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ABSTRACT

This publication of the National Science Foundation (NSF) provides brief descriptions of projects related to Mathematics Education which were funded by NSF since the late-1950's. Projects supported fall into four categories: curriculum projects, preparation of teachers, implementation activities, and general (reports, conferences, research). The listing for each project includes the project title, name and address of principal investigator(s), a brief discussion of purposes and progress, and information concerning the availability of materials. (SD)

NATIONAL SCIENCE FOUNDATION

Division of Pre-College Education in Science

Programs for Improving Elementary and Secondary School Education in Mathematics 1975

E-75-32

PREFACE

Improvement of science education is one of the major tasks of the National Science Foundation. The Division of Pre-College Education in Science supports the development and implementation of educational materials and instructional techniques for elementary and secondary schools in mathematics and the sciences, including social sciences.

The projects in mathematics supported by the Division are listed in this booklet as a reference for mathematics educators interested in pre-college education. A few projects supported by other NSF offices are also listed because of their direct relevance to pre-college education.

The Division is comprised of the Materials and Instruction Development Section (MIDS) and the Instructional Improvement Implementation Section (IIIS). The projects supported by MIDS are given in the first part of the booklet while the 1975 projects supported by IIIS are described in the section of the booklet labeled "Implementation Activities."

Information on science and social science projects in the Pre-College Division can be obtained by writing to the Foundation.

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GENERAL

Reports, Conferences and Research Activities

National Advisory Survey on School-Level Mathematical Education. 1974- . Truman Botts, Conference Board of the Mathematical Sciences, 2100 Pennsylvania Avenue, N.W., Washington, D.C. 20037.

Digest. A seven member Conference Board National Advisory Committee on Mathematics Education (NACOME) is directing a survey and critical analysis of school-level mathematical education focusing on:

1. Goals for mathematical education as expressed in State and local school curricula, in innovative teaching and curriculum projects, and in reports of recent research and development planning conferences;
2. The predominant and innovative patterns in current school mathematics course offerings, teaching methodology, and teacher preparation;
3. The patterns of student mathematics achievement as reported in recent large scale evaluation studies (NAEP), State assessment data, and pertinent research.

Materials Available. None. A report of information and recommendations is to be published in Fall, 1975.

Conference on Piaget-Type Research. 1970-1971. Myron F. Rosskopf (deceased), Teachers College, Columbia University, New York, New York 10027.

Digest. The Conference brought together 40 mathematics educators and 15 developmental psychologists interested in pursuing Piagetian research in mathematics education.

Discussion. The one-week program consisted of two basic series of lectures. Hermine Sinclaire of the University of Geneva, Switzerland, presented a comprehensive overview of Piaget's cognitive development theory relevant to research by mathematics educators. Kenneth Lovell of the University of Leeds, England, considered recent Piagetian research relevant to the school mathematics program as well as further needed research. Daily colloquia were addressed by outstanding Piagetians and small seminars enabled participants to discuss research projects and interpretations of existing research.

Materials Available. *Piagetian Cognitive-Development Research and Mathematical Education*, a report of the Conference, can be obtained from the National Council of Teachers of Mathematics, 1906 Association Drive, Reston, Virginia 22091.

Conference on the Middle School Mathematics Curriculum. 1973. Earl M. L. Beard, Department of Mathematics, University of Maine, Orono, Maine 04473.

Digest. This national conference, one of the three held during the summer of 1973 to consider ways of improving school mathematics, focused on grades six through eight.

Materials Available. A report of the conference is available from the project director. This report is also available through the ERIC Document Reproduction Service, P.O. Box O, Bethesda, Maryland 20014.

Conference on Junior High School Mathematics. 1973. Uri Haber-Schaim, Physical Science Group, Newton College of the Sacred Heart, Newton, Massachusetts 02159.

Current Contact: Uri Haber-Schaim, Director of Physical Science Group, Department of Science and Mathematics Education, School of Education, Boston University, Boston, Massachusetts 02215.

Digest. The conference was one of three national conferences held during the summer of 1973 to consider ways of improving school mathematics. The focus was on grades seven and eight.

Materials Available. A report of the conference is available from the project director. It is also available through the ERIC Document Reproduction Service, P.O. Box O, Bethesda, Maryland 20014.

Conference on the K-12 Mathematics Curriculum. 1973. George Springer, Mathematics Education Development Center, Indiana University, Bloomington, Indiana 47401.

Digest. This conference, held in Snowmass, Colorado, was one of three national conferences held during the summer of 1973 to consider ways of improving pre-college mathematics.

Discussion. Mathematicians, educators, and scientists identified current problems, discussed their causes, and proposed actions for improvement. Topics ranged from basic research in problem solving to public concern about incompetence in whole number arithmetic. Application of mathematics in solving real world problems was a central topic.

Materials Available. A report of the conference is available from the project director. It is also available through ERIC Document Reproduction Service, P.O. Box O, Bethesda, Maryland 20014.

