pupil Performances in Arithmetic of Instructional Programs Differing in Amounts of Emphasis Upon Computational Structure and Verbal Problem Solving. (Ohio University, 1965.) Dis. Abst. 27A: 4058; May/June 1967. (f-2, c-3, a-5b)

Instruction consisting of equal amounts of content dealing with computational structure and verbal problem-solving may have a more favorable effect upon pupils' immediate problem-solving performances than does computational structure alone, and at least as favorable an effect as emphasis upon problem-solving alone.

Suydam, Marilyn N. An Evaluation of Journal-Published Research Reports on Elementary School Mathematics, 1900-1965. (Volumes I and II). (The Pennsylvania State University, 1967.) Dis. Abst. 28A: 3387-3388; Mar. 1968.

To provide a basic source of information on elementary school mathematics research, a list of 799 reports was compiled, annotated and categorized on eleven aspects. Results of an evaluation of the experimental research with an instrument developed for this purpose are also presented.

Tanner, Glenda Lou. A Comparative Study of the Efficacy of Programed Instruction With Seventh Grade Low Achievers in Arithmetic. (University of Georgia, 1965.) Dis. Abst. 26: 6458-6459; May 1966. (d-5, e-2)

In general no significant difference was found in gains made by control and experimental groups as measured by an arithmetic fundamental test. Control groups, however, made greater gains in arithmetic reasoning and arithmetic problems than students under programed instruction. Analysis of questionnaire indicated that students liked programed instruction better than regular instruction, but liked it better during the first month than during the last month.

Todd, Robert Marion. A Course in Mathematics for In-Service Teachers: Its Effect on Teachers' Understandings and Attitudes. (University of Virginia, 1965.) Dis. Abst. 26: 5898-5899; Apr. 1966. (t-2)

Results indicated significant improvement in understanding of arithmetic and attitudes toward arithmetic for those completing the course. Duration of the course or use of programed text did not significantly affect the gains in understanding or attitudes.

Tom, Alan Roger. Children's Understanding of the Notion of Time in Grades Two, Four, and Six. (University of Wisconsin, 1966.) Dis. Abst. 28A: 886-887; Sept. 1967. (c-8)

Grade level accounted for more differences in children's thinking about calendar time than intellectual ability.

Toney, Jo Anne Staley. The Effectiveness of Individual Manipulation of Instructional Materials as Compared to a Teacher Demonstration in Developing Understanding in Mathematics. (Indiana University, 1968.) Dis. Abst. 29A: 1831-1832; Dec. 1968. (d-3)

Group using individually manipulated materials made greater gains in proficiency than the one seeing only a teacher demonstration. On both measuring instruments girls mean gains were greater than boys in understanding of basic principles.

Trevino, Bertha Alicia Gamez. An Analysis of the Effectiveness of a Bilingual Program in the Teaching of Mathematics in the Primary Grades. (University of Texas, Austin, 1968.) Dis. Abst. 29: 521-522; Aug. 1968. (e-7)

First grade Spanish and English speaking children taught bilingually did significantly better in arithmetic fundamentals than children taught exclusively in English. Third grade children in the bilingual program did significantly better in arithmetic reasoning than those taught exclusively in English.

Trine, Franklin Dawson. A Study to Determine the Differences in the Ability of Candidates for Elementary Teacher Certificates to Recognize Three Key Properties of Simple Mathematical Systems. (University of Wisconsin, 1965.) Dis. Abst. 26: 5275; Mar. 1966. (t-3)

Prospective primary grade teachers were found less able to recognize the presence or absence of identity elements, commutative and closure properties, than were other elementary school prospective teachers. More difficulty in recognizing the identity element was found than in recognizing the commutative or closure properties.

Trueblood, Cecil Ross. A Comparison of Two Techniques for Using Visual-Tactual Devices to Teach Exponents and Non-Decimal Bases in Elementary School Mathematics. (The Pennsylvania State University, 1967.) Dis. Abst. 29A: 190-191; July 1968. (d-3)

Pupils taught by inductive questions and teacher manipulation scored higher than pupils who manipulated materials themselves, though both groups learned. Retention was high for both, with no significant differences between groups.

Tryon, Louis A. A Comparison of a Modern Mathematics Program and Traditional Arithmetic in the Intermediate Grades. (University of Arizona, 1967.) Dis. Abst. 28B: 3792-3793; Mar. 1968. (a-3)

Students enrolled in modern program responded equally as well as those in traditional program; however, fourth grade females and fifth grade average and fast learners have more favorable attitude toward modern program.

Unkel, Esther Ruth. A Study of the Interaction of Socioeconomic Groups and Sex Factors With the Discrepancy Between Anticipated Achievement and Actual Achievement in Elementary School Mathematics. (Syracuse University, 1965.) Dis. Abst. 27A: 59; July/Aug. 1966. (e-7, f-3b)

Study revealed significant differences in discrepancy for children in each of the three socio-economic groups in arithmetic reasoning, arithmetic fundamentals and arithmetic totals. Significant differences between boys' scores and girls' scores occurred only in arithmetic fundamentals with girls' scores surpassing boys' scores from grade 6 through grade 8. An overall difference was found in the interaction of sex by grade level in arithmetic totals, although no significant difference was found at any given grade level.

Vanaman, Sherman Benton. Toward a Theory of Teaching With Special Reference to the Acquisition of Behaviors of a Mathematical Nature. (University of Maryland, 1967.) Dis. Abst. 28A: 3577; Mar. 1968. (a-3)

A teaching model and a collection of axioms, from which were deduced a set of theorems and collorarles, resulted from a review of literature and other investigations. Suggestion for testing the theory and examples of experimental designs to test specific parts of the theory are presented.

Walbesser, Henry Herman, Jr. A Programmed Investigation of Fixed-Ratio Schedules of Reinforcement Using the System of Integers Under Addition. (University of Maryland, 1965.) Dis. Abst. 27A: 4177; May/June 1967. (t-3)

The author concludes that if an individual has a high probability of constructing the correct response, the verification of the correctness of his responses need not always be present.

Wang, Margaret Li-Ching Chang. An Investigation of Selected Procedures for Measuring and Predicting Rate of Learning in Classrooms Operating Under a Program of Individualized Instruction. (University of Pittsburgh, 1968.) Dis. Abst. 29A: 1177; Oct. 1968.

No clear results concerning relationship between rate of learning and student achievement were found. Furthermore results indicate that the rate of learning is specific to a given task performance.

Westbrook, Helen Rose. Intellectual Processes Related to Mathematics Achievement at Grade Levels Four, Five, and Six. (University of Georgia, 1965.) Dis. Abst. 26: 6520; May 1966. (g-4)

Perceptual discrimination, memory span, and associative memory were found to be frequently related to achievement in the mathematics subtopics at grade four and, with the exception of memory span, at grade six; these processes were found to be less frequently related to achievement in the fifth grade.

