This third paper in a set on computer usage in mathematics education provides an annotated listing of selected books, articles, and other documents on computers. Entries are organized by topics: the general educational role of computers; computer languages and programming; and mathematics instruction applications, including teaching about computers, general uses in mathematics classes, tutorial and practice modes, and problem-solving mode. For other documents in this series, see SE 016 289 through SE 016 292. (Author/DT)
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THE USE OF COMPUTERS IN MATHEMATICS EDUCATION
RESOURCE SERIES

III. THE USE OF COMPUTERS IN
MATHEMATICS EDUCATION: BIBLIOGRAPHY

Part 1. General Educational Role
Part 2. Languages and Programming
Part 3. Mathematics Instruction Applications

ERIC Information Analysis Center for
Science, Mathematics and Environmental Education
The Ohio State University
Columbus, Ohio 43210

February 1973
THE USE OF COMPUTERS IN MATHEMATICS EDUCATION
RESOURCES SERIES

This is a set of papers and bibliographies addressed to both mathematics teachers and mathematics educators. An introductory paper discusses the general role of the computer in education. A second paper considers the use of computers in what is at present their most widely-used role, as a tool in mathematics problem-solving. A third paper reviews research related to computer uses in mathematics education. A three-part bibliography includes selected references on the general role of computers, on language and programming, and on mathematics instructional applications.

The titles in this resource series are:

The Use of Computers in Mathematics Education:
I. COMPUTER INNOVATIONS IN EDUCATION by Andrew R. Molnar

The Use of Computers in Mathematics Education:
II. COMPUTER-EXTENDED PROBLEM SOLVING AND ENQUIRY by Larry L. Hatfield

The Use of Computers in Mathematics Education:
III. BIBLIOGRAPHY
Part 1. General Educational Role
Part 2. Languages and Programming
Part 3. Mathematics Instruction Applications
  A. Teaching About Computers
  B. General Uses
  C. Tutorial and Practice Modes
  D. Problem-Solving Mode

The Use of Computers in Mathematics Education:
IV. RESEARCH ON COMPUTERS IN MATHEMATICS EDUCATION by Thomas L. Kieren

The ERIC Information Analysis Center for Science, Mathematics and Environmental Education is pleased to make these papers and bibliography available.

Jon L. Higgins
Associate Director for Mathematics Education
This publication was prepared pursuant to a contract with the Office of Education, U.S. Department of Health, Education and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their judgment in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official Office of Education position or policy.
Two things must be noted about this three-part bibliography:

(1) This is a selected list of references. Thus, there is no claim that the listing is complete, or that all materials on computers were perused as this listing was compiled. The criteria for selection are not precise, but an attempt was made to select references which those teaching about and using computers would find helpful. A continuum of backgrounds is spanned, from references requiring no previous knowledge of computers to references for those with much experience, for elementary through college levels. Hopefully, the annotations, in combination with the titles, will help the user to ascertain the appropriateness of the reference for his purpose.

(2) Each citation is included under only one category. Obviously, many citations would have been appropriate in more than one category. The user may find that it is helpful to scan each of the categories to be certain that a reference in which he might be interested is not missed.

Lists of references in which an attempt is made to select and categorize are inevitably subject to problems and questions. The compiler reaches points of despair, where he wants to throw up his hands and say, "I'll put them all in one long list!" The user reaches points of frustration, too, where he says, "That obviously doesn't belong in this category!" The categorization is intended to save the user time, a pre-selection process so that the user doesn't have to search through hundreds of references to find the ones he wants to pursue further. Hopefully, it gives the user a more compact and manageable list of those references which are most appropriate to his interests and need for information.

Many of the computer manufacturers and computer systems firms have published manuals or guides to the languages and computers which they make or use. Often these contain specific mathematical applications. Some firms also provide informative pamphlets. It is suggested that these companies be contacted for such materials.

There are many computer projects going on in various schools around the country. Some of the more widely-known ones are noted by one or more references in this listing; e.g., Dartmouth (Kiewit), CRICISAM, LOCAL. For current information on such projects, the reader may find the monthly column on "New Programs" in The Mathematics Teacher, one of the official journals of the National Council of Teachers of Mathematics, to be helpful.

Marilyn N. Suydam
Editor
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BIBLIOGRAPHY

Part 1. GENERAL EDUCATIONAL ROLE


Advantages of computer-assisted instruction and the impact of CAI in the future are discussed.


Advances in the economic implementation and educational capability of computer-based educational systems (and specifically PLATO) are discussed.


A course used in Australian secondary schools is described in detail, with possibilities for further use of computers suggested and a lengthy list of classroom computer problems given.


A project is discussed in which classroom teachers, in daily contact with students, are authoring CAI programs.


The increased use of computers in secondary schools and for teacher education is discussed.
Science 162: 73-77; October 1968.

A brief review of the rapid growth of CAI is given, with several different 
modes of application characterized and some problems discussed.

1969. ERIC: ED 034 433. Not available from EDRS.

This is a collection of papers reflecting the trends in research and 
development in CAI, intended for the reader with no CAI background.

Baker, F. B. Computer-Based Instructional Management Systems: A 
First Look. Review of Educational Research 41: 51-70; February 

A number of existing computer systems, their functions, and their level 
of development are described and compared.

ERIC: ED 029 512. Not available from EDRS.

Selected articles dealing with CAI are briefly annotated.

Barnes, O. Dennis and Schrieber, Deborah B. Computer-Assisted Instruc-
tion: A Selected Bibliography. Washington: Association for Educa-
tional Communications and Technology, March 1972. ERIC: ED 063 769.
Hard copy not available from EDRS. Microfiche, 240p.

This book includes citations for 835 journal articles, books, articles 
from edited books, and technical reports or memos.

Warnings against the system of beliefs described as the computer mentality are presented, and the effect computers may have on the educational process is discussed.


Although CAI appears promising, little use of it is being made other than as a programmed textbook: more research needs to be done and costs need to be reduced.


Key problems that remain to be solved in the development of a computer assisted instruction system are discussed.


Use of the high-cost computer in ways other than as a tutorial tool is discussed: teacher-controlled classroom use, non-tutorial classroom demonstration, simple games, and information retrieval.


The PLATO system, tutorial and inquiry logics, and university courses using PLATO are discussed.

Changes necessary before computers become part of the school system are depicted, as well as ways computers can aid in strengthening education.


A brief description of a computerized classroom is given, with reference to printouts which summarize a student's progress and automatic branching to the next portion of the student's program.


This is an account of how a computer department was set up in one school. Included is a discussion of how the computer is used in education and a brief look at the future.


Monetary and education benefits of computer managed instruction vs. computer-assisted instruction are discussed, with the advantages of highly flexible master teaching systems stressed.


An evaluation of computers in education is given, with three types of activities discussed.

A way in which two or more students may interact with the computer and each other is suggested. Several modes of operation are described including an interactive laboratory experiment.