A National Conference to Consider the Role in High School of Interdisciplinary Learning through Investigation and Action on Real Problems. 1972-1974. Earle L. Lomon, Education Development Center, Inc. (EDC), 55 Chapel Street, Newton, Massachusetts 02160.

Digest. A working conference met January 2-14, 1973, to examine the feasibility of reforming the high school instructional program to include opportunities for students to work with real problems. The recommendations formulated by the conference are presented in a published report.

Materials Available. Limited quantities of an abridged report are available from EDC. The full conference report is scheduled to be published early in 1975 by Houghton Mifflin Company, 2 Park Street, Boston, Massachusetts 02107.

Conference on Teachers' Centers in Mathematics Education. 1973. Thomas C. O'Brien, Southern Illinois University, Edwardsville, Illinois 62025.

Digest. The purpose of the conference, held April 8-10, 1974, was to provide a forum for discussions on practical and theoretical issues with respect to teachers' centers in mathematics education.

Discussion. Two teachers' centers in the St. Louis metropolitan area are oriented to the needs of elementary school teachers and focused on the development of cognitive operations by children. Other variants of teachers' centers have been established in other areas of the country. There is a need to assess the conditions for success and to consider alternative models for teachers' centers concerned with mathematics education. An informal network for communication among leaders and potential leaders of teachers' centers was encouraged.

Materials Available. A report of the proceedings of the conference is available from the project director.

The Adaptation of Programmed Tutoring to Mathematics (Programmed Math Tutorial—PMT). 1971-1974. Phillip L. Harris, Department of Psychology, Indiana University, Bloomington, Indiana 47401.

Digest. Programmed tutoring techniques originally developed for the teaching of beginning reading were adapted to the teaching of mathematics in the lower elementary school grades. The goal was to increase achievement in mathematics among primary school children.

Discussion. Programmed tutoring—a procedure which provides students with teaching assistants on a one-to-one, individualized basis and uses many of the principles of programmed instruction—has been used successfully for a number of years in the teaching of beginning reading.

In PMT the activities of a tutor are closely controlled by two programs: the *operational* programs specify in detail how the teaching is to be done, while *content* programs determine what is to be taught and the sequence in which topics are to be taken up. (PMT is not tied to any one basal mathematics textbook series.) The programs are such that the need for professional judgment on the part of the tutor is kept to a minimum. For this reason, persons with a limited knowledge of mathematics can perform successfully as tutors.

Expanded pilot testing of first grade materials began in 1971-72, and seven school systems participated in 1972-73. The participating group was substantially expanded for the 1973-74 school years.

Materials Available. Information on the materials can be obtained from the project director.

The Mathematics Aids Program. 1967-1971. Alvin N. Feldzamen, Encyclopedia Britannica Educational Corporation, 425 North Michigan Avenue, Chicago, Illinois 60611. (Grantee: Educational Broadcasting Corporation, 304 W. 58th Street, New York, New York 10019.)

Current Contact: Duane G. Straub, Director of Programming, Public Television Library, 512 E. 17th Street, Bloomington, Indiana 47401.

Digest. Two pilot programs in mathematics were produced for teachers, parents, and others interested in the "new math." The videotape programs, each 30 minutes in length, cover most of the major concepts of the new elementary mathematics curricula.

Materials Available. The two videotape programs, *New World, New Math,* and *New World, More New Math,* are available from the Public Television Library, 512 East 17th Street, Bloomington, Indiana 47401.

Stanford Mathematics Education Study Group. 1974- . E. G. Begle, Stanford University, Stanford, California 94305. (Grantee: Mathematical Association of America, 1225 Connecticut Avenue, N.W., Washington, D.C. 20036.)

Digest. Three instructional variables important in elementary mathematics are undergoing investigation. Findings are expected to be valuable in efforts to increase mathematics learning effectiveness in the classroom.

Discussion. During academic year 1973-74 the project investigated the extent to which a listing and review of prerequisite concepts, skills, and principles is provided; the extent to which nonexamples of the concept are included in student materials; and the number of practice items provided following the exposition of a skill, concept, or principle. The general procedure for each variable was preparation of two programmed versions of an appropriate mathematics topic that differed only in that one version had a high value of the variable under investigation while the other version had a low value. Investigations dealt at the fifth grade level with factors and primes and at the eighth grade level with probability. The programmed units for both levels were derived from programs developed in 1971 and 1972 by the School Mathematics Study Group (SMSG) Research and Analysis staff to illustrate the canonical teaching procedures outlined in the final report of the SMSG Panel on Research. Both of the original programs have been written in such a way that each of the instructional variables identified by the Panel on Tests was clearly evident and independent of other variables; thus each variable could be manipulated without affecting the others.

Materials Available. Inquiries about materials that will result from the study should be addressed to the project director.

A Summer Working Study—Mathematics Curriculum. 1973. Jerrold R. Zacharias, Education Development Center, Inc., 55 Chapel Street, Newton, Massachusetts 02160.