Wheatley, Grayson H., Jr. Conservation, Counting and Cardination as Factors in Mathematics Achievement Among First-Grade Students. (University of Delaware, 1967.) Dis. Abst. 29A: 1481-1482; Nov. 1968. (g-6, c-1)

Conservation of number seems to be more highly related to achievement than counting or cardination. Suggestions for teachers to be aware of concept of conservation and its role in developing concepts as addition of whole numbers are made.

Whelan, Joseph Arthur. An Analysis of the Effect of Systematic Homework in Two Fourth Grade Subjects [English and Arithmetic]. (University of Connecticut, 1965.) Dis. Abst. 26: 5143; Mar. 1966. (a-5e)

Completions of systematic homework assignment in English and arithmetic by the experimental pupils did not result in significantly higher scores on scholastic achievement than control pupils as measured by the Iowa Test of Basic Skills, Form 1.

Wickes, Harry Edgar. Pre-Service Mathematics Preparation of Elementary Teachers: The Relative Effectiveness of Two Programs in Determining Attitudes Toward, and Achievement in, Mathematics. (Colorado State College, 1967.) Dis. Abst. 28A: 2591; Jan. 1968. (t-1)

A separate course work in content and method resulted in more effectiveness for achievement than a unified course. Gains in attitudes were not significant.

Willcutt, Robert Ernest. Ability Grouping by Content Subject Areas in Junior High School Mathematics. (Indiana University, 1967.) Dis. Abst. 28A: 2152; Dec. 1967. (e-4)

No significant differences were found in achievement between self-contained heterogeneous classes and homogeneous classes taught by a team, though changes in attitude resulted.

Williams, Ralph Curtis. Teacher Preparation in Mathematical Arithmetic. (University of Southern California, 1966.) Dis. Abst. 27A: 133-134; July/Aug. 1966. (t-1, t-2)

Teachers and principals were found to have insufficient preparation in mathematics as determined by a criterion based on results of pupils' tests. Groups having positive or indifferent attitudes toward the new emphasis upon math had higher scores than the group with negative attitudes. The most effective means for raising levels of math comprehension among the members of the instructional staff appeared to involve the use of experimental mathematical materials in classrooms.

Wilson, Jean Alice. The Effect of Teaching the Rationale of the Reciprocal Principle in the Division of Fractions Through Programmed Instruction. (University of Pittsburgh, 1967.) Dis. Abst. 28A: 2926; Feb. 1968. (c-4d, d-5)

Results indicate that programmed instruction in understanding the rationale of reciprocal principle have better effect in operational proficiency over a period of time.

Withnell, Melvin Cleo. A Comparison of the Mathematical Understandings of Prospective Elementary Teachers in Colleges Having Different Mathematics Requirements. (University of Michigan, 1967.) Dis. Abst. 28: 4941; June 1968. (t-1)

High ability student teachers completing their third required mathematics course attained the highest tested mean. Students completing a second required course attained the highest algebra mean while students completing a third required course attained the higher geometry mean. The best predictors of achievement were found to be ability, attitude and high school and college mathematics background.

Wood, Lavinia Roughton. A Study of the Relationship of Performance in Written Composition to Performance in Mathematical Reasoning in Elementary School Children. (University of Georgia, 1967.) Dis. Abst. 28A: 3913; Apr. 1968. (d-7)

Performance in written composition and in mathematical reasoning appeared to be related both to intelligence and socio-economic status.

Woodward, Jean W. Identification of Mathematical Concepts Causing Learning Difficulties to Fifth-Grade Students. (University of Houston, 1967.) Dis. Abst. 28A: 2467-2468; Jan. 1968. (e-1)

Children's level of achievement in mathematics was found to be a significant factor in understanding mathematical concepts; cultural background was not significant.

Wynn, Robert Sawtelle, Jr. A Study of the Relative Efficiency of Three Methods of Teaching Percentage in Grade Seven. (Research Study No. 1, Volumes I and II). (Colorado State College, 1965.) Dis. Abst. 26: 5313; Mar. 1966. (c-6)

No significant differences in achievement or retention were found between the three methods: Unitary Analysis Method, Formula Method, or Decimal Method.

Yeager, John Leroy. Measures of Learning Rates for Elementary School Students in Mathematics and Reading Under a Program of Individually Prescribed Instruction. (University of Pittsburgh, 1966.) Dis. Abst. 27A: 2081; Jan./Feb. 1967. (e-4, f-2)

Results seem to indicate that rate of learning is specific to a given task and not a general factor characterizing student performance in all learning situations.

Zahn, Karl George. The Optimum Ratio of Class Time to be Allotted to Developmental Activities and to Individual Practice in Teaching Arithmetic. (University of Colorado, 1965.) Dis. Abst. 26: 6459; May 1966. (b-6, a-5a)

Students in groups that spent the greatest portion of their class time on developmental activities did better in arithmetic achievement than those in sections which spent more time in practice work.

Zur, Mordehai. Implications of the Recent Mathematics Reform for Grades 7-9 in the United States for the Israeli Elementary and Secondary Schools. (Columbia University, 1966.) Dis. Abst. 28A: 4436; May 1968. (a-6)

Some principles of selection of content, organization and method of presentation in the United States mathematics reform are of value to mathematics education in Israel.

APPENDIX A

BIBLIOGRAPHY OF RESEARCH REPORTS ON ELEMENTARY SCHOOL MATHEMATICS, 1900-1968

Abrego, Mildred Brown. Children's Attitudes Toward Arithmetic. Arith. Teach. 13: 206-208; Mar. 1966.

Aftreth, Orville B. A Brief Discussion of One of the Analyses in the Experiment: The Effect of the Systematic Analysis of Errors on Achievement in the Study of Fractions. J. Exp. Ed. 24: 273-281; June 1956.

Aftreth, Orville B. Shall We Expose Our Pupils to Errors? Arith. Teach. 4: 129-131; Apr. 1957.

Aftreth, Orville B. The Effect of the Systematic Analysis of Errors in the Study of Fractions at the Sixth Grade Level. J. Ed. Res. 52: 31-34; Sept. 1958.

Aftreth, Orville B. and MacEachern, Donald G. An Action Research Study in Arithmetic. Arith. Teach. 11: 30-32; Jan. 1964.

Alexander, A. M. Teacher Judgment of Pupil Intelligence and Achievement Is Not Enough. El. Sch. J. 53: 396-401; Mar. 1953.

Alexander, Vincent E. Seventh Graders' Ability to Solve Problems. Sch. Sci. Math. 60: 603-606; Nov. 1960.

Alexander, Vincent E. Sex Differences in Seventh Grade Problem Solving. Sch. Sci. Math. 62: 47-50; Jan. 1962.

Allen, Mildred M. Relationship Between Kuhlmann-Anderson Intelligence Tests and Academic Achievement in Grade IV. J. Ed. Psychol. 35: 229-239; Apr. 1944.

Allen, Robert W. The Fourth "R." Calif. J. Ed. Res. 16: 75-79; Mar. 1965.

