Presented is a supplement to a previous list of references. Contained is a compilation of information collected by the Calculator Information Center between June 1979 and December 1980. Included are references which previously appeared on bulletins distributed by the Center, plus articles from newsletters and similar less readily available sources and from non-American sources. Most references are annotated; all include a limited set of descriptors or keywords which denote the focus or contents of the reference. At the end of the listing is an index for each descriptor. (Author/MP)
Calculators:
A Categorized Compilation of References

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Supplement 1
December 1980

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The work upon which this publication is based was performed pursuant to Contract No. 400-80-0007 of the National Institute of Education. It does not, however, necessarily reflect the views of that agency.
## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>List of References</td>
<td>3</td>
</tr>
<tr>
<td>Index</td>
<td>47</td>
</tr>
</tbody>
</table>
Calculators: A Categorized Compilation of References

Since March 1977, the Calculator Information Center has met the dual functions of collecting and disseminating information about the use of calculators in education. This document lists references collected by the Center between June 1979 and December 1980, supplementing a previous compilation (Suydam, 1979). The majority of these references have appeared on Reference Bulletins distributed by the Center; two additional types of materials cited here did not appear in those bulletins:

(1) Articles from sources not readily available to wide audiences
(2) Articles and other documents from non-American sources.

No claim to comprehensiveness is made: readers are encouraged to send additional references to the Center. Omitted are approximately 400 references pertaining to applications which seem too specialized in intent for use in schools.

The alphabetized listing of references includes, in brackets, a limited set of descriptors or keywords which denote the focus or contents of the reference. At the end of the listing is an index to help the reader locate documents of interest. However, some descriptors which could have been applied to a particular reference might not be listed. Such omissions generally occurred because the descriptor did not come to mind as the reference was scanned. It is suggested that readers might add their own notes of studies appropriate in each category.

In the majority of instances, the references are annotated. In a small percentage of cases, however, no annotation is included; this occurred most often because the document was not available at the Center. The
descriptors should reflect what is known about the contents, as indicated by the title.

It is hoped that this compilation will be of aid to teachers, to researchers, and to others who need and want references on calculators.
Calculators: A Categorized Compilation of References
(Compiled June 1979-December 1980)

[Activities]

The objectives of this module include comparing sets of objects and expressing ratios as decimals or fractions.
[Activities, Decimals, Fractions, Programmable calculators, Ratios, Secondary]

Crystallographic programs for chemical analysis are described.
[Chemistry, College, Post-secondary, Programmable calculators]

Teachers in a workshop sent a 12-item questionnaire to parents and teachers of grades k-9; 334 responses were received. Parents were skeptical about the use of calculators in elementary grades. They agreed that calculators could be used for motivation, and along with paper-and-pencil computation, but expressed moderate disagreement with the use of calculators for homework and were very negative about replacing paper-and-pencil computation.
[Attitudes, Elementary (grades k-6), Junior high (grades 7-9), Parents, Research (survey), Roles, Teachers]

[Biochemistry, Programmable calculators]

[Consumer applications]

[Business, Post-secondary]

Berry, Herbert. Improving Achievement in Selected Skills of Functional Mathematics with the Use of the Electronic Hand-Held Calculator.


Calculator addition problems are presented within a problem-solving context.

[Activities, Addition, Elementary, Four-function calculators, Teachers]


This calculator activity deals with subtraction of monetary amounts and includes ideas to introduce the concept of negative integers.

[Activities, Consumer applications, Elementary, Four-function calculators, Subtraction, Teachers]


Multiplication on the calculator is introduced. That the user must sometimes use logic and imagination to arrive at a correct answer is emphasized.

[Activities, Elementary, Four-function calculators, Multiplication, Teachers]


Activities, grouped by mathematical topic, are given for exploring calculator applications in the elementary and junior high curriculum.

[Activities, Calculator keys, Curriculum, Elementary, Junior High, Teachers]


A calculator activity is presented in which a student tries to get an answer before the calculator does.

[Activities, Four-function calculators]


Calculator-based activities are provided, with worksheets on population growth and inflation.

[Activities, Algebra, Functions, Secondary, Units, Worksheets]


Programming with the TI-59 calculator is described; the advantage of the printing capability is noted.

[Post-secondary, Programmable calculators, Selection]

Bone, Dorothea D. Sine and Cosine Functions with a Calculator. Mathematics Teacher 73: 521-524, 529; October 1980.

Calculator activities are presented that involve discovering patterns of the sine and cosine functions, rounding numbers to the nearest
hundredth, plotting points, drawing graphs, and using a protractor.

[Activities, Secondary (grades 9-12), Trigonometry, Worksheets]


[Music]


Some activities in which the calculator is used to spell words are given.

[Activities, Four-function calculators]

Brabson, G. Dana and Seegmiller, David W. Programmable Calculators Add a New Dimension to Laboratories. *Journal of Chemical Education* 47: 117-119; February 1970.

Using a programmable calculator in chemistry experiments is described, with advantages and features of various models noted.

[Chemistry, College, Desk calculators, Programmable calculators, Pros/cons, Selection (features)]


[Activities]


The proposed method generalizes the common quadrature rules in a systematic way.

[Calculus, College, Programmable calculators]


Specific examples of how the calculator can be used to develop mathematical ideas are provided.

[Algebra, Functions, Roots, Secondary]


[Curriculum, Elementary, Junior high, Research, Secondary]


[Activities, Junior high, Programmable calculators, Secondary]

[Building]


Articles from the two journals are reproduced.

[Activities, Elementary, Junior high, Recommendations, References] (selected)


Use of programmable calculators in place of computers in New York State's University extension services is described.

[Post-secondary, Programmable calculators]


A lesson on subtraction using negative numbers is described.

[Elementary (grades 3, 4), Four-function calculators, Integers, Subtraction]

Casterlow, Gilbert, Jr. The Effects of Calculator Instruction on the Knowledge, Skills, and Attitudes of Prospective Elementary Mathematics Teachers. The Pennsylvania State University, November 1980.

The purpose of this study was to determine the effects of three types of calculator instruction on preservice elementary teachers' knowledge, calculator skills, and attitudes toward calculators and mathematics.

[Attitudes, Research, Teachers]


Students (n = 126) in grades 7 and 8 were randomly divided into two groups. For 24 weeks, one group had calculators available during lessons, but not on tests or for taking home; the other group used only paper and pencil. No significant differences between groups were found on computation, concepts, or attitudes; a highly significant difference on problem solving favored the calculator group.

[Achievement, Attitudes, Junior high (grades 7-8), Remedial, Research]

Ways in which calculators can be used to teach mathematical ideas are presented, with specific examples. Selection of calculators as well as why, how, what, and when questions are discussed.

**Elementary, Roles, Secondary, Selection**


The use of two models of pocket calculators to solve problems arising in connection with ionic equilibria in solution is described.

**Chemistry, College, Programmable calculators**


Activity sheets used in a workshop for elementary teachers comprise this resource packet.

**Activities, Elementary, Teachers, Worksheets**


Teacher attitudes, practices, and perceptions about school policies on calculator use were surveyed. Over 63% were strongly or mildly in favor of using calculators. The need for instructional materials using calculators was apparent.