Digest. The working conference conducted a feasibility study for Project ONE, a new program in mathematics drawing upon science, technology, and the arts, and using television and manipulable materials.

Discussion. The aim of the proposed program is to teach mathematical topics to children—especially minority children—ranging in age from 8 to 11. The plan is to use mathematical techniques in realistic problems and situations. The television programs would have high entertainment value and would use a mixture of styles and techniques, including children on-screen, skits, and animation.

Materials Available. A conference report on the summer working study is available from the project director.

An Analysis of Operational School Mathematics Curricula. 1971- . Robert B. Davis, Curriculum Laboratory, University of Illinois, 1210 West Springfield Avenue, Urbana, Illinois 61801, and Herbert Ginsburg (Rand Hall, Cornell University, Ithaca, N.Y. 14850). (Prior grantee: Syracuse University, Syracuse, N.Y. 13210. 1971-1973.)

Digest. Two parallel questions are undergoing investigation with particular reference to elementary school students. (1) What mathematics do schools attempt to teach children? and (2) What do students actually learn? Answers to these questions will lead to a consideration of what changes in mathematics education are desirable.

Discussion. Answers to the first question are being obtained by studying course guides, textbooks, CAI materials, etc., and by direct observation of actual classroom activities. What elementary school students actually learn is being determined by observation of individual students—at CAI terminals, in other school settings, and through "clinical" interviews. Early (and tentative) results suggest sizable discrepancies between what children actually learn and what present curricula seek to teach.

Materials Available. Relevant publications: Robert B. Davis and Rhonda Greenstein, "Jennifer," New York State Mathematics Teachers Journal XIX (3), 94-103 (June 1969); Robert B. Davis, "The Problems of Relating Mathematics to the Possibilities and Needs of Schools and Children," Educational Studies in Mathematics (Holland: D. Riedel Publishing Co., 1971); Herbert Ginsburg, "Children's Knowledge and Individualized Instruction," Educational Technology XII (3), 8-12 (March 1973); _____ The Myth of the Deprived Child (Englewood Cliffs, N.J.: Prentice Hall, Inc., 1972); Journal of Children's Mathematical Behavior, Vol. 1, Nos. 1 and 2, published by the Madison Mathematics Project, 1210 West Springfield Avenue, Urbana, Illinois 61801.

Evaluation of Project SEED. 1971-1973. Donald R. Kerr, Jr., Department of Mathematics, Indiana University, Bloomington, Indiana 47401.

Digest. SEED (Special Elementary Education for the Disadvantaged) is a program in which disadvantaged elementary school children are taught abstract mathematics using a guided discovery method. The project measured the impact of SEED on the self concept of children in Gary, Indiana. Results suggest a positive impact on arithmetic self concept and on attitude toward mathematics, but do not provide a clear picture concerning generalized self concept. An attempt was also made to determine the impact of the experience of the classroom teachers and on SEED teachers.

Materials Available. Copies of the report on the SEED Evaluation Project can be obtained from the project director.

Mathematical Problem Solving. 1971-1974. Joseph M. Scandura, Graduate School of Education, University of Pennsylvania, Philadelphia, Pa. 19104.

Digest. The project investigated the question of why certain students who have all the appropriate component skills are successful in solving problems, while other students who have

the same skills are not successful. The research dealt specifically with the relation of so-called "lower order" rules to "higher order" rules.

Materials Available. Details about the research and information about published reports of its findings may be obtained by writing to the project director.

Cambridge Conference on School Mathematics. 1963-1971. William T. Martin, Education Development Center, Inc. (EDC), 55 Chapel Street, Newton, Massachusetts 02160.

Current Contact: John Joanou.

Digest. The Cambridge Conference on School Mathematics was an association of prominent mathematicians who came together originally because of a shared concern about the quality of mathematics education in elementary and secondary schools, and with the preparation of teachers of mathematics. Three major conferences were held between 1963 and 1967. For each conference a report was published.

Discussion. A group of 25 mathematicians and users of mathematics met in 1963 to explore long range curriculum reform needs in mathematics. The report of that conference, which was published under the title *Goals for School Mathematics*, provided guidelines for further curriculum-related activities.

The CCSM decided at the outset that it should not concern itself principally with preparation of materials for classroom use, but should leave that to others. However, it was felt that some materials should be developed and tested to demonstrate the feasibility of the goals that had been proposed. A total of 46 feasibility studies were conducted; of these, 19 are available.

A second major CCSM conference was held in 1966 to consider problems in the training of mathematics teachers; most elementary school teachers were unable to cope with the changes being made in mathematics curricula. The outcomes of that conference were reported in *Goals for Mathematical Education of Elementary School Teachers.*

A third conference in 1967 was the result of a growing concern over the gulf between school mathematics and school science. The recommendations from this conference appear in *Goals for the Correlation of Elementary Science and Mathematics.* One outgrowth of this conference was initiation of the Unified Science and Mathematics for Elementary Schools (USMES) curriculum project.