"What may be expected in the next few years in developments from the field of time-sharing" is discussed. Development, objectives, capabilities, and drawbacks are presented.


Results from CAI research, recommended research areas, generalizations about research, and current trends in CAI are discussed.


Among the chapters are ones on using computers to individualize instruction, computer programming courses in secondary schools, teaching the computer sciences, research, and information processing for educational systems.


Opportunities in computer technology applied to solving problems in manufacturing, transportation, medicine, engineering, and other fields are presented.

No uniform "job description" for teachers in CAI appeared feasible, but it was suggested that a set of functions could be identified together with skills required for their performance.


Some of the advantages, limitations and possible applications of CAI systems are mentioned.


A filing system which aids in individualizing instruction is made possible by the computer. The instructional model used in developing IPI is discussed.


The role of the computer in the Individually Prescribed Instruction (IPI) project is described.


Various programs set up using computer instruction at various universities and school systems are described, and advantages and disadvantages of CBI are cited.

The state of the art in computer-based tutorial systems is presented, discussion of some strengths and weaknesses of this use of the computer.


A CMI system designed to aid teachers by monitoring student’s performance on behaviorally defined learning objectives is described.


Characteristics of time-sharing systems and factors involved in determining capabilities and costs are discussed. Included are a table for comparing costs, a list of national time-sharing services, a time-sharing checklist, and a sample rating sheet.


Based on a nationwide survey of secondary schools sponsored by NSF, the study describes the extent and degree of computer use in schools. Statistics on the nature and purpose of computer use, the type and level of support, school characteristics, and plans for future use are included, as is the survey instrument.

The difference between computer-assisted and computer-managed instruction is explained, individualized instruction is defined and discussed, and the computer function in PLAN is described.


Computer instruction projects, equipment, research, problems and prospects are reviewed.


This is a directory of projects dealing with CAI, primarily at the college level, based on a survey intended to uncover fugitive sources of information.


The general principles of computer operation and the concepts and methods of programming are described in this introductory text aimed at educators with little or no experience in the field of CAI. The book provides a set of steps and several useful devices for implementing most kinds of lessons on a computer.

The mobile lab, supplemented by small computers and by larger time-sharing computers, provides a network service in Oregon.


The history of time-sharing, possibilities which time-sharing allows, the operation of a time-sharing system, and areas in which improvement is needed are presented, with diagrams and printouts included.


This book is a self-teaching introduction to the field of digital computer usage, and is appropriate for use by secondary school students.


Provided are 61 references published from 1963-1968 giving information on CAI research and development, theoretical bases for CAI, types of CAI systems, languages, cost factors, and descriptions of CAI programs.


The described branched test could provide the same information for the mathematics unit studied as a conventional paper-and-pencil test in one-half the time and with substantially greater reliability in aiding instructional decision-making.

Twenty-eight references published since 1968 are listed, with special emphasis on Project PLAN and IPI.


The role of the computer in PLAN is described; this is a CMI system to assist the student to take as much responsibility as possible in the planning of his own education.


An instructional management system in which the computer provides daily reports of individual students' progress, used during 1967-68 in two first grades, is described.


This is a review of what has been done in CAI and its effectiveness.


This report of a conference at the University of California-Irvine includes a survey of development in computer-assisted instruction, library utilization, and administrative record-keeping procedures.

The role of the computer in individualizing instruction, as a facilitator of instructional management, and as a facilitator of instructional assistance are discussed.


The potential of the computer in the classroom is discussed.


This report of a conference at Lake Arrowhead, California, describes how computers work and what they can and cannot do. Innovative uses of electronic data processing in education are presented, with a discussion of the traditional and the changing roles of teachers.


Included in this handbook are chapters on CAI research, specifications, materials, and costs.


A look at CAI at the college level is presented with emphasis on programs. The problems of faculty time and economics are discussed.

Described is USOE's financial support since 1965 of computer projects in computer-presented instruction, problem solving, instructional guidance and management, long-term training and curricula, short-term training, specialized data development and analysis, automatic data processing, information management and retrieval, administration and organization, networks, and consortia.


A graduate level course using CMI to teach the techniques of programmed instruction was developed and tested.


Some computer applications in instruction, pupil and staff records processing, and management and administrative decision-making are suggested, and a curriculum for computer science education is presented.


This review focuses on theoretical and experimental development that used CAI as a research tool or as an educational system.

An analysis of some of the factors within CAI that may cause changes in teacher role is presented.


Predictions of how computers will influence society are presented.


The use of a computer as a resource from which a teacher may get ideas for instructional aids for certain teaching units is described.


The cost of CAI and the circumstances under which a school system should consider installing such equipment are discussed.


Details on how to obtain a computer and applications are included.


Provided is a compilation of abstracts of available CAI programs; a total of 226 programs in thirty subject matter areas are categorized. A Survey of the Literature is also available.

The activities of the teacher in the CAI class are discussed.


Teachers who used the resource units increased the number and improved the quality of individualized instruction tasks as determined by an experimental design using trained observers.


This is a collection of 20 papers presented at a conference held at Austin, Texas in 1968. For a review of this book, see ERIC: EJ 048 972.


Researchers and teachers used computers during off-duty hours for a school year. Topics included computer applications, programming, and Coursewriter and APL languages.


Cost-effectiveness and utilization of the ESEA Title III-funded CAI system for New York City (1968-1969) are described. An indication of high cost-effectiveness in compensatory education in the future is projected.

Described is the first installation of PYRAMID (Program Yielding Rapid Access Major Information Device), a computer-controlled library of taped audio and visual supplementary instructional materials accessible from individual carrels.


A realistic look is taken at some claims for CAI which are not supported.


A perspective of the time-sharing computer field is given, with special emphasis on applications requiring man-computer interaction.


A Washington State University interactive CAI system using FORTRAN is described, with examples of computer-student interaction.


This report surveys the various means of implementing a computer resource: commercial time-sharing, small-scale time-sharing systems, multi-use minicomputers, and minicomputer systems. Each approach is analyzed for cost, support required, number of students supported, how the students made use of the resource and its educational limitation.
are also reviewed. The implementation of high level languages, such as FORTRAN and BASIC, are considered for their educational utility and the number of students they can support. A survey of minicomputers and suitable peripheral equipment is appended.


The advantages of shared-time computer use and some of the uses to which computer assisted instruction has been put are described.


Presented is the theoretical base of Project IMPACT (Instructional Model Prototypes Attainable in Computerized Teaching), designed to be economically competitive while achieving highly individualized instruction.


This editorial argues that the American system of decentralized educational control will be responsible for CAI's being a pronounced failure in the future, because of the cost factor.


The systems approach, test theory, and the development of computer-managed instruction are analyzed as needed components of programs featuring self-selection and self-pacing.