**Attitudes, Research (survey), Secondary, Teachers**


Two classes each of kindergarten, second-grade, and fourth-grade students used calculators for 10 months. No significant difference in achievement was found in grades 2 and 4; the kindergarten group using calculators scored significantly higher than the non-calculator group.

**Elementary (grades k, 2, 4), Research**


This report on the study with students in kindergarten, grade 2, and grade 4 (see Conner, 1979) includes activities and survey instruments.

**Activities, Attitudes, Elementary (grades k, 2, 4), Research (experimental, survey)**

Creswell, John L. and Vaughn, Larry R. Hand-held Calculator Curriculum and Mathematical Achievement and Retention. *Journal for Research*

The ninth-grade Fundamentals of Mathematics students using calculators scored significantly higher on immediate tests than students not using them, but no significant retention effects were found.


Calculator algorithms for problems ranging from root finding of equations to trigonometry, surveying, navigation, and finances are included.


Problems for use with calculators are provided; modifying textbook materials and developing a file are suggested.


DuRapau, V. J. and Bernard, John. From Games to Mathematical Concepts

Three games involving functions and proof are presented, with the aim of stimulating creative thinking about the use of programmable calculators in the classroom.

[College, Functions, Games, Programmable calculators]


This is a collection of informational materials and activities on the use of calculators and computers for instruction.

[Activities, Elementary, Secondary]


The danger of sex-stereotyped electronic learning aids and their reinforcement of conventional prejudices is discussed.

[Marketing, Parents, Roles, Selection]


This speech discusses the difficulties that entering college freshman seem to have with mathematics, particularly with fractions. The use of calculators is suggested as one alternative in a success-oriented program.

[College, Decimals, Fractions]


One major conclusion from this study is that businesses expect employees to have skills on adding and calculating machines before they are hired. Offering a required course in business calculators and business math for all students enrolled in the Business Division programs was recommended.

[Business education, Business math, College, Desk calculators, Recommendations, Research]


The trigonometric function algorithm, scaling, vector rotation, pseudo-division, and pseudo-multiplication are discussed.

[Algorithms, College, Scientific calculators, Trigonometry]

The use of simulation techniques using a programmable calculator in the study of chemical reactions are presented.


Ercolano, Joseph. Fractional Computations on a Calculator.
A procedure is presented for obtaining fractional results on a calculator.


Four types of calculator knowledge needed by teachers are described: 1) special features, 2) issues relating to classroom use, 3) problem solving techniques, and 4) pedagogical role.


Information collected from NSF project participants with regard to how and why calculators should be used in the classroom is presented.

Ewbank, W. A. Results of a Survey Carried Out in October, 1979, of Children in Grades 1-6, Upland Elementary and Middle Schools and Matthews Elementary School (Eastbrook Community Schools, Indiana) Relating to the Ownership and Access to a Pocket Calculator. Xerox copy. November 1979.

A survey of 417 students indicated that percentage of calculator ownership or access ranged from 79% for first graders to 100% for sixth graders.


The solution to the equation $x^x = 3$ is approached by presenting the continuity of a function concept and the monotone convergence theorem in the forms of discussion and a calculator program.

[Activities, Significant figures]


An overview of several calculator activity publications are included along with opinions concerning the use of calculators in the schools and calculator selection and availability.

[Activities, Calculator logic, Elementary, Four-function calculators, Junior high, Pros/cons, References (selected), Roles, Secondary, Selection]


Media reactions to calculator use are described, with biased reporting evident.

[Pros/cons, Roles]


Several calculator games that involve computational practice are presented.

[Drill, Elementary, Four-function calculators, Games, Mixed operations]

Fiske, Edward B. They'll Learn Their Lessons This Time. *Mainliner* 95-99; September 1979.

[Pros/cons, Roles]


Implications for the use of calculators in industry and in schools is briefly discussed.

[Pros/cons, Post-secondary]


A calculator event in a high school mathematics tournament is illustrated.

[Secondary]


[Selection]


Three fourth-grade and three fifth-grade classes used calculators. Their (unexplicated) use did not improve achievement, attitude, or self-esteem.


Circuitry changes for converting a suitable calculator into a 0.1 sec timer by the use of a pulse generator are presented.


Among the papers in this conference report is one on "Using Calculators in Mathematics Classrooms."


Advantages of programmable calculators are listed and their potential use in mathematical experiments is mentioned.


The need to have students make mental computations led the author to
ban their use on examinations.

[Chemistry, College, Pros/cons, Testing]

A novel approach to square roots, with which a programmable calculator can be used is presented.

[Activities, Programmable calculators, Roots, Secondary]

[Science]

[Numerical analysis]

[Activities]

A series of programs provides a step-by-step procedure for sizing and positioning the drive gear.
[Post-secondary, Programmable calculators, Programming, Technical occupations]

[Engineering]

[Programmable calculators, Psychology, Research]

Harrois, Monin F. Les calculatrices de poche entrent à l'école.

[Activities]


[Games]


A child’s work with combinations is presented, including one reaction to a calculator answer.

[Activities, Elementary, Multiplication]


Students in developmental arithmetic courses at two community colleges (n = 48, 33) were randomly assigned to three treatment groups: use of conventional algorithm, conventional algorithm plus calculators, or alternative algorithm involving conversion from fractions to decimals with calculators. Self-paced slide-tape-workbook presentations were used. No significant differences among groups was found for fractional computation or understanding, or attitude toward mathematics, but significant difference between pre- and posttest scores were found for each measure.

[Achievement, Attitudes, College, Fractions, Research]


The relative effectiveness of three methods of teaching fraction computation in the context of the community college was investigated. The use of calculators was a special focus of the study. The three methods were conventional algorithms with no calculator, conventional algorithms with calculator, and alternative algorithms using decimal fractions with the calculator. The results indicate that learning calculator-based algorithms produced no difference in computational skill, understanding, attitudes, nor length of time to learn when compared with learning conventional algorithms.

[Algorithms, College, Fractions, Research]


How the calculator can be used in elementary schools is discussed, with note of curricular development proposals in Sweden.

[Curriculum, Elementary, Pros/cons, Roles]

Hedrén, Rolf. Results (from Swedish Investigation). Paper presented
at ICME-IV meeting, Berkeley, August 10-16, 1980.

Students of both the experimental and control classes of form 4 were given pre- and posttests that each contained three parts: 1) mental arithmetic, 2) algorithms, and 3) diverse test items. The results show that the students really get use to translating the inherent problem structure of a problem from the real world into a mathematical formula by solving lots of realistic word problems with a hand calculator.

[Algorithms, Problem solving, Research]


Six articles on calculators are included in this bibliography.

[Junior high, References (selected), Secondary]


[Activities]


A teaching emphasis section of the Mathematics Resource Project stresses ideas which may help to teach the topics of ratio, proportion, and scaling using calculators.

[Activities, Elementary, Games, Junior high, Ratio, Worksheets]


One activity useful to help students multiply with decimals is given.

[Activities, Decimals, Multiplication]


Use of a programmable calculator for figuring business account is described.

[Business, Desk calculators, Post-secondary, Programmable calculators]


Instances in which a programmable calculator can be used to analyze mass-spectra data are presented.