Materials Available. The conference reports are available from Houghton Mifflin Co., 2 Park Street, Boston, Massachusetts 02107:

Goals for School Mathematics (1963).
Goals for Mathematical Education of Elementary School Teachers (1967).
Goals for the Correlation of Elementary Science and Mathematics (1969).

The 19 published feasibility studies are available through ERIC Document Reproduction Service, P.O. Box O, Bethesda, Maryland 20014.

Georgia Center for Research in Mathematics Education. 1974- . Leslie P. Steffe, Department of Mathematics Education, University of Georgia, Athens, Georgia 30602.

Digest. This project represents the beginning of a concerted, long-term effort to provide an understanding of the parameters involved in effective learning and teaching of mathematics at the pre-college level. A combination of research and workshops during this first year of the project will establish investigations along three thrusts: Concept Development, Analysis of Teaching Strategies, and Problem Solving.

Discussion. The goal of the Center is to develop coordinated programs of research, both basic and applied, in well-defined directions. The intent is to develop a coordination of effort among many researchers with common interests.

Materials Available. Project reports and monographs are available from the project director.

CURRICULUM PROJECTS

Elementary and Secondary School

School Mathematics Study Group (SMSG). 1958-1972. E. G. Begle, School of Education, Stanford University, Stanford, California 94305. (Original grantee: Yale University, New Haven, Connecticut 06520. 1958-1961.)

Digest. The primary purpose of SMSG was to foster research and development in the teaching of school mathematics. The project produced materials in mathematics for students and teachers in the elementary and secondary schools.

Discussion. Major objectives of the study group were preparation of sample text materials designed to illustrate the kind of curriculum that the members of the group felt was demanded by the increased use of science, technology, and mathematics in our society, and the preparation of materials designed to help teachers prepare themselves to teach such a curriculum. A second major activity was the contribution of the National Longitudinal Study of Mathematical Abilities in which students originally in grades 4, 7, and 10 were followed for five years to determine the effects of conventional, SMSG, and other new course sequences on performance in mathematics and science. This activity was extended to grades K-3, for which special tests measuring mathematics achievement were developed to evaluate higher cognitive skills usually ignored by standard tests. While the main thrust was the investigation of mathematics achievement in terms of curricular materials, the study was also concerned with such variables as socio-economic status, and the timing and placement of exposures to mathematical concepts.

SMSG also carried out some experimentation with specialized materials designed to fulfill specific needs in mathematics education. Available materials include:

1. Elementary School Texts—The elementary school materials are designed for use in self-contained classrooms and are suitable for average students as well as for those of higher ability. For each of the grades 1 through 6, there is a student text and a teacher commentary; for kindergarten, there is only a teacher book.

2. Junior High School Texts—These texts review and extend the mathematics of the elementary school in such a way as to provide a sound intuitive foundation for high school courses. A considerable amount of informal geometry is included. Each text is accompanied by an extensive teacher commentary.

3. Texts for Slower Students—These texts include the bulk of the mathematics for grades 7-9 listed in the series above and below, but with the level of reading difficulty reduced. It is expected that students will proceed through these materials at a slower rate. Each text is accompanied by an extensive teacher commentary.

4. High School Texts—These texts are designed for average and above-average students in a college preparatory program.

5. Supplementary Materials—A variety of booklets is available. Their common characteristic is that each requires less than a full academic year. In addition to the revised version of *Mathematics Through Science*, the unit *Mathematics and Living Things* is available in preliminary form. It is designed for use at the eighth-grade level and uses biological experiments to motivate mathematical ideas.

6. Supplementary and Enrichment Series—Most of these pamphlets are designed to allow teachers to try short modern treatments of particular mathematics topics in class. Student texts and teacher commentaries are available for most of the topics, though some pamphlets are designed for independent study or enrichment.

7. New Mathematical Library—This consists of a series of short expository monographs on various mathematical subjects. Objectives of the series are dissemination of good mathematics in the form of elementary topics not usually covered in the school curriculum, awakening of interest among gifted students, and presentation of mathematics as a meaningful human activity.

8. Studies in Mathematics—The books in this series are intended for teachers. Some provide background for a specific student course, and others are more general in nature.

9. Filmed Course for Elementary School Teachers—This course consists of 30 half-hour color films. The series is intended primarily to provide in-service elementary school teachers with a foundation in mathematics for any of the newer elementary school mathematics programs. *Brief Course in Mathematics for Elementary School Teachers* from the series *Studies in Mathematics* is designed to accompany the filmed course. The first 16 of the films provide a suitable background in mathematics for teachers of grades K-3. The remainder, building on these, is concerned with mathematics normally taught in grades 4-6.

10. Secondary School Mathematics—This is the second round of development of text materials suitable for all students at the junior high school level. The content is organized into 14 booklets of 2 chapters each and 14 teacher commentary booklets.