This is a compilation of CAI programs and projects. Information includes program name, author, source, description, level of instruction, use of program, availability of program, language programmed in, and other data.


A brief survey of the current usage of computers as an instructional tool is given.


The use of computers at an inner-city high school was investigated. It was found that a wide variety of students benefited from using BASIC with a teletype terminal. The majority of the students in a select group mastered the basic features of FORTRAN in a one-week period. Methods of training teachers to use computers as a tool of instruction was also studied.


This is a report on time-sharing developments, particularly at Dartmouth. Attempts to assess the value of this kind of program in other locales are made.

This is a report on an NSF-sponsored conference at which the importance and uses of the computer in mathematics and other fields were discussed.


Availability of individuals with appropriate skills, sufficient funds, faculty attitudes and incentives, and poor documentation of programs were among the obstacles cited as critical in the adoption of CAI.


Cost analysis of several computer systems indicated that CAI can be an effective tool for education and can be justified economically in institutions of higher education if the demand for CAI instruction time is extremely large.


This is a report by a panel of ten scientists and educators who inspected CAI projects at seven research and development centers.


Some questions to be considered in evaluating CAI are presented and briefly discussed.

This is a brief review of some of the procedures and pitfalls involved in implementing a CAI project in a hypothetical school system.


Technical, economic and political obstacles to the development of complete computer systems in education are discussed.


This is a review of the uses of computers in many educational fields.


A general summary of USOE's support of projects on computers in education during 1967-69 is given.


The relevance of the computer to academic disciplines is discussed and a list of over 200 programs is presented.

The development of a non-federally-funded project, based on the Southern Minnesota School Computer Project (which receives no federal funds for hardware or communications) is described.


This is a rather devastating critique of those who think that machines of any kind can replace a teacher.


The way computers and other technology are used is considered. Limitations of the Stanford CAI system are noted and the time factor in developing CAI materials is decried.


This is a report by a project director indicating the use of the computer in the Kansas City Schools; the use in mathematics instruction is included.

The use of minicomputers is discussed, followed by consideration of factors to consider before investing in minicomputers.


Both published and unpublished articles are cited (1954-1969). CAI articles are listed separately, no annotations are included.


The components of descriptive and prescriptive computer-based systems designed to aid teachers in the management of instruction are identified, and the tasks for which computer support is appropriate are described.


A preliminary version of a computer-oriented information system to assist IPI is described.


A brief, elementary description of the computer's uses in drill-and-practice, tutoring, inquiry, problem-solving, simulation, and other roles is presented.

This is a review of CAI, its various uses, and difficulties such as the lack of common characteristics among CAI hardware and software.


The several modes, parameters, instructional logic, and instructional decision rules of CAI are described.


A model for the monitoring and management of the instructional program was developed and is described in some detail.


The question is viewed as inappropriate within a system constrained by traditional classrooms, school days, and school administration. Radical changes in instructional methods and administration are predicted, and it is claimed that the technical problems of CAI will not be cost-prohibitive.


The history of computers, the anatomy of a computer, software, computer language, computer manufacturers, time-sharing, applications, costs, and the future of computer science are all discussed.

Questions which the teacher is likely to have about CAI are answered, with illustrations of different tasks which a computer can be used for in a school.


An exploratory phase in which junior and senior high school students constructed instructional programs was followed by an investigation of the effectiveness of CAI in the development of social studies problem solving skills at the eighth grade level.


Research is reported on the development of psychological theory and the design and use of a computer-based instructional system.


This book contains an overview of computer assisted instruction.

The potential for computer use in skill subjects, the hope it provides for accommodating individual differences, and the relief from routine record-keeping it can provide are cited. Problems include machine reliability and costs, the need for audio messages, and the need for sound programs.


What CAI is and what it can do are discussed. Prospects for future work and an overview of some significant research are presented.


The "Socratic System" where the computer states a problem and then provides a framework in which a student can proceed to solution was explained, with examples.


A project in which the computer is used in the classroom is discussed, indicating advantages, such as increased motivation, as well as problems.


A university interactive computer system for instruction, recording, and management is described.

This is an annotated bibliography of 424 selected books, reports, and papers which relate to computers, computers as teaching aids, and computer languages.


A list of published works on computers and their use in education is given.


A computer-based teaching system, written in ALGOL, is described. It operated in three modes: teacher (a set of information and constructs), student (a CAI program), and dialogue (for student-browsing).


This is an interestingly written and pictured discussion of various computer uses, providing general background.


Cooperative purchasing and the use of mark sense card readers to enable schools to afford the best computers available for use in classroom work are recommended.
Guidelines for testing the validity and effectiveness of a CAL module are given.

Eight major misconceptions are cited, with several suggestions that could be used to provide computer experiences in the schools so as to avoid these misconceptions.

The computer is viewed as being very useful in mathematics, while its usefulness in other subject areas is viewed with uncertainty.

This is a comprehensive review of the practical implications of timesharing data processing techniques.

Information on computer-based instructional systems are included. Literature surveys and reviews, conferences and symposia, and professional organizations.


Dimensions and modes of computer use in education, advantages and limitations and lists of literature surveys, reviews, societies, and services are included.


This guide is intended for those who are concerned with the planning of computer courses for the training of teachers. Suggestions for content and methods are included. Included are the study of the computer itself and some indications of the influence of the computer within subject areas and its effect on society. The guide can be used by informed teachers when preparing courses for secondary school children.


This guide lists commercially available products and services in the field of computers and education. Manufacturers' reports on educational computer systems, computer training devices and instructional aids, teacher aids and courses, instructional systems, services and other are listed by sections.
Outcomes from a seminar including experts in CAI are presented, including a comprehensive statement concerning the value of computers in schools, a description of the system approach, and an outline of the essentials of computer operation. The need for guidelines and the problem of costs is noted.

A model for calculating the minimum cost of performing specified instructional tasks was developed; data for CAI is presented. It was concluded that CAI can be economically justified only if it becomes the dominant mode of instruction in a given instructional environment.
BIBLIOGRAPHY

Part 2. LANGUAGES AND PROGRAMMING


A formal programming language for writing and checking proofs is defined and its computer processing requirements are specified. Attempts at verifying some simple semantic inferences for a discourse on finite geometry are reported.


This computer science text has a primary emphasis on FORTRAN programming. It is suitable for secondary school students who have completed first-year algebra.


This text provides an introduction to computers and programming languages, presents BASIC and FORTRAN, and includes examples and exercises at varying levels of difficulty, complete with flowcharts and computer solutions.


A two- to three-week unit of computer instruction is described and evaluated.

Scores of tests of temperament, programming aptitude, and critical thinking, together with SCAT scores and a measure of mathematical background, were correlated with achievement on an introductory programming course.


High school students who had twice the number of hours of instruction learned FORTRAN as well as college students did.