[Chemistry, College, Programmable calculators]

This bi-monthly column presents problems and suggestions about calculator use.


[Hutton, Lucreda A. Calculators: Teacher's Attitudes and Children's Ability. Mathematics Teaching 90: 20-21; March 1980. Comments on the project described by Vannatta and Hutton (1980) are presented.]

[Hyatt, Herman R. Teaching Arithmetic with Calculators. MATYC Journal 13: 203-204; Fall 1979. Use of calculators to aid students in solving problems in a community college arithmetic course is briefly described.]

[Ikeda, M. Electronic Calculators Tip Market in Japan's Favor. Business Japan 25: 19; 1%.]

[Jackman, Lance E. Programmable Hand-Held Calculators in Biochemistry Laboratory Courses. Journal of College Science Teaching 9: 94-95; November 1979. Ways programmable calculators are used in biochemistry courses are briefly described.]


[Johnson, David C. Figure and Chips. London: Chelsea College, January 20, 1979. Included is a brief historical survey of calculators and computers in addition to implications for their use in school mathematics.]

[Johnson, David C. Types of Calculators - Let's Use More Appropriate Descriptors. Mathematics in School 9: 19-20; September 1980. Three types of logic -- 1) arithmetic, 2) algebraic, and 3) Reverse Polish Notation -- are explained and their importance in selecting...
machines for school use is described.

[Four-function calculators, Scientific calculators, Selection]


Little systematic effort has been devoted to developing programs for the deaf. Data were collected on a wide variety of practices.

[Curriculum, Elementary, Handicapped, Junior high, Research, Secondary]


[Astronomy]


[Activities, Secondary]

Kahan, William M. Personal Calculator Has Key to Solve Any Equation f(x) = 0. Didactic Programming 2: 36-39; Winter-Spring 1980.

How the SOLVE key on the HP-34C works is discussed.

[Calculator keys, College, Functions, Programmable calculators]


An overview of advantages and disadvantages of using calculators is provided.

[Elementary, Pros/cons, Secondary]


[Selection]


[Physics, Post-secondary]


Two types of problems that could be used to develop the idea of concurrent processing with calculators are presented.

[Algebra, Algorithms, College, Programmable calculators, Secondary]

Koop, Janice B. Calculators and the Community College Arithmetic Class. MATYC Journal 14: 113-120; Spring 1980.

The aims of remedial arithmetic courses for community college students
are considered. Reasons for using calculators in such a course are then provided.

[College (community), Pros/cons, Remedial, Roles]

[Pharmacy, Programmable calculators]


Comments from a teacher using the Math 11 programmable calculator materials developed by Rising et al. are given.
[Curriculum, Programmable calculators, Research, Secondary (grade 11)]


A list of references on the use of calculators in college classes is given.
[College, References (selected)]

Lamborn, Bud. TRIANG (Program for HP-41C). California: San Jose State University Computer Science Institute, June 1980.

An HP-41C program is outlined that solves for the unknown measurements of a triangle in three separate cases: 1) given SSS, 2) given SAS, and 3) given ASA.
[Activities, Geometry, Programmable calculators, Secondary, Trigonometry]


A game with the goal of finding the number which would lead to 1 when used as the operator is presented.
[Activities, Elementary, Games]


A game in which students must ascertain the number which would lead to 0 when used as the operator is presented.
[Activities, Elementary, Games]


A game using the constant is presented with a description of it being used by students and an explanation.
[Activities, Elementary, Games]

Five calculator activities are described that are designed to explore ordered operations. Suggestions are given on mathematical objectives, strategies for solving, and possible extensions or follow-up activities.

[Activities, Mixed operations]


The role of calculators in a mathematics course for preservice elementary teachers is described.

[Course description, Four-function calculators, Roles, Teachers]


Activities


Techniques for developing ability to multiply and divide by powers of ten are described, with the calculator suggested as one of several tools to use.

[Activities, Division, Multiplication]


[Selection]


Single-page exercises involving place value, rounding, and patterns are provided.

[Activities, Consumer applications, Decimals, Division, Estimation, Fractions, Pattern searches]


The polynomial function is explored using a calculator.

[Algebra, College, Scientific calculators, Secondary]


A six-week course for students aged 8-11 and 12-15 is outlined, and how some topics were explored is described.

[Course description, Elementary (ages 8-11), Gifted (enrichment), Junior high (ages 12-15), Programmable calculators]

Several topics with which the exchange key can be used are described: Fibonacci numbers, square roots, and geometric series.

[Algorithms, Calculator keys, Scientific calculators, Secondary, Selection features]


The impact of the calculator on the elementary and junior high mathematics curriculum is discussed and recommendations for its use are presented.

[Elementary, Junior high, Recommendations, Roles]


[Attitudes, Research]


A method of using a display calculator for communicating algorithms in classroom mathematics instruction is described.

[Algorithms, Classroom management, College, Roles, Secondary]


A demonstration for a calculus class on Newton's method is described, with general principles for planning demonstrations noted. A list of additional topics for demonstrations is also given.

[Activities, Calculus, College, Teachers (planning)]


Several examples are presented for using a calculator to motivate the concept of infinite composition of functions, including continued square roots, continued fractions, and infinite products.

[Calculus, College, Functions, Scientific calculators, Secondary]


[Scientific calculators, Selection]

Students in three mathematics classes for prospective elementary teachers were assessed on two aptitudes, field independence and general reasoning, and randomly assigned to either an expository (n = 24) or a discovery (n = 23) treatment. The instruction involved errors in measurement and calculations with approximate data. A significant interaction was found with general reasoning on the retention test, as predicted. There were no interactions with field independence.

McNemar, Robert; Huber, James; Gilbreath, Catherine; and Myers, Alberta. Columbus Calculator Project. Final Report, ESEA Title IV-C. Columbus, Ohio: Columbus Public School District, 1979.

This teacher training manual includes instructions on operating a calculator and implementing calculators in the classroom.


The role of calculators in problem solving is explained and suggestions for their proper use are outlined.


Some uses of the calculator in the semantical and syntactical modes are outlined.


The possible impact of the calculator on abilities and arithmetic skills are discussed along with ideas on how the calculator might be used to teach semantical and syntactical number sense.


A basic business mathematics course that involves electronic desk calculators is described.


Ways in which a fourth-grade class used calculators are described. [Activities, Attitudes, Elementary (grade 4)]


Discussion of the effects of calculators in college mathematics is presented. The effects are categorized in three groups: effects upon content, effects upon process, and effects upon emphasis. [College, Curriculum, Roles]


An "elementary analysis" of roundoff errors in calculator demonstrations of the limit process is presented, with numerical illustrations that can easily be shown in the classroom. [Calculus, College, Numerical analysis]


Some conclusions of this calculator study are: 1) students using calculators were able to solve as many computational problems as those using paper and pencil, 2) girls who have experienced using calculators benefit more than boys who used calculators, 3) the use of calculators does not affect the computational or problem-solving ability of students, and 4) low ability groups do not benefit from the use of calculators as much as medium ability and high ability groups. [Basic mathematics, Junior high, Problem solving, Pros/cons, Recommendations, Research]


A calculator using RPN logic is integrated into instruction on problem solving; specific illustrations are included.