11. *ELMA Technical Reports* contain tests and other measuring instruments used in the Study of Elementary Mathematical Abilities. Certain findings of the study appear in two volumes titled *A Longitudinal Study of Mathematical Achievement in the Primary School Years: Description of Design, Sample, and Factor Analyses of Texts* and *A Longitudinal Study of Mathematical Achievement in the Primary Years. Curriculum and Socio-Economic Comparisons and Predictions from Previous Achievement.*

12. *NLSMA Reports* contain the results, instruments, and descriptions of the National Longitudinal Study of Mathematical Abilities. There are 33 reports of this five-year study of approximately 112,000 students in grades 4-12.

13. *Soviet Studies in the Psychology of Learning and Teaching Mathematics* include 14 volumes of translated articles and books.

In addition to the above, the study group has (1) arranged for translation of some publications into Spanish, (2) prepared programmed learning materials in various areas, and (3) prepared numerous reports and supplementary publications.

Materials Available. For information about the activities of the SMSG, a list of publications and films, or to receive the SMSG Newsletter, write to the project director. All the published materials are available from A. C. Vroman, Inc., 2085 E. Foothill Boulevard, Pasadena, California 91109.

Elementary School

Project for the Mathematical Development of Children (PMDC). 1974-

Eugene D. Nichols, Florida State University, Johnston Building, Tallahassee, Florida 32306.

Digest. The primary purpose of the Project activities is to gain new insights into the ways in which young children acquire mathematical concepts and skills. These fall into the following five themes:

1. Investigation of the role of symbolism, verbalization and generalization in the development of mathematical concepts.

2. Theory verification of the Piagetian model for learning and teaching mathematics.

3. Clinical observation and individual interviews aimed at investigating children's patterns of thinking, their mathematical behavior (with special emphasis on development of misconceptions) and the effect of programs and teachers on children's development of mathematical concepts and skills.

4. Theory and model building of questioning and interview techniques, the use of the emerging theories and models in the training of teachers in interview techniques.

5. Assessment of children's knowledge and performance capabilities; assessment of teachers' behaviors.

Discussion. The project was organized following recommendation of a National Conference supported by Florida State University. Modules are produced for investigating questions related to the themes. It is anticipated that some of these modules will be refined into materials for use in first and second grade classrooms.

Materials Available. Newsletters and Conference Report (September 1973) are available from the project director.

Mathematical Problem Solving Project (MPSP). 1974- . George Springer, Mathematics Education Development Center, Indiana University, Bloomington, Indiana 47401.

Digest. The project is investigating ways of developing the problem-solving abilities of children and is preparing materials for use in grades 4, 5, and 6. Research is being conducted on the strategies used in solving mathematical problems and the means of of teaching them. The electronic hand calculator is being studied as a tool for use in problem solving and modules for problem solving are being prepared which can be inserted into the curriculum. The work is being carried out at three centers: Indiana University, the University of Northern Iowa, and the Oakland Schools in Pontiac, Michigan, with the cooperation of the National Council of Teachers of Mathematics.

Discussion. It is planned to produce a series of small modules which can be inserted into the curriculum in grades 4, 5, and 6 to develop the problem-solving abilities of the children.

Materials Available. A newsletter is available from the project director.

Basic Research on How Chiidren Learn Mathematics. 1974- . Hassler Whitney, Institute for Advanced Study, Princeton, N.J. 08540.

Digest. The nature of the activity for the project has two closely related directions.

1. Continue studies on what "learning math" really means and can mean to young children.

2. Continue the development of materials that promote the best kind of learning in a normal classroom.

Discussion. It is found that under practically all the early grade math programs now in use in the schools, the children soon learn to think "what am I supposed to do," and look just for an answer to put down rather than think about the problem. The result, for most children, is rote learning or failure to learn, and inability to use math in real life problems. One must both understand thoroughly how this comes about, and find better ways for real progress.

In the first direction, one must see all the complexities relating to the child and his work in math, and find ways to document this so that it can be more generally understood. In the second direction, a program of math activities must be devised in a manner which the ordinary teacher can carry out, enabling the child to grow in the human and cognitive directions together. The "human" development is much deeper and more basic than is generally expressed by the word "affective."

Materials Available. The first part of the activity program, covering the first grade and more, is available from the Institute for Advanced Study. Materials for the next few grades are at present under development.

Explorations into ways of Improving the Elementary Mathematics Learning Experience in a Small Subsystem of a Large City School System. 1974- . Max S. Bell, Graduate School of Education, The University of Chicago, Chicago, Illinois 60637.

Digest. The project focuses on trying to find ways that elementary schools (public and private) in a compact and well defined city neighborhood can achieve a considerable improvement in the early mathematics learning experience. By a variety of inquiries with school teachers and administrators, we hope to find out what some of the barriers are to such improvement and where some of the "leverage points" are where relatively small efforts might be most effective.