The Altoona program uses BASIC in grades 8-9 and FORTRAN in grades 10-12. Programming taught in junior high school facilitated problem solving in mathematics and science in high school, and the experimental group using BASIC became better algebraic problem solvers.


Twelve teaching packets for integrating computer programming in existing junior and senior high school courses are included.

A unit on teaching programming concepts is presented, with basic computer and programming ideas explained.


A framework for a general, introductory curriculum in computer science is outlined, with a list of resource materials and suggestions for evaluation.


This reference book contains an introduction to computing and a discussion of number bases, as well as some material on numerical approximation.

As an introduction to Computer Programming  
ERIC: ED 059 530. Not available from EDRS.


An introductory text in computing using ALGOL emphasizes numerical calculations.


University students receiving instruction in FORTRAN via CAI were compared to groups receiving conventional lectures and programmed instruction. All three were found equally effective with no serious negative feelings reported toward machine instruction.


Computer programming with FORTRAN and COBOL is presented.

Bratis, John David. Some Considerations in the Design of Computer Languages for Interactive Problem Solving. (The Ohio State University, 1971.) Dissertation Abstracts International  
32B: 4611; January 1972.

An actual problem-solving situation was analyzed to determine how students used computer languages in solving problems and what modifications should be made in the languages.


This is a grade 12 or college freshman text which takes account of the role of the computer in mathematics instruction, with many ideas for teachers.


This text is a revision of *Numerical Methods and FORTRAN Programming*. Emphasis has been placed on attacking practical problems. The case studies examine problems in depth, complete with flow charts, programs, and printouts.


This book contains details about LOGO and includes several teaching sequences.


Most of the article is devoted to computer programming and computer language courses, with some applications for mathematics and physics. The program of six schools is described briefly.


This is a supplement to Computer Science: A Primer and A First Course by the same authors, with constant reference to the textbooks. Many illustrative problems are included.

Frye, Charles H. *CAL Languages: Capabilities and Applications.* Datamation 14: 34; September 1968.

A concise but relatively complete description of the various types of languages is given, and a system for evaluation of languages is proposed.


Students may use this book as a step-by-step guide as he learns at his own pace at the terminal.

Characteristics of APL, its relation to other popular problem-solving languages, and its uses in education as well as in general problem solving are discussed.


The use of computers in British classrooms and purposes of teaching programming are discussed.


A computer language and hardware for instructional use are discussed.


Hartman, Lyle G. and Behr, Carolyn. A Videotaped Course Designed to Teach FORTRAN. *Audiovisual Instruction* 16: 33-34; February 1971. ERIC: EJ 032 831.

Fifty videotape lessons were developed to teach FORTRAN IV to university students, independent of a particular computer or textbook.


This course integrates use of a computer, using BASIC.


This computer science text emphasizes FORTRAN, and includes examples that could be used in mathematics classrooms.


This is a textbook for pre-calculus students; the programming language APL is used.


This is a comprehensive sourcebook on APL programming and includes examples.


The BASIC language, time-sharing, and debugging are presented, followed by eleven chapters on applications.

Several mathematical units for use with the Wang 370 Computing System are included, for use in algebra 2 or more advanced courses.


No significant differences were found for the order of teaching FORTRAN and BAL. Students preferred the language they would use occupationally, though there was some partiality for the language taught first.


This is (to be) a seven-volume series designed to explain and illustrate computer programming techniques exclusive of numerical analysis.


A complete description and analysis of FORTRAN IV are given, with motivating examples and problems relevant to the work of the behavioral scientist.
A course is proposed for the mathematics student; included are objectives, prerequisites, methods, teaching aids, binary system, computation principles, and machine operation.


This easy-to-read book relates different computer languages and their uses, and traces the growth in complexity of computers.


Computers and binary arithmetic are presented, plus programming and uses of the computer.


This book is designed for undergraduate students in engineering or science; it can be used as a teacher reference for evaluation of functions, solving equations and systems of equations.


This pamphlet contains a simple introduction to BASIC and illustrations of computer applications in mathematics.


This college-level text has some settings with implications for secondary school mathematics.


This book is for students with a vocational interest in the fields of data processing and computer programming. The emphasis is on problem solving rather than proof.


This is an advanced reference text for the teacher, with mathematical discussion of topics followed by a series of related topics for a computer user.


In a summer activity program, superior students were taught the binary system, what a computer is and its limitations, and some BASIC language, and wrote and tested at least two computer programs.


This book contains many sample engineering applications; no previous computer background is assumed.

Each chapter is self-contained, and emphasizes those features of a language that can be used on more than one type of computer; a set of exercises is included. The languages covered are: ALGOL 60, FORTRAN, COBOL, PL/I, and Extended Mercury Autocode; a short introduction is also included for BASIC.


This study compared the learning of FORTRAN taught by computer, programmed text, or conventional text. The mean performance of the computer group was significantly superior to that of the other groups.


This is an elementary introduction and includes examples from mathematics, science and business.


This is a source of problems for computer solution, mainly on matrix theory. Problems are motivated in a story setting.


This text includes 41 lessons and 50 review problems in BASIC.


Readily understood problems, many worked-out or with solutions, are included.


This dictionary contains 1200 entries and many tables, number conversion techniques, lists of computers, and other information.


The emphasis is on the analysis of classes of problems and the design of algorithms, for students of all disciplines.


The state of programming languages and projections for the future are discussed.


This is a collection of over 5,000 abstracts on mathematical and arithmetic techniques related to computers, mostly on the college level.
The EIN (Educational Information Network) is a non-profit organization which coordinates the sharing of educational computing resources. Through its catalog, software (programs) are offered for distribution. Prices are indicated.
Part 3. MATHEMATICS INSTRUCTION APPLICATIONS

A. Teaching About Computers


The use of game-learning computers in sixth grade mathematics classes is described. The game uses memory and storage with cards, cups, and marbles.


This is an elementary programmed introduction to computer hardware.


Among the differences between algebra and computer-algebra are (1) computers generally do not perform algebraic manipulation but do perform indicated operations, and (2) computers make decisions according to if-then instructions.


Some of the many difficulties encountered when applying mathematical theory to the computer are explained, with examples used to illustrate how the computer demands more stress on understanding of algorithms, basic definitions, and numerical theorems.

A novel way of teaching elementary computer science to secondary school students is presented, with the format for the first lesson included.


This is an elementary introduction to what a computer is and how it works.


This book, written by students, encourages others to experiment in constructing computers. Many diagrams are included for simple computers.


The results of a survey conducted during 1967-8 to determine the usage of calculators and computers in programs of mathematics instruction in New York State secondary schools are given. Only 13 per cent of the schools reported having calculators in the mathematics department, with two per cent of these having computer features. Five per cent of the schools had computer facilities which were used by mathematics classes.


This is an introduction to how a computer works.

A simplified computer which can be used to illustrate AND and OR functions is described.


This book is about computing but not about programming. Essays concerning the automated state, the organization of memory, circuit logic, information patterns, and varied uses of computers are included.