[Calculator logic, Junior high (grade 7), Problem solving]


Hand-held calculator logic systems found on the market are introduced and the advantages and disadvantages of each are explored.

[Calculator logic, Selection, Teachers]


Four classes in grades 2 and 3 used calculators with the on-going instructional program from October to mid-May, while four classes did not have access to calculators in their mathematics lessons. Statistically significant differences favored the second-grade calculator group only on subtraction and the third-grade group only on place value and division; no other differences were significant.

[Addition, Division, Elementary (grades 2, 3), Four-function calculators, Multiplication, Place value, Research, Subtraction]


A clear rationale, encouraging teachers to accept and explore uses of calculators in elementary school classrooms, is presented.

[Elementary, Roles, Teachers]


The second chapter of the book, Calculators and Elementary Education, is presented. Calculator characteristics are described with examples to illustrate uses.

[Activities, Calculator keys, Calculator logic, Elementary, Four-function calculators, Selection]


This third chapter of Calculators and Elementary Education presents problems and discusses ways the calculator is useful in problem solving.

[Activities, Elementary]
The fourth chapter of Calculators and Elementary Education is presented, with a focus on using calculators to analyze functions and algebraic formulas.

[Activities, Elementary, Four-function calculators, Functions]


The use of the memory of a four-function calculator is detailed. The goal is to understand how the contents of various memory locations change as a calculation is keyed in and executed.

[Calculator memory, Elementary (teachers), Four-function calculators]


Samples of applications of calculators that may be suited for the elementary school are listed. The applications involve using the calculator to form words, giving insight into machines, deciding when to use mental arithmetic, and playing games.

[Calculator keys, Elementary, Estimation, Games, Problem solving]


Along with a variety of computer activities, three calculator activities are described.

[Activities, Elementary, Four-function calculators]


Suggestions are made for using programming as a vehicle for teaching problem solving skills to fourth and fifth graders.

[Activities, Elementary, Gifted, Problem solving, Programmable calculators]


[Activities, Equations, Functions]


[Selection]


[Estimation]

[Activities]


[Numerical analysis]


[Estimation]


[Numerical analysis]


[Programmable calculators]


Four seventh-grade classes were randomly assigned to groups using or not using calculators for two months. No significant differences were found between groups on measures of achievement and attitudes.

[Achievement, Attitudes, Junior high (grade 7), Low achievers, Research]


Teacher reactions to how the calculator might be used in schools were obtained. Generally, it was felt that they should not be used until basic facts are learned, although 96% recognized that children can learn mathematics from using calculators.

[Elementary, Research (survey), Roles, Secondary]


[Research (survey)]

In an experiment featuring a non-equivalent control group design, calculators were used by the pupils of two fourth-grade classes (age 11-12). The calculator was used with a standard curriculum and textbooks. Results on the understanding, application, and attitude tests indicated a significant (p < .05) difference in favor of the experimental group.


Sixty-eight pairs of elementary preservice teachers in Jamaica were randomly assigned to ability groups using or not using calculators for six weeks. No significant differences were found in achievement, retention, problem-solving ability, or attitude.


An alternative method for determining cube roots is presented.


The status of calculator use in Belgium in terms of curricular implications, research activities, instructional practices, teacher in-service, and calculator selection is summarized.


The need for written and mental algorithms is discussed, with a proposal for the type and extent of calculations to be taught given the calculator.


This letter discusses the point that calculators are not a panacea; students must still frame the question and interpret the answer.


A review of articles on the use of calculators is given, with an emphasis on research conclusions. The need for policy guidelines is discussed, and eight suggested guidelines are listed.


Ten misuses of calculators in the schools are discussed and suggestions are made for improvement.

Reys, Robert E.; Bestgen, Barbara J.; Rybolt, James F.; and Wyatt, J. Wendell. Hand Calculators: What's Happening in Schools Today?
Results from interviews with 194 elementary and secondary teachers in Missouri are presented. Eighty-four percent said that calculators should be available to children in school. Eighty percent felt that children should master the four operations before using calculators. Almost two-thirds indicated the need for in-service training. Additional findings are also reported.


Thirty-four experimental studies on calculator use are critiqued. Results showed support for the computational benefits of calculator use, but support for conceptual benefits was minimal. Attitude changes were immediate and task-specific. Defective research designs were noted.


This report presents comments and data from a teacher using the Math 11 programmable calculator materials developed by Rising et al.


This Russian publication presents numerous activities showing how to use the calculator for everyday calculations. Various types of calculators are also discussed.


This book contains a section on the use of calculators and the effects on achievement.

[Calculus, College]


This book can be used in schools to help the weaker student solve day to day mathematical problems.

[Activities, Consumer activities, Junior high, Low achievers, Secondary]


Calculator problem-solving activities for the secondary school student are presented.

[Activities, Basic mathematics, Games, Junior high, Problem solving, Secondary]


A way of packing and carrying AC-powered calculators is described.

[Classroom management]


Eighty-one freshmen enrolled in engineering technology programs were assigned to groups using or not using calculators. The experimental group was given 10-15 hours of instruction to provide requisite skills using calculators. For 13 of 15 practical engineering problems, a greater percentage of the experimental subjects were correct; thus, the calculator group performed significantly better than the non-calculator group.

[Achievement, College, Engineering, Problem solving, Research]


Activities for several age levels are included in this book.

[Activities, Games]


[Status report]

Salt, Brian C. D. *Programmes for Animation: A Handbook for Animation Technicians: 57 Programmes in Animation for a Programmable Calcu-

[Programmable calculators]


The calculator was used in a computational activity to spell words.

[Activities, Elementary, Four-function calculators]


Some investigations with the format of each digit in the display on a LCD calculator or watch are suggested.

[Activities, Selection]


How the calculator can facilitate the development of problem-solving skills is discussed.

[Elementary, Problem solving]


The international review by Suydam (1980) is summarized in this Japanese article.

[International, Reviews, Status reports]


A successful teaching unit using the TI-30 and a Philadelphia School District guide is described.

[Consumer applications, Secondary, Scientific calculators, Units]


Ways in which calculators were used in a plane geometry course are listed.

[Activities, Geometry, Secondary]


Following discussion of the case for using calculators in school and presentation of recommendations for their use in problem solving, studies of the effect of their use with problem solving are summarized.

[Elementary, Pros/cons, Recommendations, Research, Secondary]

The calculator activities and applications presented in this article are designed to build analytical as well as technical problem-solving skills. Calculator games and puzzles, problem solving in the "real world", and basic operations are given special attention.

[Activities, Basic mathematics, Calculator keys, Games, Problem solving]


The purposes of this study were to determine the effects of hand-held calculator usage on the problem-solving effectiveness of average sixth-grade mathematics students and the investigate differences in problem-solving processes between calculator users and nonusers. The results indicated that the hand-held calculator neither positively nor negatively influences the problem-solving effectiveness of average sixth-grade students.

[Elementary, Problem solving, Research]


The role of the calculator in computation instruction is explained.

[Basic mathematics, Curriculum, Elementary, Junior high, Recommendations]


An enrichment activity is included that requires the aid of a programmable calculator.

[Activities, Geometry, Junior high, Programmable calculators]


The current use of calculators in the elementary schools is evaluated and myths concerning their place in the curriculum are discussed.