By direct involvement in classrooms and some clinically oriented inquiries with students we hope to find out something about what mathematical concepts young children have. By working closely with some especially interested sub-groups of teachers we hope to discover something about effective ways of implementing the best of existing materials and see where there are significant gaps in available materials.

Discussion. The work proceeds by a series of small scale investigations. So far these have included interviews and questionnaire responses from a number of teachers and administrators; development in several stages of a clinical instrument to investigate actual concepts primary youngsters have about numeration and place value and their awareness of mathematical aspects of the common world; several investigations into the use and potential of minicalculators in school classrooms, initiatives in forging closer links among the university, the local teacher center, and the local schools. Activities over the next six months will include a volunteer group of upper grade teachers meeting weekly to consider curriculum and implementation of new methods and new materials (at the Teacher Center); a second group of primary school teachers meeting weekly with similar concerns (at the University); inclusion of a number of local teachers (as auditors or as regular students) in laboratory/activity oriented mathematics courses at the University; continued exploration of the implications of minicalculators for school classrooms, and continued development and use of clinical interview instruments with students. Each of these is rather small scale and tentative but the results may prove interesting in estimating the possibilities for and barriers to improvement of the early mathematics experience in such community sub-systems as this one and perhaps on a larger scale.

Materials Available. None.

Experimental Teaching of Mathematics in the Elementary School. 1959-1971. Patrick Suppes, Institute for Mathematical Studies in the Social Sciences, Stanford University, Stanford, California 94305.

Current Contact: Marguerite Shaw, Ventura Hall, Stanford University, Stanford California 94305.

Digest. Materials for the implementation of computer-assisted instruction were produced in each of two areas of elementary mathematics. One area is concerned with a drill-and-practice supplementary curriculum for grades 1-6. The second is an extension and revision of the tutorial computer-based curriculum in logic and algebra aimed at more capable students in grades 4-8.

Discussion. The drill-and-practice supplementary curriculum is divided into 15 major concepts and skills, ranging from horizontal addition to the solving of elementary word problems. Initial grade placement in each of these 15 skill or concept strands is based on the student's abilities, and each student is moved through the structure according to his individual performance, without reference to the performance of other students. The criterion for moving from one grade placement level to the next in each strand is set so that the average student should make one year's grade-placement progress in one academic year.

The extended and revised tutorial computer-based curriculum in logic and algebra is designed to carry capable students up to the level of covering, from an axiomatic standpoint, a good part of the algebraic content of a ninth grade algebra course. The important aspect of this course is that the student constructs individual counterexamples, and these are checked recursively by the computer. Any valid proof within the rules given to the student is accepted by the computer program.

Materials Available. The following are available from the project: *Drill-and-Practice Mathematics*, Grades 1-6, block structure, *Drill-and-Practice Mathematics*, Grades 1-6, strands structure; *Logic and Algebra Curriculum*, Grades 4-8.

There are three kinds of materials available for each curriculum. a listing of the curriculum, a listing of the computer program for the curriculum. and magnetic tapes on which the foregoing are listed.

A project memorandum provides specific costs and other details about the courses, references related research publications, and lists names and addresses of commercial sources for software services in computer oriented instruction.

Unified Science and Mathematics for Elementary Schools (USMES). 1970- . Earle L. Lomon, Education Development Center, Inc., 55 Chapel Street, Newton, Massachusetts 02160.

Current Contact: Betty M. Beck.

Digest. Since its inception in 1970, USMES has been developing and carrying out field trial implementations of a series of interdisciplinary units for use with elementary school students. The units, based on long range investigations of real problems that exist in the students' local communities, bring together content and processes that draw on science, mathematics, and social studies.

Discussion. The project's target is the development of a total of 32 problem challenges to span grades 1 through 8 and to provide flexibility of choice for teachers/students; since 1970, 27 challenge units have been under development. The 5 remaining challenges will be initiated in summer and fall of 1975.

The USMES units are being developed in elementary school classrooms by teachers and consultants and each unit is based upon a special type of real challenge which meets certain requirements. Each challenge must (1) contain within it the prospect for many hours of productive activity, (2) be practicable in that it should allow students to reach some results within the time and resources available to them, (3) have the potential for a substantial amount of application (as well as acquisition) of facts and scientific concepts with mathematical structuring appropriate to the age level, and (4) have a large amount of overlap between the natural and social sciences and different aspects of mathematics.

All USMES materials are essentially resource instruments for student and/or teacher use. The challenges are adaptable for use with many different age groups and with students of different backgrounds and interests. Available materials include: (1) *USMES Guide*, a compilation of information for use in planning a curriculum based on USMES units; (2) A Teacher's Resource Book for each unit, containing specific unit ideas, documentation of class activities, and reference to other materials that could be used in connection with the unit; (3) *"How to" Cards*, to provide students with information about specific skills or processes they need; (4) *Technical Background Papers*, written to provide information for teacher use on problems that may arise in connection with various investigations; (5) *Teacher Logs* describing actual classroom experiences with a given unit, some of which are included in each *Resource Book;* and (6) and (7) *Design Lab Manual* and *Catalog of Design Lab Construction.*

The Design Lab as used with USMES units is a specialized work area in which students can design, construct, and test out apparatus needed for their researches, and is an essential resource if USMES objectives are to be realized. There are no prepackaged USMES apparatus kits and none is planned.