Ames, Louise Bates. The Development of the Sense of Time in the Young Child. J. Genet. Psychol. 68: 97-125; 1946.

Anderson, George R. Visual-Tactual Devices and Their Efficacy. Arith. Teach. 4: 196-201; Nov. 1957.

Anderson, George R. These Eighth Graders Don't Hate Arithmetic. Math. Teach. 51: 267-269; Apr. 1958.

Andreen, Earl W. A Study of Workbooks in Arithmetic. J. Ed. Res. 32: 108-122; Oct. 1938.

Anthony, Kate, et al. The Development of Proper Attitudes Towards School Work. Sch. and Soc. 2: 926-934; Dec. 25, 1915.

Ashlock, Robert B. A Test of Understanding for the Primary Grades. Arith. Teach. 15: 438-441; May 1968.

Ashlock, Robert B. and Welch, Ronald C. A Test of Understandings of Selected Properties of a Number System. Ind. U. Sch. Ed. Bull. 42: 1-74; Mar. 1966.

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Baldauf, Robert J. A Comparison of the Extent of Educational Growth of Mentally Advanced Pupils in the Cedar Rapids Experiment. J. Ed. Res. 52: 181-183; Jan. 1959.

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Ballou, F. W. Improving Instruction Through Educational Measurement. Ed. Adm. and Sup. 2: 354-367; June 1916.

Balow, Bruce and Curtin, James. Ability Grouping of Bright Pupils. El. Sch. J. 66: 321-326; Mar. 1966.

Balow, Irving H. Reading and Computation Ability as Determinants of Problem Solving. Arith. Teach. 11: 18-22; Jan. 1964.

Balow, Irving. The Effects of "Homogeneous" Grouping in Seventh-Grade Arithmetic. Arith. Teach. 11: 186-191; Mar. 1964.

Balow, Irving H. and Ruddell, Arden K. The Effects of Three Types of Grouping on Achievement. Calif. J. Ed. Res. 14: 108-117; May 1963.

Banghart, Frank W.; McLaulin, John C.; Wesson, James B.; and Pikaart, Leonard. An Experimental Study of Programmed Versus Traditional Elementary School Mathematics. Arith. Teach. 10: 199-204; Apr. 1963.

Barnes, Kenneth; Cruickshank, Raymond; and Foster, James. Selected Educational and Experience Factors and Arithmetic Teaching. Arith. Teach. 7: 418-420, 430; Dec. 1960.

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Bassham, Harrell; Murphy, Michael; and Murphy, Katherine. Attitude and Achievement in Arithmetic. Arith. Teach. 11: 66-72; Feb. 1964.

Bassler, Otto C. Intermediate Versus Maximal Guidance - A Pilot Study. Arith. Teach. 15: 357-362; Apr. 1968.

Beall, Ross H. What Is Good Fraction Drill? El. Eng. R. 6: 49-52; Feb. 1929.

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Beatty, Willard W. The Additive Versus the Borrowing Method of Subtraction. El. Sch. J. 21: 198-200; Nov. 1920.

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Bigelow, Elizabeth B. A Study Made From the Results of the Stanford Achievement Test in Grade Two. Ed. Meth. 12: 232-235; Jan. 1933.

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Blackwell, A. M. A Comparative Investigation Into the Factors Involved in Mathematical Ability of Boys and Girls. Br. J. Ed. Psychol. 10: 143-153; June 1940 (Part I); 10: 212-222; Nov. 1940 (Part II).

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APPENDIX B

Instrument for Evaluating
Experimental Research Reports

Marilyn N. Suydam
The Pennsylvania State University

Directions:

Evaluate with the nine underlined questions which follow. The quality of the article in terms of each question should be rated on a five-point scale. The specifications for these five points are:

1) Excellent: all requirements for the question are met; nothing essential could be added

2) Very good: most requirements are met

3) Good: some requirements are met

4) Fair: a few requirements are met

5) Poor: none or too few of the requirements are met

Certain "Key points" should be considered in ascertaining a rating for each question. These are listed below the question, followed by adjectives which indicate the continuum on which the "key point" should be assessed. Do NOT make a response to these "key points." They are intended to focus the attention of all raters on the same pertinent aspects of each question.

Please make only nine responses for each article, one for each question.

Instrument for Evaluating Experimental Research Reports

Marilyn N. Suydam
The Pennsylvania State University

1. How practically or theoretically significant is the problem? (1-2-3-4-5)

   a. Purpose (important---non-important)
   b. Problem origin
      1) Rationale (logical---illogical)
      2) Previous research (appropriate---inappropriate)

2. How clearly defined is the problem? (1-2-3-4-5)

   a. Question (operational---vague)
   b. Hypothesis(es) (relevant---irrelevant) (logical---illogical)
   c. Independent variable(s) (operational---vague) (relevant---irrelevant)
   d. Dependent variable(s) (operational---vague) (relevant---irrelevant)

3. How well does the design answer the research questions? (1-2-3-4-5)

   a. Paradigm (appropriate---inappropriate)
   b. Hypothesis(es) (testable---untestable)
   c. Procedures (clear---unclear)
   d. Treatments (replicable---unreplicable) (appropriate---inappropriate)
   e. Duration (appropriate---inappropriate)

4. How adequately does the design control variables? (1-2-3-4-5)

   a. Independent variable(s) (uncontaminated---contaminated)
   b. Administration of treatment (rigorous---unrigorous)
   c. Teacher or group factors (controlled---uncontrolled)
   d. Subject or experimenter bias (controlled---uncontrolled)
   e. Halo effect (controlled---uncontrolled)
   f. Extraneous factors (controlled---uncontrolled)
   g. Individual factors (controlled---uncontrolled)

Instrument for Evaluating Experimental Research Reports (continued)

Marilyn N. Suydam
The Pennsylvania State University

5. How properly is the sample selected for the design and purpose of the research? (1-2-3-4-5)

   a. Population (appropriate---inappropriate)
   b. Drawing of sample (random---unspecified)
   c. Assignment of treatment (random---unspecified)
   d. Size (appropriate---inappropriate)
   e. Characteristics (appropriate---inappropriate)

6. How valid and reliable are the measuring instruments or observational techniques? (1-2-3-4-5)

   a. Instrument or technique
      1) Description (excellent---poor)
      2) Validity (appropriate---inappropriate)
      3) Reliability for population (excellent---poor)
   b. Procedures of data collection (careful---careless)

7. How valid are the techniques of analysis of data? (1-2-3-4-5)

   a. Statistical tests
      1) Basic assumptions (satisfied---unclear)
      2) Relation to design (appropriate---inappropriate)
   b. Data
      1) Treatment (appropriate---inappropriate)
      2) Presentation (clear---unclear)
      3) Level of significance (specified---unspecified) (appropriate---inappropriate)
      4) Discussion (accurate---inaccurate)