Characteristics of computer arithmetic that may cause programming problems are considered. How numbers are stored in a computer, round-off error, overflow, and double-precision arithmetic are among the topics considered.


The use of flow charts in solving problems involving basic arithmetic operations is presented, as an aid in analysis of problems.


How a computer can be constructed from an old gasoline pump for use in the classroom is described. It can be used to check multiplication.

Having college class members act out computer decision is proposed, with an example of the class becoming a prime-generating machine. A list of steps and a flow chart are included in addition to a FORTRAN program.


A computer simulated by students is described, with sample "programs" presented.


A simple demonstration program for explaining to the uninitiated how a computer can "learn" through experience is included.


How to introduce flowcharts and some samples made by elementary school children are included.


A simple classroom activity for demonstrating the binary system, addition and subtraction of binary numbers, simple logic operations, the role of on-off switches, and computer applications is explained. The computer is "constructed" using human components.

Flow charting symbols and how to use them in four charts are presented.


A base-two demonstration with students is presented.


A simulated computer, using only paper-and-pencil procedures, is described.


This book emphasizes algorithm design and flow charts to illustrate how the computer can be used to solve problems.


Articles and excerpts answer many basic questions about what a computer is, how it works, and how it came about in the first place.


Relay games are suggested as an introduction to flow charting.

A classroom activity using computer programming techniques as motivation for computational practice in grades 4-8 is described.


The communication system used by computers is explained. Included are the development of the present system, means of transmission, what is needed, and obstacles to overcome.


A two-week unit on how a computer works is presented, with topics such as the binary system, coding, floating point arithmetic, computer programming and history.


A lesson to familiarize students with the various components of a computer system, demonstrate how some of these components function, and provide an understanding of the use of base two in the memory unit of a computer system is presented.
B. General Uses


Illustrations of how computers were used in the elementary school classroom are given, with students generating their own problems in sixth grade.


Since computer science is not a branch of mathematics, responsibility falls to the mathematics teacher to determine which aspects of it (e.g., algorithmic procedures, flow-charting, rapid calculation) and which languages (e.g., BASIC, FORTRAN, PL/I, ALGOL) are most suitable for teaching mathematical concepts. Several examples are included.


Thirty per cent of the schools offered technically-oriented computer-related courses; 20 percent used computer time for enrichment and supplementary activities; only one school used the computer for tutorial instruction. Two-thirds of the colleges had a recommended computer-related mathematics course, but only one-fourth included computer-related topics.

A majority of the students involved in a five-college, computer-extended calculus project found computer assignments on learning to program BASIC, the limit concept, and the derivative helpful. Generally, the course was considered more interesting with the computer than without it.


Behavioral objectives were developed and procedures devised to transfer records of these from optical scanner answer forms to pupil progress reports. Data on use of this system are reported. Teachers tended either to use it consistently or only once or twice; they either reported on all students an equal number of times or on a select few.


This report describes an undergraduate program designed to produce mathematicians who will know how to use and to apply computers.


Specific recommendations for the inclusion of computer-use in the secondary schools are made.

How mathematics can be taught more effectively with computers, how computers must be programmed, how teachers can be trained, and the effects on the mathematics curriculum were explored in this project using a time-sharing system.


A program for disadvantaged high school students using computers in mathematics and science instruction is described.


Uses of computers in the high school classroom are described, using languages such as BASIC for rapid calculations. Economic feasibility and advantages for all students are discussed.


Several uses of randomness and computer simulation in games of chance and genetics are discussed.


A program on preparation for work in computer science is proposed; general mathematics courses for the prospective computer specialist are cited.
The conclusion that computer programming is applicable in the elementary school is supported by a case-study of one third-grade student's experiences with the computer.


A computer-based instructional system for teaching the notion of mathematical proof is described. The program, how to use it for research and teaching, block diagrams of key program routines, and example curriculums are included.


A program to aid students in developing proofs is described and student reactions indicated.


Ways of using computers for instruction were studied, and a course of study recommended.

Harvey, R. B. Grade Seven and a Computer. School Science and Mathematics 68: 91-94; February 1968.
The class programmed several simple problems after receiving instruction on loops, test and branch strategies, and other simple computer programming steps.


A summary of the literature about computer education is presented, which includes relatively little research on mathematics education.


This is a report on a conference at The Pennsylvania State University, at which the present status and future prospects of CAI and its implications for the teaching of mathematics were discussed, including both machine and program development.


The pedagogical question of what can be done with the computer that is relevant to the mathematics curriculum is reported. Five modes of interaction between computer and students are proposed: problem solving, programmed desk calculator, simulation, drill and practice, and tutorial.


Types and uses of digital computers in secondary schools, specific topics for use in mathematics classes, teacher training, and potential scope of secondary school computer activity are presented.

This is a report on an experimental project to teach computer concepts to academically talented fifth and sixth graders. The unit covered the history of computers, numeration systems, computer hardware, and simple FORTRAN programming.


Developments in CAI at Stanford regarding drill-and-practice via "strands" - a type of branching - are discussed in general terms. Tutorial programs, time-sharing, simulation and gaming, inquiry systems, and hardware developments are briefly described.


Some current uses of computer for individualizing instruction are presented.


General descriptions of CAI and computer programming and some uses of the computer as an enrichment tool in mathematics and science are presented.


A rationale for supplementing the teaching of mathematics through the use of educational technology is presented. Ways of developing technological aids and examples of possible projects are included.

The computer was used to produce report sheets containing statements which the teachers selected by code. Parents and pupils had favorable reactions to the reporting system.


This bulletin describes the possible uses of computers in the mathematics classroom: The operational procedures of computer use and the basic ideas of flow charting are explained.


Use of the computer as a tool for computation, learning concepts, and problem solving is described for Algebra II and Physics courses.


No significant differences were found between students who used a CAI program alone or in pairs.


A one-semester course in junior high is proposed; content included study of the abacus, the slide rule, and computer programming using FORTRAN with flow charts.

A CAI program on probability for statistics students was described.


The development of an NSF-funded computer-oriented calculus text and supplementary materials is described in detail.


The mathematical competence of general education students appears to be enhanced when the content is integrated with computer science applications.


Instructional uses of computers, steps in problem solving, computer systems, and sample problems are presented. Cost analysis revealed that time-sharing systems are the least expensive and most efficient way to use computers as instructional tools in teaching mathematics.


A program which assists the student in learning elementary algorithms of an undergraduate numerical methods course is described in detail, including special programming features and evaluation results.

Students who used an interactive graphics program achieved significantly more than a group not using the computer.


Among the topics included are acquiring a computer capability, choosing a computer language, installing a time-sharing system, administering the computer terminal, using the computer in the mathematics classroom, and a summary of results from 18 schools using the time-sharing computer at Dartmouth.