Materials Available. During their developmental stage, USMES materials are available only to the limited number of schools participating in developmental and closely associated field trial activities under close supervision by the project staff. However, beginning in the fall of 1973 inexpensive editions of certain of the more fully developed USMES trial materials became available for purchase by interested teachers or schools. For general information about the program and for information of available materials and prices, write to either of the staff contacts mentioned above.

Elementary School Mathematics and Science Project (UICSM). 1969- . Peter B. Shoresman, School of Education, University of Illinois, Urbana, Illinois 61801.

Digest. This project developed integrated mathematics/science materials for use in open classroom settings in grades K-6. The materials are intended primarily for teacher use.

Discussion. The materials developed by this project are intended for use by teachers working in any of a variety of open classroom situations where mathematics and science can be related to each other as well as to other areas of the elementary curriculum. Materials consist of booklets, some of which contain student activity cards. Each booklet outlines a topic suitable for study by elementary school children. Examples of unit titles are: *Merging Science and Mathematics, Electricity and Reasoning,* and *Do You See What I See?*

Materials Available. About a dozen units are available in preliminary edition from the project. Information on plans for commercial publication can also be obtained from the project director.

Minnesota School Mathematics and Science Teaching Project (MINNEMAST). 1961-1970. James H. Werntz, Jr., University of Minnesota, Minnesota School Mathematics and Science Center, 720 Washington Avenue, S.E., Minneapolis, Minnesota 55455.

Current Contact: Jean Dailey.

Digest. The MINNEMAST Project developed a coordinated curriculum in mathematics and science for grades K-3, as well as teacher preparation materials and teaching aids.

Discussion. Based on the premise that the elementary school curriculum should emphasize the interrelationship between science and mathematics, this project produced 29 sequential units that coordinate the teaching of mathematics with the teaching of science in kindergarten and the primary grades. These materials are aimed not only at preparing children in concepts, skills, and attitudes, but also at developing within children the ability to organize content and skills acquired from any of a variety of sources. Teacher manuals, student manuals, printed aids for students, and kits of materials are available for each of the units. In order to facilitate the transition to upper-elementary materials, the project prepared the publication, *MINNEMAST Recommendations for Science and Math in the Intermediate Grades.*

In conjunction with the project's concern and efforts to improve the preparation of prospective elementary teachers, Professor Avron Douglis wrote the text, *Ideas in Mathematics*, which provides a new approach to undergraduate mathematics instruction. Since several MINNEMAST Units involve living things, the project produced a teacher resource handbook, *Living Things in Field and Classroom.* In addition, a resource book of enrichment materials in science and mathematics history, *Adventures in Science and Mathematics* is available.

Materials Available. From W. B. Saunders Co., West Washington Square, Philadelphia, Pa. 19104: *Ideas in Mathematics.*

From either the MINNEMAST office or EduTech Products, Inc., 250 Canal St., Lawrence, Massachusetts 01840:

1) The MINNEMAST Coordinated Units,
2) teacher manuals,
3) kits of materials,
4) detailed information about these materials and a price list,
5) a free booklet, *Questions and Answers about MINNEMAST,*
6) a moderately priced booklet, *Overview*, which provides a more comprehensive discussion of the curriculum,
7) *Living Things in Field and Classroom* (Teacher Handbook),
8) *Adventures in Science and Mathematics*, and
9) *MINNEMAST Recommendations for Math and Science in the Intermediate Grades* (Transition Document).

Secondary School

Mathematics Resource Project. 1974- . Alan R. Hoffer, Department of Mathematics, University of Oregon, Eugene, Oregon 97403.

Digest. The project is developing in service and instructional resource materials from which teachers can select to extend their knowledge and to make more flexible the learning environment for children. Each resource book will contain sections in the following areas: mathematical content to provide teachers with a deeper understanding of the topic of the book and possible ways to extend the topic; didactics, including suggestions for alternative teaching strategies and techniques for diagnosis and evaluation and a disucssion of learning theories; applications and problem solving, which give suggestions for student or class projects including starting points, carry through and follow-up; and a comprehensive section on classroom materials, identified by level of difficulty with an annotated bibliography.

Discussion. The long range plan of the project is to develop ten teacher-oriented resource books with the following titles: Number Sense and Arithmetic Skills; Measurement; Mathematical Sentences and Systems; Geometry; Relations and Graphs; Number Patterns and Theory; Ratio, Proportion and Scaling; Statistics and Information Organization;

Probability and Expectation; Mathematics in Science and Society. By summer 1975 experimental versions of the books Number Sense and Arithmetic Skills and Ratio, Proportion and Scaling will be into field trial stage as well as selected units from Mathematics in Science and Society.