8. How appropriate are the interpretations and generalizations from the data? (1-2-3-4-5)

   a. Consistency with results (excellent---poor)
   b. Generalizations (reasonable---exaggerated)
   c. Implications (reasonable---exaggerated)
   d. Limitations (noted---not noted)

Instrument for Evaluating Experimental Research Reports (continued)

Marilyn N. Suydam
The Pennsylvania State University

9. How adequately is the research reported? (1-2-3-4-5)

a. Organization	(excellent---poor)
b. Style	(clear---vague)
c. Grammar	(good---poor)
d. Completeness	(excellent---poor)
	(replicable---unreplicable)

APPENDIX C

Instrument for Evaluating
Survey Research Reports

Richard L. Kohr
The Pennsylvania State University

Directions:

The following instrument is to be used for evaluating survey research reports within the framework of curriculum research. It is composed of nine major questions which are underlined. You are to rate the quality of the report in terms of <u>each</u> of these nine questions using the following five-point scale:

1) Excellent: all requirements for the question are met; nothing essential could be added

2) Very good: most requirements are met

3) Good: some requirements are met

4) Fair: a few requirements are met

5) Poor: none or too few of the requirements are met

In determining a rating for each question certain "key points" should be considered. These are listed below the question, followed by adjectives which indicate the continuum on which the key point should be assessed. Do NOT make a response to these "key points." They are intended to focus the attention of all raters on the same pertinent aspects of each question. In some studies certain "key points" may be irrelevant. In such cases base your judgment on those "key points" which are relevant. It is also possible that you may think of "key points" not included among those listed under a major question. Where relevant such additional "key points" may be used in assessing that question. There may be some instances in which none of the "key points" seem relevant or where the report fails to supply sufficient information. If this occurs, evaluate the question in terms of what you think should have been done and/or what information should have been included.

Please make only nine responses for each article, one for each question.

Instrument for Evaluating Survey Research Reports

Richard L. Kohr
The Pennsylvania State University

1. How practically or theoretically significant is the problem? (1-2-3-4-5)

   a. Purpose (important---non-important)
   b. Problem origin
      1) Rationale (logical---illogical)
      2) Previous research (related---unrelated)
   c. Generalizability (extensive---limited)

2. How clearly defined is the survey problem? (1-2-3-4-5)

   a. Objectives and procedures (specified---unspecified) (operational---vague)
   b. Delimitations (noted---not noted)
   c. Variables
      1) Control (relevant---irrelevant) (operational---vague)
      2) Dependent (relevant---irrelevant) (operational---vague)

3. How relevant and how well defined is the population? (1-2-3-4-5)

   a. Precise definition of population
      1) Geographical limits (specified---unspecified)
      2) Time period covered (specified---unspecified)
      3) Sociological description (specified---unspecified)
      4) Sampling units (specified---unspecified)
   b. Relevance of defined population to problem (relevant---irrelevant)

4. How adequate are the sampling procedures? (1-2-3-4-5)

   a. Adequacy of sampling frame
      1) Time period covered (current---outdated)
      2) Inclusiveness of defined population (complete---incomplete)
   b. Method of sampling (specified---unspecified) (appropriate---inappropriate)
   c. Obtained sample
      1) Size (sufficient---insufficient)
      2) Representativeness (adequate---inadequate)

Instrument for Evaluating Survey Research Reports (continued)

Richard L. Kohr
The Pennsylvania State University

5. How adequately are sources of error controlled? (1-2-3-4-5)

a. Sampling error	(controlled---uncontrolled)
b. Non-response	(controlled---uncontrolled)
c. Interviewer bias	(controlled---uncontrolled)
d. Response error	(controlled---uncontrolled)
e. Response set	(controlled---uncontrolled)
f. Experimenter bias	(controlled---uncontrolled)
g. Teacher effect	(controlled---uncontrolled)
h. Control variables	(controlled---uncontrolled)
i. Extraneous factors	(controlled---uncontrolled)
j. Qualifications of research personnel (interviewers, coders, observers)	(experienced---inexperienced) (trained---untrained)

6. How adequate are the measuring instruments? (1-2-3-4-5)

a. Choice of measurement technique(s)	(appropriate---inappropriate)
b. Instrument(s)	
1) Development of instrument	(pretested---not pretested) (satisfactory---unsatisfactory)
2) Description of administration and scoring procedures	(clear---unclear) (complete---incomplete)
3) Wording of statements or questions	(clear---ambiguous
4) Sequence of statements or questions	(logical---illogical) (random---fixed)
5) Evidence of reliability	(appropriate---inappropriate) (satisfactory---unsatisfactory)
6) Evidence of validity	(appropriate---inappropriate) (satisfactory---unsatisfactory)
c. Rules for categorizing	(specified---unspecified)

Instrument for Evaluating Survey Research Reports (continued)

Richard L. Kohr
The Pennsylvania State University

7. How appropriate is the statistical analysis of the data? (1-2-3-4-5)

   a. Procedures of data collection (specified---unspecified) (careful---careless)
   b. Relation of obtained data to objectives (essential---unessential) (sufficient---unsufficient)
   c. Descriptive measures
      1) Statistic(s) (appropriate---inappropriate)
      2) Evaluation of descriptive (appropriate---inappropriate)
      3) Establishment of relationships (appropriate---inappropriate)
   d. Statistical tests
      1) Basic assumptions (satisfied---unsatisfied)
      2) Relation to procedures (appropriate---inappropriate)
      3) Significance levels (specified---unspecified)
   e. Description of results (accurate---inaccurate)

8. How reasonable are the conclusions drawn from the data? (1-2-3-4-5)

   a. Interpretations (consistent---inconsistent) (reasonable---exaggerated)
   b. Generalizations (reasonable---exaggerated)
   c. Implications (reasonable---exaggerated)
   d. Qualifications
      1) Discussion of methodological problems and errors (comprehensive---limited)
      2) Alternative explanations (noted---not noted)
      3) Other limitations (noted---not noted)

9. How adequately is the research reported? (1-2-3-4-5)

   a. Organization (excellent---poor)
   b. Style (clear---vague)
   c. Grammar and mechanics (excellent---poor)
   d. Completeness (excellent---poor) (replicable---unreplicable)
   e. Presentation of statistics (complete---incomplete) (clear---unclear)

INSTRUMENT FOR EVALUATING
SURVEY RESEARCH REPORTS
ADDENDA
EXPLANATION OF QUESTIONS AND KEY POINTS

Richard L. Kohr
The Pennsylvania State University

1. How practically or theoretically significant is the problem?
   a. Purpose: this key point involves a judgment as to the importance of the stated purpose of the study. Consideration may be with practical importance (to obtain information contributing to the solution of some practical problem) or with theoretical significance (to obtain information having a bearing on theory development or in explaining certain phenomena).

   b. Problem Origin
      1) Rationale: assessed here is the logic of the rationale describing the origin of the problem being investigated. The source of the problem might originate from a practical situation in which little or no related research could be cited. On the other hand, the problem could arise from previous research in which case the rationale should describe' how the present problem logically follows from the cited research.