[Algorithms, Curriculum, Elementary, Evaluation, Pros/cons]


A payment scheme activity is presented that uses the calculator as an investigative tool for generating the sum of a finite geometric series with n terms.

[Activities, Calculus, Consumer applications, Proofs, Secondary]
[Numerical analysis, Scientific calculators]

[Science, Selection]

How the pseudo-multiplication and pseudo-division techniques used in calculators to evaluate transcendental functions are based on elementary identities is shown.
[Algebra, Functions, Logarithms, Scientific calculators, Secondary, Trigonometry]

Instructions for making a milk carton calculator for practicing basic skills are outlined.
[Basic mathematics, Elementary, Parents]

Nine third-grade classes were randomly assigned to use calculators 8-10 minutes per day for checking and other activities, to use programmed feedback "calculators" 8-10 minutes per day for drill, or to have a traditional paper-pencil approach for 16 weeks. Significant differences favored the calculator group over both other groups on acquisition and retention computation measures, and the programmed-feedback group over the control group on acquisition. No differences for concepts or attitude were found.
[Achievement, Attitudes, Checking, Drill, Elementary (grade 3), Four-function calculators, Preprogrammed devices, Research]

[Business education]

Teaching the skills necessary to develop algorithms for programmable calculators is discussed.
[Algorithms, College, Programmable calculators, Secondary, Teachers]

A program for a Hewlett-Packard HP-25 Programmable Scientific Calculator is presented that will display successive members of various series such as increasing powers of a number and Fibonacci numbers.

[Pattern searches, Programmable calculators, Programming, Secondary, Scientific calculators]


How programmable calculators and computers help students gain insight into techniques for finding square roots and calculating functions are detailed.

[Functions, Logarithms, Programmable calculators, Roots, Trigonometry]


This article specifies the calculator skills that are basic skills.

[Curriculum, Elementary, Junior high, Secondary]


Twenty-four reference bulletins compiled prior to June 1979 are included.

[References]


References on calculators published prior to June 1979 are listed, with categories indexed.

[References]


Status reports from April 1978 and May 1979 are included.

[Status report]


Seven information bulletins prepared prior to June 1979 are included.

[Activities, Workshops]

Research reports on calculator use are abstracted and critiqued by mathematics educators.

[Research (review), References]


Included arc reports from 16 countries on calculator uses in schools, plus a synthesis, a report from a Working Group for the Second International Mathematics Study, and a bibliography.

[Achievement, Activities, Attitudes, Curriculum, Pros/cons, Recommendations, References (selected), Roles, Status report]


Students in two seventh-grade classes were randomly assigned to instruction on ratios using or not using calculators for three weeks. No significant differences in achievement or attitude were found between groups on paper-and-pencil tests.

[Achievement, Attitudes, Junior high (grade 7), Ratios, Research]


Calculators are briefly discussed in this article on mathematical anxiety of women.

[Attitudes, Problem solving]


Six ninth-grade general mathematics classes used a calculator-assisted supplementary curriculum during one-fifth of instructional time, while the control group used the regular curriculum. No significant difference was found between groups except for high-scoring students who used the calculator curriculum.

[Curriculum, General mathematics, Junior high (grade 9), Research]


An experiment on prime factorization is presented; it could be used as a basic lesson plan with seventh graders.

[Activities, Junior high (grade 7), Units]


A procedure is illustrated which changes a numeral in base 8 or base 16 to a base 10 numeral.

Three second-year algebra classes used 10 days to investigate a series of probability exercises. The student-programming group estimated answers and then wrote their own programs to verify their estimates. The teacher-programming section used the teacher's programs to verify estimates. The control group received the results of a hypothetical experiment to verify estimates. Some difference in estimation achievement was noted for the student-programming group; attitudes were significantly better than in the control group.


The capabilities of the programmable calculator and its possible uses by a vocational agriculture teacher are discussed.


How the calculator can extend understanding of pi is presented.


Comments from teachers on how they use calculators are quoted.


The use of calculators by 38 intermediate-level classrooms in Indianapolis is described. Materials correlating calculator use with textbooks were provided for teachers. Results after two years of use indicated achievement "well above normal expectations" in computation
and problem solving.

[Achievement, Elementary (grades 4-6), Four-function calculators, Research]


[Activities]


[Activities]


[Activities]


[Activities]


[Activities]


A program for producing perspective drawings is described, with specific directions on how to proceed.

[Engineering, Post-secondary, Programmable calculators, Programming]


A variety of ways are provided to use the calculator to assist in teaching consumer mathematics applications.

[Activities, Consumer applications, Secondary]


Three problems involving iteration for solution are presented.

[Activities, Algebra, Scientific calculators, Trigonometry]

How to use the integrated circuit of a calculator as a device to indicate the position of a telescope is explained.

[Post-secondary, Science]


Calculator use in college calculus courses is surveyed and described. Also, the effects of incorporating electronic aids in the calculus classroom are discussed.

[Achievement, Calculus, College, Curriculum, Research]


The possible impact of calculators on mathematics teaching is discussed with comments on the use in the United Kingdom.

[Elementary, References (selected), Roles, Secondary]


Suggestions are made for using the calculator as a "laboratory" for the exploration and investigation of number properties and patterns.

[Activities, Algebra, Functions, Junior high, Pattern searches, Properties, Secondary]


Storage registers in programmable calculators are discussed in this article.

[Calculator memory, Elementary, Programmable calculators, Programming]


Refinements of work with calculator algorithms previously conducted by the author are reported. Work with "chaining" and the doing/undoing property in addition and subtraction was tested with 24 third-grade students. Results indicated the need for further instruction with both ideas. Students were able to manipulate the calculator keyboard, but had difficulty with the conceptualizations of the calculations to be executed.

Observations and instructional materials from calculator explorations with seventh-grade students from 1976 through 1978 are presented. Algebraic-logic calculators with no operational hierarchies were used; at the end of the year, RPN calculators were introduced.


Suggestions from reports on calculators are presented, including conference recommendations.


Ninety pupils in grades 4-6 were randomly assigned to calculator, paper-pencil, or control groups for two weeks. The calculator group used a preprogrammed "Matheputer." All groups made gains on multiplication fact tests, but the paper-pencil group improved most.


This study compared the problem-solving performance of elementary school pupils using calculators with that of pupils not using calculators. The processes used by the two treatment groups were analyzed along with computational errors, production scores, and time-on-task. Two significant results from this study are: the calculator group
used more processes and made less computational errors than the non-calculator group.


Four middle school calculator activities are presented that deal with estimation, problem-solving, application, and decimals.


Two proposals for the elementary mathematics curriculum are addressed: 1) shift from a computationally based curriculum to a conceptually oriented curriculum using the calculator as an instructional tool, and 2) eliminate the teaching of complex computations. Recommendations are made for curricular change, including what should be taught and the role of the calculator.


Two classes from each grade 2-6 in five locations participated, with one class at each level randomly assigned to the calculator group and the other to the non-calculator group. Both groups used the on-going program during the 18-week study. No significant differences were found between groups. Attitudes of the calculator group were favorable.


No significant achievement differences were found between groups using or not using calculators in grades 2-6 in five states. Comments on calculator use are included.