In 82% of the colleges surveyed, the computer was used in one or more mathematics courses; 73% of the institutions gave students direct access to the computer.


A type of branching CAI program providing the student with objectives, content options, and diagnostic tests is described as used in elementary school mathematics classes.

This is a description of the introduction of computer mathematics in one high school, from its early beginnings as an informal group of interested students to its status as a fully accredited computer course of two classes and a laboratory.


Four computer-based resource units were developed on set theory relations and function, algebra, trigonometry, and analytic geometry. Objectives, multiple-choice questions, programmed materials, and diagnostic computer programs were included. No significant differences in achievement were found when this program was compared with a non-computer-use method.


The course was developed for college-bound seniors with an interest and aptitude in mathematics.


One-third of the 647 schools surveyed used computers; 54% of these used computers for both instruction and administration. Use for problem-solving in mathematics and science and for teaching data processing accounted for over 80% of computer use in instruction.

Project LOCAL, a program to demonstrate and evaluate the use of the computer in secondary school mathematics and science instruction and to train teachers in computer usage, is briefly described.


Descriptions of games, such as Nim, tic-tac-toe, magic squares, roulette, blackjack, etc., and how they may be programmed for play on a computer are given, with sample programs in BASIC and FORTRAN.


Five types of CAI are defined: tutorial, drill and practice, inquiry, calculator, and management. A list of elementary school mathematics programs for CAI is presented.


Excerpts from five interviews with directors of mathematics curriculum development projects are presented, including one with Patrick Suppes of Stanford referring to the CAI work he has done.


A general discussion on using the computer to solve theoretical and applied mathematics problems is given. Examples from calculus are provided.
Various uses of computers are discussed in terms of their impact on learning and curriculum. Some computer activities for a junior high mathematics class are suggested.


The classes in which the computer was used to score and provide immediate feedback on weekly exercises scored significantly higher than classes in which scoring time took a week.


Use of the computer program for PERT, a form of critical path analysis, was found to aid in the ordering of interrelated units of study in mathematics.


The computer-administered test was found to have a correlation of .59 with SAT math scores and GPA. Diagnosis, instant scoring and reporting of results, and ease of administration and of revision were cited as advantages.

Wolff, Robert Francis. A Feasibility Study on the Construction of a Diagnostic Test on Proper Fractions to be Administered, Scored and
A test administered via a teletypewriter effectively diagnosed students' errors.

Young, James Heyward, Jr. The Use of A Computer-Based Resource Guide to Pre-Plan a Unit of Instruction and to Develop Student Attitudes Toward Mathematics. (State University of New York at Buffalo, 1970.) Dissertation Abstracts International 31A: 1700; October 1970.

Teachers who requested materials after preplanning were rated higher on instructional units than those who asked for a "dump".


The introduction of computer science concepts and processes into regular mathematics courses is described.


Some key questions facing secondary schools as they consider the use of computers in their mathematics program are discussed, with some specific suggestions for levels at which a computer might be used.


A history of computers and several computational algorithms and mathematics topics are presented.
No significant differences in achievement were found whether pupils (grades 4-8) or computer selected the problem type, with varied types of feedback.

Brod, Rodney Lynn. The Computer as an Authority Figure: Some Effects of CAI on Student Perception of Teacher Authority. (Stanford University, 1972.) Dissertation Abstracts International 33A: 139; July 1972.

Students were found to form authority relationships for goal attainment with the computer (when using a drill-and-practice program as remedial instruction in mathematics), thus reducing students' perception of the teacher's task-specific authority.

ERIC: EJ 012 289.

This is a report on the nation's largest CAI operation in a public school system. Results indicate definite success based on three criteria: (1) acceptance of CAI by schools and pupils, (2) cost per pupil, and (3) student achievement.


Previous level of arithmetic achievement, intelligence, and reading ability had the greatest effect on success in the CAI drill-and-practice program.

C. Tutorial and Practice Modes


It was reported that (1) pupils were exposed to about one-third the number of drill-and-practice lessons originally intended, (2) the program did not appropriately compensate for individual differences, (3) achievement test results showed no consistent pattern favoring CAI or non-CAI groups, (4) the amount of drill-and-practice in CAI and non-CAI classes was not observably different, and (5) attitudes toward the program of students, teachers, administrators, and parents were favorable.


Developing and implementing a CAI program in mathematics and initial reading to individualize instruction was the focus of this project. Problems and introductory methods are described.


Mathematics and reading programs following a tutorial model are described and results of use are reported.

No significant differences in achievement were found whether pupils (grades 4-8) or computer selected the problem type, with varied types of feedback.

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Previous level of arithmetic achievement, intelligence, and reading ability had the greatest effect on success in the CAI drill-and-practice program.

CAI was effective in improving computational skills in whole numbers, fractions, decimals, and percent for ninth graders.


No significant difference on standardized tests was found for students taught by CAI or conventional instruction. The groups each scored higher on certain content areas.


Pupils who had 3-15 minutes of extra computational practice per day gained significantly from pre-to post-test; however, scores were not significantly different from those of a group with no extra practice.


Students using the computer program achieved significantly better on measures of computational skills than those not using the program.

Dean, Peter M. Learner Versus Teacher Controlled Arithmetic Practice. San Jose, California: IBM Corporation, February 1971. ERIC: ED 047 956. Not available from EDRS.

This study was designed to investigate the effect of allowing students (in grades 4-6) to generate their own addition, subtraction, and multiplication problems and make their own decisions concerning their rate of progress. Students under learner-controlled conditions learned more than students under teacher control.

Students were able to "acquire knowledge" about properties of triangles and quadrilaterals from a CAI program which allowed students to draw and verify figures.


Programmed instruction was compared with CAI for a unit on the concept of significant figures with eighth graders. The overall performance of students using programmed instruction was significantly better than that of students using CAI. The difference was attributable to the poor performance of low ability students using CAI.


A program which will convert a small general-purpose computer to an electronic teaching machine capable of teaching skills with facts of multiplication and addition is presented.


Pupils who used a computer-aided instruction program for practice on multiplication facts gained significantly more than pupils who had only regular classroom instruction in grade 4.

This is a report on the first effort to systematically develop extensive curriculum materials using the LOGO language; teaching sequences on geometry and logic are presented.


The application of LOGO to teaching sequences on numbers and functions is presented; the material on numbers is extremely detailed.


Process models were tested with data from children using CAI. They appear to use different strategies for different combinations, and the strategy used may be a function of the combination itself. Strategies used in grade 3 appear to be the ones for the same combinations in grade 6 in 72 per cent of the cases.


A description of an in-service project in Mississippi is given, with a brief description of the Stanford drill-and-practice program.


The results of the use of the Stanford program for a two-year period are cited.

Several taxonomic schemes for classifying types of computer applications in instruction are reviewed, classifications which may be called CAI are identified, and drill-and-practice modes are discussed in detail within the perspective provided by these classifications.