      2) Previous Research: refers to previous research on the problem being investigated. If prior research is cited it should contribute to the development of the problem.

   c. Generalizability: pertains to how widely applicable or generalizable the problem is with regard to time period and situation. For example, some surveys apply only to some local problem and, therefore, have little applicability beyond that problem. Other surveys investigate problems which are more common to the field of education in general and, consequently, are more generalizable.

2. How clearly defined is the survey problem?

   a. Objectives and Procedures: refers to the specific information being sought or questions to be answered. The objectives should be clearly stated in order to be readily understood. In addition, objectives should be stated such that they may be easily translated into procedures for their assessment (operationally defined).

   b. Delimitations: a description of the limits or boundaries of the study.

c. Variables
   1) Control: has reference to variables included in the study for purposes of control or explanation. Where control variables are included they need to be both relevant to the survey objectives and operationally defined. Also entering into the judgment of this category is the consideration of whether certain variables should have been included where they were not.

   2) Dependent: refers to the variable(s) under study. Of concern here is the relevance of such variables in answering the survey objectives and whether they are operationally defined.

3. <u>How relevant and how well defined is the population</u>?

   a. Precise Definition of Population
      1) Geographical Limits: pertain to the geographical boundaries which are placed on the locality from which the sampling units are drawn and to which generalizations will be extended.

      2) Time Period Covered: it is necessary to make explicit the time period covered by the survey and, therefore, the period to which the survey most directly applies.

      3) Sociological Description: refers to an adequate description of the population in terms of sociological and demographic variables. Examples are sex, age, grade level, pupil grouping pattern, socio-economic status, etc.

      4) Sampling Units: refers to what is being sampled. Sampling units could be pupils, classrooms, schools, school districts, countries, states, etc.

   b. Relevance of Defined Population to the Problem: pertains to the extent to which the defined population is related to the survey objectives, i.e., is the defined population relevant to the population to which the problem logically applies.

4. <u>How adequate are the sampling procedures</u>?

   a. Adequacy of Sampling Frame: the sampling frame is a file of all the units in the defined population. The frame may be composed of lists from various sources, e.g., if pupils are the sampling units, source lists may be obtained from school records, current enrollment records, state directories of school districts, etc.

1) Time Period Covered: refers to how current the lists are. Outdated lists may render the obtained sample unrepresentative of the defined population.
2) Inclusiveness of Defined Population: has reference to the extent to which the units contained in the frame are inclusive of the defined population. That is, are there units of the population that are not included in the frame which could result in a lack of representativeness of the obtained sample.

b. Method of Sampling: this requires a judgment as to whether the appropriate sampling technique was used. Sampling methods include simple random sampling, stratified random sampling, cluster sampling, multistage sampling, etc.

c. Obtained Sample: attention here is focused on the actual or obtained sample upon which the study is conducted.
   1) Size: refers to whether the size of the sample was sufficient for providing stable estimates of the population parameters.

   2) Representativeness: pertains to how representative of the defined population the obtained sample is.

5. <u>How adequately are sources of error controlled</u>?

The sources of error (key points) listed below may not all be relevant to the particular study being evaluated. Of importance to this question is whether or not the investigator <u>considered</u> the relevant sources of error and what steps he may have taken to compensate for or exert some control over them.

a. Sampling Bias: refers to errors in the sampling process which lead to a definite lack of representativeness of the obtained sample which in turn introduces a systematic error into the results.

b. Non-response: has reference to refusals, non-return of questionnaires, absences from school, and instances in which subjects are no longer available (e.g. moved, death).

c. Interviewer Bias: an effect the interviewer may have on the respondent's replies which tends to yield distorted information.

d. Response Error: refers to errors in responses given by respondents. It sometimes happens that the data elicited does not represent the phenomena that the investigator intended because the respondent: (1) failed to understand or misinterpreted the questions, (2) did not give a serious reply, (3) does not have or cannot recall pertinent information, or (4) gave an evasive or dishonest reply.

e. Response Set: defined as the tendency on the part of the respondent to answer statements or questions in a manner independent of their content. For example, a tendency to use extreme categories such as strongly agree and strongly disagree when responding to a questionnaire.

f. Investigator Bias: the effect attributed to the investigator which influences the findings obtained in the study.

g. Teacher Effect: an effect which may be attributed to the teacher(s) involved in a study.

h. Control Variables: refers to any kind of confounding that might result from procedure of classifying <u>S</u>s to various dimensions of a control (independent) variable.

i. Extraneous Factors: miscellaneous sources of error.

j. Qualifications of Research Personnel: refers to interviewers, coders, observers, and raters. Of importance here is the amount of relevant prior experience possessed and the extent to which such personnel have been trained for their job.

6. <u>How adequate are the measuring instruments</u>?

Measuring instruments includes a variety of measuring techniques, e.g. questionnaires, observations, interview, judgment scales, semantic differential, achievement, procedures for categorizing, etc. These techniques may be either standardized or developed by the researcher.

a. Choice of Measurement Technique(s): of concern here are various alternative methods such as questionnaires, interview, etc. The judgment here refers to whether a technique or instrument other than the one(s) selected by the investigator might have been more appropriate. Considerations involve the relative merits and weaknesses of the technique(s) in question as well as time and cost factors.

b. Instrument(s)
   1) Development of Instrument: in general an instrument should be pretested in order to select and revise items, improve weak points such as wording and sequencing of

items. The judgment to be made here, in addition to noting whether or not the instrument was pretested, is with the relative adequacy of the pretesting.

2) Description of Administration and Scoring Procedures: refers to whether such description is presented clearly and in sufficient detail for purposes of replication.

3) Wording of Statements or Questions: when presented, the wording may be analyzed according to various characteristics including clarity, conciseness, use of simple words, ambiguity, multiple meaning questions, catchwords, and stereotypes, etc.

4) Sequence of Statements or Questions: in some instances it may be desirable to have items arranged in a logical order as in some questionnaires. In other cases the items should be randomly sequenced. Other situations may require a semi-random arrangement of items.

5) Evidence of Reliability: evidence should be presented with regard to appropriate forms of reliability such as internal consistency and stability. Judgments may be made as to the appropriateness of (a) the form of reliability reported, (b) the procedures used in obtaining the reliability estimate, and (c) how satisfactory the obtained estimate is. Also included under reliability are indices of agreement such as inter-rater agreement and the extent to which some desired standard of performance is reached by a rater.

6) Evidence of Validity: a judgment needs to be made as to whether or not such evidence is presented, whether the type or types of validity (e.g. predictive, concurrent, construct, content) reported is appropriate in the case at hand. In addition some consideration should be given to whether validity data reaches an acceptable level.

7) Rules for Categorizing: sometimes variables are measured by assignment to several categories. For example, socio-economic status might be stratified according to five levels or categories. The rules for the assignment of individuals to a level must be specified.