[Consumer applications, Handicapped (mentally retarded), Secondary]
Association of School Administrators Points 8: 24-27; September 1979.

[Pros/cons]


[Activities, Numerical analysis]

One worksheet illustrates loops using a calculator; another is for use with a computer.  

[Activities, Elementary (grade 6), Junior high (grades 7-8)]

Consequences that result from the effects of calculators on society, the school, didactics, and mathematics education are presented.  

[Algorithms, Curriculum, Functions, Problem Solving, Recommendations]

Two lessons showing how a calculator can be used to help students discover the "rule of 72" and use it to investigate problems involving population, inflation, and energy are presented.  

[Activities, Secondary]

Four worksheets on bills and checks are given, with note that the calculator could be used to check work.  

[Activities, Checking, Consumer applications, Junior high, Secondary, Worksheets]


[Attitudes, Elementary, Research (survey), Secondary, Teachers]

An investigation of the effects of calculator use in schools in West
Germany is presented, with details on the procedures, the tests, and the results.


This text, appropriate for the elementary and junior high school students, presents games, puzzles, problems, and exercises for the four-function calculator.


Zakariya, Norma; McClung, Margo; and Winner, Alice-Ann. The Calculator in the Classroom. Arithmetic Teacher 27: 12-16; March 1980.

Three lessons using calculators in grades 3, 4, and 5 are outlined.


The model considered how calculators can be incorporated into a mathematics program. Systems commitment, needs assessment, goals, resources, training, evaluation, and dissemination were discussed.


One-hundred-eight students in grades 7-12 used drill-and-practice programs with or without calculators. No significant differences were found between treatments.


Several findings on calculator use were noted in this study on prob-
lem solving. Average and low ability students used calculators more often than high ability students. They were used most often on division problems.

[Elementary (grades 3-6), Problem solving, Research]


One of eight NCTM recommendations is that "mathematics programs must take full advantage of the power of calculators and computers at all levels." The NCTM acknowledges that computational skills are still necessary, but stresses the need to integrate calculator use at all levels, reinforces their usefulness in problem solving, notes the need for imaginative materials, and emphasizes the key component of teacher education.

[Recommendations]


A high school calculator implementation program is described.

[Curriculum, Evaluation, Secondary, Units]


Programmable calculator activities are presented for algebra.

[Activities, Algebra, Programmable calculators, Secondary]


[College, Programmable calculators, Research]


[Activities]


[References (selected)]


The calculator worksheets are correlated with the Heath Mathematics student books and can be used for practice, problem-solving, enrichment, group work, new approaches to skills development, and homework.

[Basic mathematics, Elementary, Worksheets]

Calculators. Mechanix Illustrated 76: 80; March 1980.
Information on several types of calculators is included in this column.

[Selection]


Seventeen four-function and seven scientific calculators are rated according to keyboard and display performances.

[Four-function calculators, Scientific calculators, Selection]


[Calculator logic, Programmable calculators]


"Structure programming" of four-function calculators is discussed and examples of the iteration notion are given.

[Elementary, Four-function calculators, Iteration, Secondary]


Four sets of slides, audiodiscs and tapes, filmstrips, and worksheets provide a sequence for arithmetic, algebra, and trigonometry using the TI-30 calculator.

[Calculator keys, Drill, Kit, Secondary, Worksheets]


Reviews of three guidebooks using calculators for secondary school mathematics are included.

[Reviews, Secondary]


Helpful publications are listed for the amateur astronomer who uses a programmable calculator.

[Astronomy, Programmable calculators, References (selected)]


[Selection]


Three calculator tricks are presented that require the calculator to be turned around 180° to read the answer.


**Children and Calculators in the Classroom.** Vancouver, British Columbia, Canada: Simon Fraser University, 1979.


INDEX

This index is designed to help the user locate references to designated areas of concern related to the use of calculators in education. It should be noted that the cross-referencing is not exhaustive: there may be other references which could be pertinent, but have been omitted due to oversight.

The following topics are included in the index:

Achievement
Activities
Addition
Algebra
Algorithms
Astronomy
Attitudes
Basic mathematics
Biochemistry
Building
Business
Business mathematics
Calculator keys
Calculator logic
Calculator memory
Calculus
Checking
Chemistry
Classroom management
College
Consumer applications
Course description
Curriculum
Decimals
Desk calculators
Differential equations
Division
Drill
Elementary
Engineering
Equations
Estimation
Exponents
Evaluation
Finance
Four-function calculators
Fractions
Functions
Games
General mathematics
Geometry
Gifted
Handicapped
History
Industrial education
Industry
Integers
International
Iteration
Junior high
Kit
Logarithms
Logic
Low achievers
Marketing
Measurement
Mixed operations
Multiplication
Music
Naval applications
Navigation
Numerical analysis
Parents
Pattern searches
Pharmacy
Physics
Place value
Post-secondary
Preprogrammed devices
Probability
Problem solving
Programmable calculators
Programming
Proofs
Properties
Pros/cons
Psychology
Ratios
Recommendations
References (selected)
Remedial
Research
Reviews
Roles
Roots
Science
Scientific calculators
Secondary
Selection
Significant figures
Status report
Subtraction
Teachers
Technical mathematics
Technical occupations
Testing
Topology
Trigonometry
Units

Vocational agriculture
Worksheets
Workshops

Australia
Belgium
Canada
England
Finland
France
Hong Kong
Japan
Sweden
Union of Soviet Socialist Republics
West Germany

* * * * * * * * * * * * * * * * * * * * * * * * *

Achievement
Chang, 1979
Engelmeier, 1979
Fugate, 1979
Hector, 1979a
Noone, 1980
Packer, 1979
Pedersen, 1979
Roberts, 1980
Rosier, 1980
Rynone, 1980
Standifer, 1978
Suydam, 1980
Szeteia, 1980
Townsend, 1979
Vannatta and Hutton, 1980
Warfel, 1980
Wynands and Wickmann, 1980

Activities (continued)
Conner, 1980
Doe, 1978
Dorn and Councilman, 1980
East and Moursund, 1979
Ehrlich, 1975
Festraets and Noel, 1977
Fielker, 1979a
Glaeser, 1976
Goodman and Bernard, 1979
Gribbin and Gribbin, 1979
Harrois, 1976
Hatch, 1979
Hirst, 1980
Hoffer, 1975
Hoffman, 1980
Huff, 1979 a, b, c, d; 1980 a, b, c, d, e
Jurgensen, 1979
Lamborn, 1980
Lange and Meissner, 1980 a, b, c
Lappan and Winter, 1979
Lent, 1979
Leutzinger and Nelson, 1980
Lund and Smart, 1979
McCarty, 1980
Meiring, 1980
Meyer, 1980
Moursund, 1979b, 1980 a, b, e
Musser, 1980
Nachtergaele, 1977
Noel, G., 1978-79
Pasework, 1975
Pearce, 1977
Rothery, 1980 a, b
Activities (continued)
Sackson, 1979
Schussheim, 1978
Selkirk, 1980
Shuler, 1979
Shult, 1980 b
Sigurdson et al., 1973
Sloyer, 1980
Suydam, 1979 d, 1980
Toth, 1979, 1980
Van Hamme, 1977
Vergnaud, 1977
Vervoort and Mason, 1980
Villers, 1977
Vivet and Laurent, 1976
Waits, 1979
Waits and Schultz, 1979
Watson, 1979 b
Weaver et al., 1979
Wheatley, C., 1980 b
Wilmet, 1977
Wilson, 1978
Woodward and Hamel, 1979
Wundrow, 1977
Yvon and Downing, 1978
Yvon et al., 1980
Zakariya et al., 1980
Calculateurs ..., 1978
Calculator Activities, 1979
Children and Calculators ..., 1979
Paper No. 1 ..., 19...
Pocket calculators ..., 1976
SMP, 1979
Children and ..., 1979

Addition
Bitter, 1980 c
Moser, 1979
Weaver, 1979

Algebra
Blume, 1979
Bristol, 1979
Dickson, 1978
King, 1980
Maor, 1979
Snider, 1980
Townsend, 1979
Waits and Schultz, 1979
Watson, 1979 b
Calculateurs ..., 1978
Paper No. 1 ..., 19...