This report summarizes the development of a commercially available program in computational skills which makes extensive use of computer capabilities. Languages used are APL and Coursewriter III.


Four variables were identified which significantly affected the difficulty of problems: number of operations, sequence of problems, complexity, and conversions. Verbal clues, order of operations, and number of steps had little effect on difficulty.


Specific problem contexts are used to give definition and articulation to central notions like problem, problem form, solution method, and optimal strategy. Strategy formation on extrapolating number sequences and exploring mazes are illustrated. The focus on story problems in algebra is on converting into formal mathematical terms.

The engaging characteristics of CAI that were identified were: its curiosity-provoking aspects, its immediate feedback, its provision of a form of competence-testing for the student, and its presentation of lessons matched to the student’s level of competence. Engagement was highest on easy lessons and did not begin to drop until pupils missed more than 20% of the problems on the drill-and-practice lesson.


This is a report on a project with the School Districts of Philadelphia and Pittsburgh to develop tutorial CAI programs for general mathematics and algebra. Course development, summative evaluation, and a cost analysis are presented along with summaries of the courses and the materials used with them off-line.


Responses for 203 logic problems were analyzed; seven structural variables were found to be significant in predicting problem difficulty (but they accounted for only one-third of the variance).

A significant difference in achievement favored the group taught a unit on probability and statistics with CAI. Attitudes were not different, but students preferred teacher-pupil interaction.

Papert, Seymour. Teaching Children Thinking. Mathematics Teaching 58: 2-7; Spring 1972. ERIC: EJ 056 228.

Computer programs can be written by children to instruct each other.


Use of the Stanford drill-and-practice program is described. The school administration felt CAI was viable, but problems of cost, lack of sufficient programs, plurality of language, and inappropriateness of computer design for educational purposes raise doubts as to its widespread implementation.


The feasibility of using CAI in mathematics courses for elementary school teachers was discussed. No significant differences were found between two small groups of pre-service teachers given instruction on mathematics content by a teacher or via CAI.


A variety of reactions of children in grades K-6 to a PLATO installation are related.

The CAI drill-and-practice program promoted realistic attitudes toward mathematics; it did not prove dehumanizing and no across-the-board negative attitudes resulted.


The McComb, Mississippi CAI mathematics project is described.


Not available from EDRS.

Experiments in computer-assisted instruction are described, with a discussion of why CAI is desirable, type of equipment, types of CAI, and types of responses.


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

Program information and data for pupils using texts on sets, numbers, and probability, and CAI programs on drill, logic, and algebra during 1966-67 were presented and discussed.


This is one of several reports on the Stanford CAI Project. Information on more recent development is available in another book from the same publishers, as well as in articles and other reports.


Research in schools in California and Mississippi is summarized; the Stanford drill-and-practice program and the tutorial program were used.


CAI programs in mathematics were evaluated; the conclusion was reached that problems of lack of teaching training and of time can be overcome by the computer, which can also offer valuable student enrichment programs.


Block and strand CAI drill-and-practice programs in elementary school mathematics are described.

Details of the arithmetic drill-and-practice program are described. There is also an overview of CAI at Stanford since 1963.


A description of a program to review and teach basic number facts as a supplement to the teacher's daily instruction in grade 4 is given. 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.


Research related to the use of the drill-and-practice materials in elementary schools is reported. The sequential variable was identified (from six factors considered) as the most important in determining problem difficulty.

Using the computer to compare the solution of finding the volume of a right-truncated cone given the altitude and half angle is described. Various techniques used in solving the problem are shown, with a flow chart and program in BASIC.


The main goal of COEXIST is to develop a new introductory sequence of calculus courses, accompanied by a physics sequence and an introductory engineering course, relying on the use of time-shared computer and automatic plotting equipment.


"Computer-extended-instruction" is described for use in high school mathematics courses. Several examples are given to show how FORTRAN programs can help students understand mathematical concepts.


How the computer can be used in solving the problem of maximizing an area is presented.

D. Problem-Solving Mode


Each book contains a number of annotated BASIC programs along with some exercises.


The use of remote console of a time-sharing computer for mathematics at the high school level is discussed.


Students at Colorado College in a computer assisted mathematics course did better than students who were not aided by a computer.


College students who used computer homework assignments achieved significantly higher than those who did not use the computer.

This is an eight-volume teaching guide covering many topics in mathematics, science, and social science, with programs included. "Huntington Two," an extension of this project, is continuing the development of computer-related materials.


The use of student-written computer programs simulating the play of the 1969 World Series is described. The probabilities for National League wins were determined under varying circumstances.

Buchman, Aaron L. Patterns in Algorithms for Determining Whether Large Numbers Are Prime. Mathematics Teacher 63: 30-41; January 1970. ERIC: E. 013 60C

The computer and number theory are used to develop successively more efficient algorithms for determining whether large numbers are prime. A program in BASIC is included.


Uses of the computer in calculus courses are discussed.


The four computer-extended instruction units use BASIC; they are intended to supplement a textbook and assume availability of computer facilities.
A Case Study in Mathematics - The Cone Problem.


Using the computer to compare the solution of finding the volume of a right-truncated cone given the altitude and half angle is described. Various techniques used in solving the problem are shown, with a flowchart and program in BASIC.


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"Computer-extended-instruction" is described for use in high school mathematics courses. Several examples are given to show how FORTRAN programs can help students understand mathematical concepts.


How the computer can be used in solving the problem of maximizing an area is presented.

The use of computer is conjunction with a traditional mathematics course is discussed. Some maximization and minimization problems using BASIC are presented.


This collection of 22 teacher-written projects deals with the classroom application of computers. The projects were completed during an in-service summer program at the University of Colorado; the participants used BASIC on remote consoles connected to the GE time-sharing computer system in Phoenix.


The use of the computer in an algorithmic approach to high school analytic geometry is discussed, with a program for exploring the geometric relations between the graphs of two linear equations.


After a brief review of major uses of the computer, the difference between theoretical computation (that of arithmetic and algebra) and practical computation (that actually carried out on a computer) is explored. The limitation of a computer system, with a finite, floating-point, is thus presented.

Changes in calculus resulting from computer use were explored, with pedagogical, structural, and philosophical factors cited.


This is a source book for problems with a wide range of difficulty, mostly at the college level, which can best be solved with the aid of a computer. These are designed to aid in the teaching of problem solving and computer solution rather than mathematical concepts; FORTRAN is used.


During the first years, significant differences were found between seventh grade groups who used computer-programming and those who did not on only one of 11 criterion tests. Learning of BASIC programming language seemed to interfere with concurrent study of numeration systems. During the second year, significant differences favoring the computer group were found on three of 12 tests, with high and average achievers especially favored. The number theory unit seemed particularly relevant for computer use.


This is a review of some of the pedagogical rationales and recent research evidence related to the use of computers as instructional tools in mathematics classrooms, particularly as problem-solving tools.