7. <u>How appropriate is the statistical analysis of the data?</u>

a. Procedures of Data Collection: a description of the data collection procedures should be given. A judgment may be made with respect to the degree of care taken during the collection process.

b. Relation of Obtained Data to Objectives: refers to how essential and sufficient the obtained data is for fulfilling the objective. It sometimes happens that irrelevant or non-essential data is collected which contributes nothing to the study and may even serve to confuse the issue. Sometimes there is a failure to collect sufficient information and it is, therefore, impossible to evaluate some descriptive finding.

c. Descriptive Measures
   1) Statistic(s): refers to the appropriateness of the statistic(s) used for descriptive purposes, e.g., frequencies, percentages, median, mean, etc.

   2) Evaluation of Descriptive Data: has reference to the appropriateness of the statistical procedures for evaluating a descriptive finding. Included here is a judgment as to whether important descriptive findings should have been evaluated, given that sufficient data was collected in the first place.

   3) Establishment of Relationships: pertains to the appropriateness of the statistical techniques in establishing a relationship. Included here is a judgment as to whether important relationships should have been established, assuming that sufficient data was collected.

d. Statistical Tests
   1) Basic Assumptions: refers to whether or not the basic assumptions have been satisfied for the legitimate use of the statistical tests performed.

   2) Relation to Procedures: has reference to the appropriateness of the statistical tests performed relative to the procedures used in the study.

   3) Significance Levels: if statistical tests were performed, the levels of significance should be reported. Also of concern here is whether certain tests could have been performed but were not.

e. Description of Results: pertains to the author's description of the statistical findings. In the written report this is generally found in statements pointing out to the reader the statistical findings which are deemed important by the researcher. Of primary concern is the accuracy of this description with respect to the statistical analysis.

8. <u>How reasonable are the conclusions drawn from the data?</u>

a. Interpretations: refers to the meaning attributed to the results of data analysis. The interpretations should be consistent with the data, i.e. logically follow from the results. In addition, the interpretations need to be reasonable.

b. Generalizations: has reference to applying what has been interpreted (inferred from the data) to conditions or situations which may be different in one or more respects from those of the study. The generalizations may be judged according to how reasonable they are.

c. Implications: pertains to the drawing of inferences which goes beyond the realm of interpretation and perhaps approaches the area of speculation. These inferences may be judged in terms of reasonableness.

d. Qualifications

1) Discussion of Methodological Problems and Errors: survey research does not embody the degree of control that experimental research achieves. Furthermore, the existence of extensive methodological problems and the presence of error are readily acknowledged. It is necessary then, for the researcher to give some consideration of these topics in his report.

2) Alternative Explanations: where an explanation of some finding is being offered it may be important to consider various alternative explanations.

3) Other Limitations: a miscellaneous category for the noting of limitations other than those covered above.

9. <u>How adequately is the research reported?</u>

a. Organization: refers to the degree to which the report is systematically arranged. In a well organized report main thoughts should flow logically and smoothly.

b. Style: refers to the manner of expression or the way in which thoughts are put into words. Important here is clarity of expression.

c. Grammar and Mechanics: refers to correct English usage in general.

d. Completeness: pertains to how complete the report is; it should include the important aspects of the study. This includes a consideration of whether necessary topics have been omitted from the report as well as whether the information presented is in sufficient detail for purposes of replication.

e. Presentation of Statistics: has reference to the presentation of statistical findings. Generally, statistical information is summarized and presented in table form. Of concern here is the extent to which the presentation includes all the important statistical information. In addition, clarity of presentation is important.

REPORT OF TEST OF RELIABILITY:
INSTRUMENT FOR EVALUATING SURVEY RESEARCH REPORTS

Procedures. The population of survey research articles used in the study of the reliability for the instrument were those in the field of elementary school mathematics originally collected and reported by Suydam (1967). The 230 articles were stratified according to year and journal. A stratified random sample of ten survey research reports were drawn. Xeroxed copies of these ten articles along with the survey evaluation instrument and notes to aid in its interpretation were given to nine judges who independently read and rated each report. Serving as judges were the following:

1. Three staff members of the Center for Cooperative Research with Schools (CReWS) who were experienced in the application of instruments in evaluating research reports and who were familiar with the content area of elementary school mathematics.
2. Three faculty members of the Educational Psychology department. None of these judges were familiar with the content area nor did they have prior experience with instruments for evaluating research.
3. Three faculty members of the Elementary Education department whose specialty area was elementary school mathematics. Each had prior experience in using instruments for the evaluation of research, although not with the present instrument.

These nine judges may be regarded as fairly representative of staff members of a research organization who are experienced in research activities, and of research-oriented faculty members in departments of educational psychology and elementary school mathematics.

Results. An internal consistency measure of reliability (inter-rater agreement) was determined by analysis of variance (ANOVA) procedures as outlined by Rabinowitz and Eikland (1964) and Medley and Mitzel (1963). The ANOVA model used for determining reliability for each group of judges separately and for all judges combined is that of a randomized block design in which Articles is the block effect, Judges is the repeated measure, and the Articles X Judges interaction is the error term. Articles and Judges are both regarded as random effects in the present context. The dependent variable is the total score for an article derived by summing the score for the nine questions or items comprising the survey instrument. Reliability or inter-rater agreement is found by:

$$r_{tt} = \frac{MS_{\text{Articles}} - MS_{\text{Articles X Judges}}}{MS_{\text{Articles}}}$$

Since the intent is to discriminate among articles, the total variance of concern is that due to the Articles effect as shown in the above formula. True score variance is estimated by subtracting the error variance from this total variance. The resulting ratio of true score variance to total variance estimates the reliability for the situation in which all judges rate the articles. It is, of course, important to obtain a reliability estimate for a single judge or rater which reflects the common situation in which only one judge rates a study. This estimate of reliability for a single rater may be found by:

$$MS_{\text{True score}} = \underline{MS_{\text{Articles}} - MS_{\text{AJ}}}$$

$$r_{tt} = \frac{MS_{\text{True scores}}}{MS_{\text{True scores}} + MS_{\text{AJ}}}$$

The value obtained by the above formula is the same as that obtained by Snedecor's formula described by Ebel (1951).

Table 1 summarizes the reliability estimates obtained by separate analyses of variance (see Tables 2 through 6) for each of the three groups of judges and for all nine judges combined. A final reliability estimate is reported in which the effect of judges is separated into two effects, one due to groups of judges and the other as judges within groups. Thus Articles X Judges interaction is partitioned into Articles X Groups and a residual (Articles X Judges within groups). This particular analysis is used for an additional prupose later in this investigation. In this design judges are nested within groups. This clustering of judges is termed strata by Rabinowitz and Elkland (1964), who indicate that when strata effects are present appropriate estimates of reliability may be obtained for both strata random and strata fixed assumptions. In the present context strata (groups of judges) is regarded as a fixed effect.