Algorithms
Dickson, 1978
Egbert, 1979
Hector, 1979 b
Hedren, 1980
Johnson, D., 1979
King, 1980
Maor, 1980 b
McCarty, 1979
Meissner, 1980 b
Plunkett, 1980
Slesnick, 1980
Stolarz, 1980
Toth, 1980
Weaver, 1979
Winkelmann, 1978

Astronomy
Duffett-Smith, 1979
Jones, 1978
More Aids ..., 1980

Attitudes
Balka, 1979
Bitter, 1980 a
Gasterlow, 1980
Chang, 1979
Cohen and Fliess, 1979
Conner, 1980
Engelmeyer, 1979
Fugate, 1979
Gerald, 1973
Hector, 1979 a
Hutton, 1980
Mayer and Bayman, 1980
Meissner and Wollring, 1978
Meyer, 1980
Noone, 1980
Paasonen, 1980
Packer, 1979
Reys et al., 1980
Roberts, 1980
Standifer, 1978
Suydam, 1980
Szetela, 1980
Tobias, 1980
Townsend, 1979
Wyatt et al., 1979
Basic mathematics
Berry, 1980
Creswell and Vaughn, 1979
Meissner, 1980 a, b
Miles, 1980
Rothery, 1980 b
Shult, 1980 b
Shulte, 1980
Sovchik, 1980
Wheatley, B., 1980
Calculator Worksheets, 1980

Biochemistry
Barnes and Waring, 1980
Jackman, 1979

Building
Buckwalter, 1978
Mims, 1979

Business
Berg, 1979
Hohenstein, 1979
Huffman, 1978

Business education
Edsall, 1980
Merchant, 1980
Stewart, 1978

Business mathematics
Edsall, 1980
Merchant, 1980

Calculator keys
Bitter, 1980 b
Bitter and Mikesell, 1980
Kahan, 1980
Maor, 1980 b
McNemar et al., 1979
Moursund, 1979 b, 1980 d
Shult, 1980 b
Math Skills ..., 1980

Calculator logic
Fielker, 1979 a
Gabel et al., 1979
Mitchell, 1979
Mitchell and Blume, 1980
Moursund, 1979 b
Advanced Calculator ..., 1979

Calculator memory
Bitter, 1980 b
Moursund, 1980 c
Toth, 1980
Wavrik, 1979

Calculus
Briggs, 1979
McCarty, 1980
McCune et al., 1980
Miel, 1980
Peckham and Weir, 1978
Rosser and DeBoor, 1979
Sloyer, 1980
Warfel, 1980

Checking
Standifer, 1978
Wundrow, 1977

Chemistry
Attard and Lee, 1979
Brabson and Seegmiller, 1970
Clare, 1979
Ehrlich, 1980
Gold, 1979
Holdsworth, 1980

Classroom management
McCarty, 1979
McNemar et al., 1979
Rouse, 1979
Colleges
Attard and Lee, 1979
Biondi et al., 1979
Brabson and Seegmiller, 1970
Briggs, 1979
Clare, 1979
Dorn and Councilman, 1980
DuRapau and Bernard, 1979
Edgell, 1979
Edsall, 1980
Egbert, 1979
Ehrlich, 1975
Eisner, 1979
Fearnley-Sander, 1980
Gabel et al., 1979
Gallagher and Brandenburg, 1978
Gerald, 1973
Gold, 1979
Hector, 1979 a, b
Holdsworth, 1980
Hyatt, 1979
Jackman, 1979
Kahan, 1980
King, 1980
Koop, 1980
Lai, 1979
Maor, 1979
McCarty, 1979, 1980
McCune et al., 1980
McLeod and Adams, 1980
Michelow and Vogeli, 1977
Miel, 1980
Packer, 1979
Peckham and Weir, 1978
Rosser and DeBoor, 1979
Rynone, 1980
Stolarz, 1980
Warfel, 1980
Weir, 1979
Calculateurs ..., 1975

Consumer applications
Belstock and Smith, 1980
Bitter, 1980 d
Lund and Smart, 1979
Rothery, 1980 a
Shore, 1980
Sloyer, 1980
Waits, 1979
Wheeler et al., 1980
Wundrow, 1977

Course description
Leake, 1980
Maor, 1980 a
Merchant, 1980
Wheatley, C., 1980

Curriculum
Bitter and Mikesell, 1930
Brolin, 1980
Elich and Elich, 1980
Etlinger and Ogletree, 1980
Hedren, 1979
Johnson, D., 1979
Johnson, K., 1977
Krist, 1978
Michelow and Vogeli, 1977
Plancke-Schuylten, 1980
Reys, 1980
Roesch, 1978
Rosier, 1980
Shulte, 1980
Slesnick, 1980
Sturgess, 1978
Suydam, 1980
Toole, 1980
Trede, 1980
Warfel, 1980
Wheatley, C., 1980
Winkelmann, 1978
Zastrocky, 1980
Beginning ..., 1980

Decimals
Andersen et al., 1973
Bitter, 1979 b
Edgell, 1979
Hoffman, 1980
Lund and Smart, 1979
Wheatley, C., 1980 b