Writing and using computer programs related to selected mathematical content appeared to positively affect performance on those topics.


This is an advanced text that might be used as a teacher reference for particular topics appropriate to advanced students in secondary schools.


A FORTRAN II program consisting of three basic parts is outlined; generating and storing all primes less than 1000, generating all prime triplets whose replacement set is that of the primes stored in the computer and whose least member exceeds 3, and testing the spacing of each triplet generated for divisibility by 6.


No evidence was found that use of the computer significantly affected generalization skills or achievement, except for certain simple analysis skills.


A BASIC program for developing the algorithm for polynomial synthetic division is described; a flow chart and printout are included.

The use of the computer with BASIC in two eleventh grade classes in integrated algebra/trigonometry and with two twelfth grade classes in mathematical analysis is described.


The computer is used as an aid to teaching the idea of an existence theorem, Gauss's theorem for constructible regular polygons.


This college level text emphasizes applications for the computer.


Simulation and its value to instruction, theorem proving techniques, and the analysis of application of the FORTRAN deductive system are considered.


A single general method, synthetic substitution, is described; it will evaluate any polynomial by giving the computer the coefficients and the value of x for the desired function of x.

Procedures for using FORTRAN and modular arithmetic as a vehicle for generating random numbers are given.


This revision of a 1966 listing contains selected sources of classroom materials or suggestions for classroom use of the computer as a problem solving tool in mathematics, some references on computers in education and computer science, a listing of periodicals and articles, and a list of professional societies.


This is a set of six supplementary student booklets for grades 7-12, containing many exercises. Students write computer programs in BASIC to study concepts and solve problems.


The more effective method of computer utilization appeared to be program-writing with no direct computer-access.

Eighteen laboratory exercises integrating mathematics and physics are given, using new approaches to instruction aided by the computer.


This is one in a series of reports on the Dartmouth project. More recent reports may be obtained by writing to the project.


The Dartmouth time-sharing system from its beginning to 1968 is described.


A series of programmed booklets on "occupationally oriented basic mathematics" were developed for use with a time-sharing system, using FORTRAN.


One quadratic equation is solved with the development of more sophisticated programs (using BASIC) and analysis of data from internal approximation. It is suggested that students then attack the general problem of solving quadratic equations. Research results supporting the use of computers in this way are cited.

Mean achievement of the group using computer programming for problem solving tended to be higher, especially for average students.


How to plan for computer use in a laboratory situation is discussed, with a specific illustration of objectives and content.


This reference contains specific suggestions on how and when to use the computer in a first-year algebra course.


A number of interesting problems are given; the material is written to be used without a computer.


The computer program and some sample printouts are presented and briefly discussed.

A major goal of the project is to produce units in which the computer can be used to enhance the teaching or learning of mathematics, science, and other secondary school subjects. The regional computer system and how it has been used in the schools are described.


After discussion of various uses of computers, computer programming as a tool for teaching problem solving in mathematics is discussed. The CAMP materials and the philosophy of embedding the computer-use in the mathematics curriculum are then described.


Four methods for reaching a pre-set value for Pi are presented, with a listing of each program.


A FORTRAN program to order an arbitrary set of numbers in ascending sequence is discussed.


A matrix algebra course for high school seniors using computer programming with FORTRAN IV is described.

This article puts the computer into a historical perspective, illustrating the extraction of square roots with a flow diagram and a seventeenth century algorithm.


This somewhat-dated booklet contains a general description of computers and computer-assisted problem solving in mathematics.


Many mathematics curriculum areas with potential for computer use are given in this report, as well as more detailed information on some selected mathematics problems.


This is one in a series of reports on the Dartmouth time-sharing project.


No significant differences were found on the language test or in number of mathematics problems solved, but students preferred the time-sharing mode to quick-batch and slow-batch modes.

A computer program and output for a problem in calculus are presented.


Reported is a project designed to use the computer as the basis for a laboratory approach to the presentation of mathematics. Classroom instruction was augmented by student experiments in devising and testing mathematical algorithms on the computer.


Students who used a computer scored significantly higher on some (but not all) measures of achievement than those not using the computer.


This introductory text on solving problems with BASIC includes many problems for use in secondary school mathematics classes.


The use of the computer in an exploratory mathematics program in elementary numerical analysis is discussed. Examples are included on numerical
integration, matrices, linear equations, and various methods for finding roots of polynomials.


An experiment designed to test the effectiveness of computer use by junior college students is reported. No significant difference in achievement was found between 15 students using the computer as a calculator and 15 students using pencil and paper.


This initial book in a new SMP computer series emphasizes the logical processes of computer algorithms for problems without assuming a particular language or machine application. Flow charts are followed by computer results. Basic computer concepts are developed and mathematical application explored.


This twelfth grade mathematics and computer course textbook extensively describes how the computer works and how to use the computer in studying mathematics. Supplements for FORTRAN and ALGOL are available.


A computer program with flow chart, sample data, and output for the formula for solving n simultaneous equations in n variables is given.

This series of paperbacks, on such topics as "Interest in Money", "Random Numbers", "Population Holocaust", "Excursion in Astrology", and "Your Handwriting", provide applications in computer programming. One idea is presented in each booklet and described in both BASIC and FORTRAN.


The use of the computer to calculate the values of series as approximations to Pi is described. A computer program for computational verification output of two series which converge to Pi is included.


This is a report on the development and use of a course on calculus.


A series of laboratory exercises is presented, with no specific programming language used.


Calculus is introduced using algorithmic concepts; the development of concepts is independent of a specific programming language.

Use of the PDS 1020 computer in statistics and algebra is described. Measurement of effectiveness and recommendations for a continuing program are presented.


About fifty problems, with an explanation for each to motivate the solution, are included.


The approximation of Pi, applying Archimedes’ method with computers, is detailed; the program and output in BASIC are included.


An illustration is given of two classroom applications for the computer: calculating partial sums of convergent series and finding an approximate square root. A rationale for computer education in the mathematics classroom is also provided.


Summing a geometric series and producing a table of perfect squares are suggested as two possible topics for an elementary teacher to present to his class to illustrate the use of computers.

Students who had review of trigonometry using flow charting and elementary computer techniques gained significantly more than those who had trigonometry with or without a computer mathematics course first.


This article demonstrates an iterative method of evaluating the cosine function which can be derived using secondary school trigonometry. A sample computer run is included.


The writing, execution, and correction of computer programs (using CUPL) was found to strengthen understanding of mathematical concepts and result in a strong positive attitude at each of the grade levels studied (7, 8, 12, college freshmen). Although high-IQ students tended to derive greater benefit, average and low-IQ students also benefited.


Various uses of the computer in calculus instruction and changes introduced by computers are discussed. A revamping of the entire course content, rather than merely inserting certain topics from numerical analysis, is proposed.