As may be noted, the CReWS group had the highest inter-rater agreement, followed by the elementary education and educational psychology faculty members. Of interest is the lower obtained reliability when all nine judges are pooled. Since the spearate reliabilities are equal to or higher than that obtained for all nine judges combined, a strata effect is suggested. The final analysis considered strata (groups of judges) as a fixed effect and the increased reliability confirms the presence of a strata effect. This indicates that the judges within each group correlate more highly among themselves than with other judges.

(See next page for Table 1)

Table 1

Reliability Estimates for Separate Groups of Judges and for all Judges Combined

Group of Judges	N	Reliability ANOVA	Reliability Single Judge
Educational Psychology	3	.80	.57
Elementary Education	3	.84	.64
CReWS Staff	3	.95	.86
All Judges Combined	9	.80	.34
All Judges with Groups as Strata	9	.91	.78

Table 2

Analysis of Variance Summary Table for Educational Psychology Group

Source of Variance	S.S.	df	MS
Articles	1188.83	9	132.093
Judges	520.27	2	260.133
Articles X Judges	477.07	18	26.504

Table 3

Analysis of Variance Summary Table for Elementary Education Group

Source of Variance	SS	df	MS
Articles	1438.83	9	159.870
Judges	65.07	2	32.533
Articles X Judges	458.27	18	25.459

Table 4

Analysis of Variance Summary Table
for CReWS Group

Source of Variance	SS	df	MS
Articles	971.87	9	107.985
Judges	17.87	2	8.933
Articles X Judges	102.13	18	5.674

Table 5

Analysis of Variance Summary Table
for All Judges Combined

Source of Variance	S.S.	df	MS
Articles	3075.73	9	341.748
Judges	884.29	8	110.536
Articles X Judges	1561.27	72	21.684

Table 6

Analysis of Variance Summary Table for Testing
Equality of Group Means and Homogeniety of Function

Source of Variance	S.S.	df	MS	F	p
Articles	3075.73	9	341.75		
Groups of Judges	281.09	2	140.54	1.40	n.s.
Judges within Groups	603.20	6	100.53		
Articles X Groups	532.80	18	29.10	1.52	n.s.
Articles X Judges within Groups	1037.47	54	19.21		

An additional analysis was performed in order to determine how "equivalently" each group of judges was using the Instrument for Evaluating Survey Research Report. Classical test theory regards two tests to be equivalent (parallel forms) if they have equal means, variances, standard errors of measurement, and rank order subjects in the same way (Medley, 1957). An analogous condition holds in the present situation. Here equivalence refers to whether the various groups of judges are using the survey instrument in the same manner (as indicated by the various psychometric characteristics). In the present situation the survey instrument is regarded as equivalent if the various groups of judges do not differ significantly with respect to mean scores on the articles, variances, and errors of measurement, and if the articles are rank-ordered in the same way by each group of judges. Test for homogeneity of variance are performed by forming an F-ratio based on the $MS_{Articles}$ derived from the separate ANOVA's for each group of judges:

$$F = \frac{\text{Largest } MS_{Articles}}{\text{Smallest } MS_{Articles}}$$

In order to test for homogeneity of measurement error an F-ratio is formed by placing the largest MS error in the numerator and the smallest MS error in the denominator for each comparison. The error term is the MS for Articles X Judges interaction. Table 7 below summarizes the mean squares for each group of judges.

(See next page for Table 7)

Table 7

Mean Squares used for Tests of Homogeneity of Variance and Homogeneity of Measurement Error

Group of Judges	MS Articles	MS Articles X Judges
Educational Psychology	132.093	26.504
Elementary Education	159.870	25.459
CReWS Staff	107.985	5.674

Table 8 summarizes the F-ratios for each between group comparison for homogeneity of variance. As may be observed none of the F-ratios were statistically significant; therefore, the variances of the groups of judges may be regarded as essentially equivalent.

Table 8

Tests of Homogeneity of Variance Error Among Groups of Judges

Comparison	F*	p
Educ. Psych. -- Elem. Educ.	1.21	n.s.
Educ. Psych. -- CReWS Staff	1.22	n.s.
Elem. Educ. -- CReWS Staff	1.48	n.s.

*df = 9.9 for each comparison

In Table 9 the F-ratios for homogeneity of measurement error among groups of judges are presented. Two of these comparisons are statistically significant. In each instance the CReWS group had significantly lower errors of measurement than the comparison groups.

Table 9

Tests of Homogeneity of Measurement Error Among Groups of Judges

Comparison	F*	p
Educ. Psych. -- Elem Educ.	1.04	n.s.
Educ. Psych. -- CReWS Staff	4.67	.01
Elem. Educ. -- CReWS Staff	4.99	.01

*df - 18.18 for each comparison

The tests for homogeneity of group means and of function were obtained within the context of a single analysis of variance which is summarized in Table 6.

In this analysis the Groups main effect is non-significant, thereby supporting the requirement of homogeneous means. Homogeneity of function is assessed by testing for the presence of an Articles X Groups interaction effect. Here again the resulting F-ratio was non-significant, providing evidence for homogeneity of function. While it might appear that evidence for equivalence has been obtained, with the exception of homogeneity of variance among groups of judges, one not of caution is required. In the present situation only three judges comprised each group and, consequently, with the small N, there is a reduced power for detecting differences.

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APPENDIX D

CATEGORIES AND CODING FOR MATHEMATICAL TOPIC

a. Educational objectives and instructional procedures
   1) Historical development and procedures
   2) Values of arithmetic
   3) Planning and organizing for teaching (meaning approach; multi-graded; departmentalized, self-contained, non-graded; team teaching; modern, traditional; exposition, discovery; incidental, systematic; activity program; teaching practices)
   4) Attitude and climate
   5) Specific procedures
      a) Drill and practice
      b) Problem solving
      c) Estimation
      d) Mental computation
      e) Homework
      f) Review
      g) Checking
      h) Writing and reading numerals
   6) Foreign comparisons

b. Topical placement
   1) Pre-first-grade concepts
   2) Readiness
   3) Logical order
   4) Quantitative understanding
   5) Content to be included in grade
   6) Time allotment

c. Basic concepts (and methods of teaching them)
   1) Counting
   2) Number properties and relations
   3) Whole numbers
      a) Addition
      b) Subtraction
      c) Multiplication
      d) Division
   4) Fractions
      a) Addition
      b) Subtraction
      c) Multiplication
      d) Division
   5) Decimals
   6) Percentage
   7) Ratio and proportion

8) Measurement (time, denominate numbers)
9) Negative numbers (integers)
10) Algebra
11) Geometry
12) Sets
13) Logic
14) Our numeration system
15) Other numeration systems
16) Probability and statistics (graphing)

d. Materials
1) Textbooks
2) Workbooks
3) Manipulative devices
4) Audio-visual devices
5) Programmed instruction
6) Readability and vocabulary
7) Quantitative concepts in other subject areas

e. Individual differences
1) Diagnosis (errors)
2) Remediation (slow learner, underachiever)
3) Enrichment (acceleration)
4) Grouping procedures (ability, homogeneous, individualized, flexible)
5) Physical, psychological, and/or social characteristics
6) Sex differences
7) Socio-economic differences

f. Evaluating progress
1) Testing
2) Achievement evaluation
3) Relation to achievement
   a) Age
   b) Intelligence
4) Effect of parental knowledge
5) Effect of teacher background

g. Studies related to learning theory
1) Transfer
2) Retention (retroactive inhibition)
3) Generalization
4) Organization (process, reasoning)
5) Motivation
6) Piagetian concepts
7) Reinforcement (knowledge of results)

t. Studies related to teacher education
   1) Pre-service
   2) In-service
   3) Background