Desk calculators
Brabson and Seegmiller, 1970
Edsall, 1980
Engel and Kunze, 1979
Hohenstein, 1979
Merchant, 1980
<table>
<thead>
<tr>
<th>Differential equations</th>
<th>Elementary (continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moser, 1979</td>
</tr>
<tr>
<td></td>
<td>Moursund, 1979 a, b; 1980 a, b, c, d, e</td>
</tr>
<tr>
<td></td>
<td>Musser, 1980</td>
</tr>
<tr>
<td></td>
<td>Ogletree and Etlinger, 1980</td>
</tr>
<tr>
<td></td>
<td>Pedersen, 1979</td>
</tr>
<tr>
<td></td>
<td>Plancke-Schuyten, 1980</td>
</tr>
<tr>
<td></td>
<td>Plunkett, 1980</td>
</tr>
<tr>
<td></td>
<td>Reys et al., 1980</td>
</tr>
<tr>
<td></td>
<td>Schussheim, 1978</td>
</tr>
<tr>
<td></td>
<td>Shields, 1980</td>
</tr>
<tr>
<td></td>
<td>Shult, 1980 a, c</td>
</tr>
<tr>
<td></td>
<td>Shulte, 1980</td>
</tr>
<tr>
<td></td>
<td>Slesnick, 1980</td>
</tr>
<tr>
<td></td>
<td>Sovchik, 1980</td>
</tr>
<tr>
<td></td>
<td>Standifer, 1978</td>
</tr>
<tr>
<td></td>
<td>Sturgess, 1978</td>
</tr>
<tr>
<td></td>
<td>Tyler, 1980</td>
</tr>
<tr>
<td></td>
<td>Vannatta and Hutton, 1980</td>
</tr>
<tr>
<td></td>
<td>Watson, 1979 a</td>
</tr>
<tr>
<td></td>
<td>Wavrik, 1979</td>
</tr>
<tr>
<td></td>
<td>Weaver, 1979</td>
</tr>
<tr>
<td></td>
<td>West, 1980</td>
</tr>
<tr>
<td></td>
<td>Wheatley, C., 1980 a, b</td>
</tr>
<tr>
<td></td>
<td>Wheatley, C., 1980</td>
</tr>
<tr>
<td></td>
<td>Wheatley and Shumway, 1979</td>
</tr>
<tr>
<td></td>
<td>Wheatley et al., 1979</td>
</tr>
<tr>
<td></td>
<td>Wilson, 1978</td>
</tr>
<tr>
<td></td>
<td>Wyatt et al., 1979</td>
</tr>
<tr>
<td></td>
<td>Zakariya, 1980</td>
</tr>
<tr>
<td></td>
<td>Zweng, 1979</td>
</tr>
<tr>
<td></td>
<td>Calculator Worksheets, 1980</td>
</tr>
<tr>
<td></td>
<td>Le' Renouveau ..., 1980</td>
</tr>
<tr>
<td></td>
<td>Pocket Calculators ..., 1976</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
</tr>
<tr>
<td></td>
<td>Biondi et al., 1979</td>
</tr>
<tr>
<td></td>
<td>Gyles, 1980</td>
</tr>
<tr>
<td></td>
<td>Rynone, 1980</td>
</tr>
<tr>
<td></td>
<td>Vollaro, 1979</td>
</tr>
<tr>
<td></td>
<td>Equations</td>
</tr>
<tr>
<td></td>
<td>Nachtergaele, 1977</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Estimation

- Bitter, 1979a
- Lund and Smart, 1979
- Moursund, 1980d
- Noel, G., 1978b
- Noel, G., 1979b
- Townsend, 1979
- Wheatley, C., 1980b
- Zakariya et al., 1980

Exponents

- Eisner, 1979

Evaluation

- Slesnick, 1980
- Beginning ..., 1980

Finance

- Dickson, 1978
- SMP, 1979

Four-function calculators

- Bitter, 1979b; 1980b, c, d, e
- Blakeley, 1980
- Boyle, 1977
- Carnihan, 1979
- Fielker, 1979a
- Fisher, 1979
- Hyatt, 1979
- Johnson, D., 1980
- Leake, 1980
- Moser, 1979
- Moursund, 1979b; 1980b, c, e
- Romanovskis, 1980
- Schussheim, 1978
- Standifer, 1978
- Vannatta and Hutton, 1980
- Wheatley and Shumway, 1979
- Wheatley et al., 1979
- Yvon and Downing, 1978
- General Purpose ..., 1976
- Le Renouveau ..., 1980
- Paper No. 1 ..., 19..

Fractions

- Andersen et al., 1973
- Edge1, 1979
- Ercolano, 1979
- Hector, 1979a, b
- Lund and Smart, 1979
- Zink, 1980

Functions

- Blume, 1979
- Bristol, 1979
- Dorn and Councilman, 1980
- DuRapau and Bernard, 1979
- Fearnley-Sander, 1980
- Johnson, D., 1979
- Kahan, 1980
- McCune et al., 1980
- Moursend, 1980b
- Nachtergaele, 1977
- Snider, 1980
- Stover, 1980
- Watson, 1979b
- Winkelmann, 1978

Games

- Bitter, 1979c
- DuRapau and Bernard, 1979
- Fisher, 1979
- Hartman, 1979
- Hoffer, 1975
- Lange and Meissner, 1980a, b, c
- Moursund, 1980d
- Rothery, 1980b
- Sackson, 1979
- Shult, 1980b
- Yvon and Downing, 1978
- Pocket Calculators ..., 1976

General mathematics

- Toole, 1980

Geometry

- Lamborn, 1980
- Roberts and Roberts, 1978
- Shuler, 1979
- Sigurdson et al., 1973
- Turinese, 1979
Gifted
Maor, 1980 a
Musser, 1980

Handicapped
Johnson, K., 1977
Wheeler et al., 1980

History
Merzbach, 1977
Turck, 1972

Industrial education
Roberts and Roberts, 1978

Industry
Jagannath, 1980

Integers
Carnihan, 1979

International
Shimada, 1980
Suydam, 1980

Iteration
Le Renouveau ..., 1980
SMP, 1979

Junior high
Balka, 1979
Bitter and Mikesell, 1980
Brolin, 1980
Brown, 1979
Burt, 1979
Chang, 1979
Engelmeyer, 1979

Junior high (continued)
Fielker, 1979 a
Hirsch, 1980
Hoffer, 1975
Johnson, K., 1977
Maor, 1980 a
May, 1980
Meiring, 1980
Miles, 1980
Mitchell, 1979
Noone, 1980
Rothery, 1980 a, b
Shulte, 1980
Sigurdsen et al., 1973
Sturgess, 1978
Szetela, 1980
Toole, 1980
Toth, 1979
Watson, 1979 b
Weaver et al., 1979
Wheatley, C., 1980 b
Wilson, 1978
Wundrow, 1977
Pocket Calculators ..., 1976

Kit
Math Skills ..., 1980

Logarithms
Snider, 1980
Stover, 1980

Logic
Gadrey, 1976

Low achievers
Engelmeyer, 1979
Noone, 1980
Paasonen, 1980
Rothery, 1980 a

Marketing
Eastman, 1980
Ikeda, 1980
Measurement
Bitter, 1979 b

Mixed operations
Fisher, 1979
Lappan and Winter, 1979

Multiplication
Bitter, 1980 e
Engelmeyer, 1979
Hatch, 1979
Hoffman, 1980
Leutzinger and Nelson, 1980
Moser, 1979
West, 1980

Music
Bowsher, 1980

Naval applications
Dickson, 1978

Navigation
Rogoff, 1980

Numerical analysis
Gribaumont, 1977
Meissner, 1980 a, b.
Michel, 1977
Miel, 1980
Noel, G., 1979 a
Noel, Y., 1978
Smith, 1979
Wilmet, 1977
Zakariya et al., 1980

Parents
Balka, 1979
Eastman, 1980
Sovchik, 1980

Pattern searches
Lund and Smart, 1979
Stoner, 1980
Watson, 1979 b

Pharmacy
Koup, 1980

Physics
Gabel et al., 1979
Killingbeck, 1976

Place value
Bitter, 1979 a
Moser, 1979

Post-secondary
Attard and Lee, 1979
Berg, 1979
Boardman, 1979
Campbell, 1979
Dickson, 1978
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