APPENDIX E

CATEGORIES AND CODING FOR TYPE OF STUDY

d	Descriptive:	research in which the researcher reports on records which may have been kept by someone else; includes reviews, historical studies, and textbook analyses or comparisons
s	Survey:	research which attempts to find characteristics of a population by asking a sample through the use of a questionnaire or interview; includes also the status study, in which a group is investigated as it is to ascertain pertinent characteristics (measures assigned variable only)
c	Case study:	research in which the researcher describes in depth what is happening to one designated unit, usually one child
a	Action research:	research which uses nominal controls; generally teacher or school originated; procedures of actual practice may be described
r	Correlation:	research which studies relationships between or among two or more variables; uses correlational statistic primarily
F	Ex post facto:	research in which the independent variable or variables were manipulated in the past; the researcher starts with the observation of a dependent variable or variables. He then studies the independent variables in retrospect for their possible effects on the dependent variables. (He may examine interrelationships of two or more assigned variables or two or more levels of one assigned variable)
e	Experimental:	research in which the independent variable or variables are manipulated by the researcher to quantitatively measure their effect on some dependent variable or variables, to test a logically derived hypothesis

APPENDIX F

CATEGORIES AND CODING FOR DESIGN PARADIGM

1.1 One-shot study, no control group (posttest only)
1.2 One group pretest-posttest
1.3 Static group comparison

2.1 Pretest-posttest, control group, matched, n = classes
2.2 Pretest-posttest, control group, matched, n = students
2.3 Pretest-posttest, control group, randomized, n = classes
2.4 Pretest-posttest, control group, randomized, n = students
2.5 Posttest only, control group, matched, n = classes
2.6 Posttest only, control group, matched, n = students
2.7 Posttest only, control group, randomized, n = classes
2.8 Posttest only, control group, randomized, n = students
2.9 Three or more groups, pretest-posttest, matched, n = classes
2.10 Three or more groups, posttest only, matched, n = classes
2.11 Three or more groups, pretest-posttest, matched, n = students
2.12 Three or more groups, posttest only, matched, n = students
2.13 Three or more groups, pretest-posttest, randomized, n = classes
2.14 Three or more groups, posttest only, randomized, n = classes
2.15 Three or more groups, pretest-posttest, randomized, n = students
2.16 Three or more groups, posttest only, randomized, n = students
2.17 Solomon's four group
2.18 Pretest-posttest, own control, randomized
2.19 Posttest only, own control, randomized
2.20 Posttest-retention test, own control, randomized

3.1 Pretest-posttest, control group, matched, n = students//nc[1]
3.3 Pretest-posttest, control group, randomized, n = students//nc
3.4 Pretest-posttest, insufficient information re n
3.5 Posttest only, control group, matched, n = students//nc
3.7 Posttest only, control group, randomized, n = students//nc
3.8 Posttest only, insufficient information re n
3.9 Three or more groups, pretest-posttest, matched, n = students//nc
3.11 Three or more groups, posttest only, matched, n = students//nc
3.13 Three or more groups, pretest-posttest, randomized, n = students //nc
3.15 Three or more groups, posttest only, randomized, n = students//nc

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[1]nc = not correct (n = students when the sampling unit seems to have been classes).

3.17 Solomon's four group, n = students//nc
3.18 Pretest-posttest, own control, insufficient information re n
3.19 Posttest only, own control, insufficient information re n
3.20 Posttest-retention test, own control, insufficient information re n
3.21 Non-equivalent control group, pretest-posttest
3.22 Non-equivalent control group, posttest only
3.23 Separate sample pretest-posttest
3.25 Counterbalanced
3.27 Time series
3.28 Equivalent time samples
3.29 Equivalent materials samples

APPENDIX G

CATEGORIES AND CODING FOR STATISTICAL PROCEDURE

a. Descriptive types of measures
- 1.1 Raw scores, frequency distributions
- 1.2 Difference between scores
- 1.3 Medians
- 1.4 Means
- 1.5 Difference between means or medians
- 1.6 Percentages
- 1.7 Proportions or ratios
- 1.8 Quartiles
- 1.9 Ranks
- 1.10 Percentiles and deciles
- 1.11 Q-Sort
- 1.12 Standard scores

b. Inferential types of tests
- 2.1 Chi square one-sample test ("goodness of fit")
- 2.2 Contingency Coefficient
- 2.3 Fisher's Exact Probability for 2 x 2 Tables
- 2.4 McNemar's Test for Significance of Changes
- 2.5 Cochran's Q Test for Several Related Proportions
- 2.6 Chi square Test for Independence
- 2.7 Methods for Maximizing Probability of Correct Classification
- 2.8 McNemar's Test for Non-Independent Proportions
- 2.9 Behrens-Fisher Test of Equality of Means on a Personality Test
- 2.10 Tukey Gap Test

- 3.1 Pearson's Resolution of Mixed Gaussian Series
- 3.2 Analysis of Variance
- 3.3 F-test
- 3.4 t-test
- 3.5 Analysis of Covariance
- 3.6 Scheffe's Multiple Comparison Procedure
- 3.7 Tukey's Multiple Comparison Procedure
- 3.8 Hotelling's T^2
- 3.9 Mahalonobis' D^2
- 3.10 Fisher's Discriminant Function
- 3.11 Rao's V_k
- 3.12 Multiple Discriminant Analysis
- 3.13 Multiple Regression Analysis
- 3.14 Multiple Discriminant Function
- 3.15 z-test, Critical Ratio
- 3.16 Cochran-Cox test

3.17 Probable error
3.18 Probable error ratio
3.19 Welch-Nayer test for homogeneity of variability

4.1 Sign test
4.2 Median test
4.3 Mann-Whitney U Test
4.4 Kruskal-Wallis One-way AOV
4.5 Friedman's Two-way AOV
4.6 Wilcoxon's Matched-pairs Signed-ranks Test
4.7 Wilcoxon's Test of Significance for Unpaired Replicates

5.1 Kendall's Coefficient of Concordance (W)
5.2 Spearman's Rank Correlation (rho)
5.3 Kendall's Rank Correlation (tau)

6.1 Factor analysis
6.2 Regression analysis
6.3 Multiple correlation
6.4 Correlation
6.5 Phi coefficient
6.6 Wherry Doolittle Test Selection Method (for multiple correlation)
6.7 Johnson-Neyman Technique