Materials Available. A report of the planning conference is available from the project director.

First Year Algebra Via Applications Development Project. 1974- Zalman Usiskin, Graduate School of Education, University of Chicago, 5835 S. Kimbark, Chicago, Illinois 60637.

Digest. The goal is to develop feasible classroom materials for a first-year algebra course for average students which offers the student a picture of the wide range of applications of mathematics and develops many of the mathematical topics themselves from this picture. Special attention is given to integrating concepts from probability and statistics into the development.

A preliminary version of materials is being written and taught during the school year 1974-75 by the project director.

Discussion. The preliminary version will be revised on the basis of classroom trials and comments from teachers and educators.

Materials Available. A projected outline is available. Information about availability of the preliminary or revised versions can be obtained from the project director.

University of Illinois Committee on School Mathematics (UICSM). 1962-1971. Russell E. Zwoyer, University of Illinois Curriculum Laboratory, 1210 West Springfield, Urbana, Illinois 61801.

Digest. UICSM began its activities in 1951 when it initiated studies of the content and teaching of college-preparatory mathematics in grades 9-12, and support for the Committee's work during its first decade was provided largely by the Carnegie Corporation. NSF funding, which began in 1962, enabled UICSM to enlarge its range of interests to include development of a two-year program for under-achieving junior high school pupils, a two-year vector geometry course for senior high school use, and a film series for training teachers of first-year algebra.

Materials Available. Text materials for the first project (1951-1962), which developed high school college preparatory courses, are published by D. C. Health and Company, 285 Columbus Avenue, Boston, Massachusetts 02116. These materials include:

High School Mathematics, Courses 1, 2, 3, and 4 (student and teachers editions).

Introduction to Algebra

Materials for the 7th and 8th grade course *(Stretchers and Shrinkers,* and *Motion Geomtery)* are available from Harper and Row, Publishers, Inc., 2500 Crawford Avenue, Evanston, Illinois 60201.

The vector geometry course materials can be obtained from The Macmillan Company, 866 Third Avenue, New York, N.Y. 10022.

The teacher training films are available for rental or purchase from Modern Learning Aids, 1212 Avenue of the Americas, New York, N.Y. 10036

Ninth Grade Mathematics Course. 1969-1973. Russell E. Zwoyer, University of Illinois Curriculum Laboratory, 1210 West Springfield, Urbana, Illinois 61801.

Digest. Development of an applied ninth grade mathematics course was motivated by a growing awareness of need for a status course that would be an alternative to conventional ninth grade algebra courses and convent. .al general mathematics courses was initiated in the 1973-74 school year. Following refinement it is expected that the materials will be made available through commercial channels.

Discussion. The primary objective of this curriculum development project is to create a mathematics course that may be readily modified to meet differing needs of a wide range of

students, and that will be attractive and useful to students who expect to discontinue the study of mathematics after their first year in high school. The course will encompass other areas in which the students are involved—social studies, general science, industrial arts, career courses, etc.

Since it is intended that the exact content of the course be adjusted to the needs and interests of each student group with which it is to be used, much more material is being prepared than would normally be included in a one-year course. Advisory materials are also being prepared to assist teachers in choosing from among topics available those that seem most appropriate to any given class.

Teaching techniques are also being developed to aid teachers in efforts to motivate students whose attitudes toward mathematics have been negative or indifferent.

The units that make up the course fall into three categories: *Coordinates and Functions, Probability and Statistics,* and *Mensurational Geometry,* with the first of these making up most of the course.

Materials Available. Until such time as the materials become commercially available, information about the course can be obtained from the project director.

Source Book on Applications of Mathematics. 1974- . Alex Rosenberg, Cornell University, Ithaca, New York 14850. (Grantee: Mathematical Association of America, 1225 Connecticut Avenue, N.W., Washington, D.C. 20036.)

Digest. The project will produce a source book for secondary school mathematics teachers on applications of mathematics. Applications from other academic disciplines as well as from everyday life will be considered. Particular emphasis will be put on model building in studying real world problems.

Discussion. The resulting source book will contain background material for the teacher, including various sorts of models, what is involved in constructing a model, the relation between models and the real world, and some completely worked out examples of model construction. This is a joint project with the National Council of Teachers of Mathematics (NCTM) and the Committee on the Undergraduate Program in Mathematics (CUPM).

Materials Available. Comments and evaluation by secondary school teachers will be the basis for revision of a preliminary version. Information about availability of a preliminary version and the final edition can be obtained by writing to the project director.

Development of Computer Simulation Materials (Huntington II). 1970-1975. Ludwig Braun, State University of New York, Stony Brook, New York 11790. (Prior grantee: Polytechnic Institute of Brooklyn, Brooklyn, New York 11201. (1970-1972.)

Digest. This project is producing computer-simulated experiments to support secondary school studies in biology, physics, and the social sciences.

Discussion. Selection of experiments to be simulated is based on (1) the value of exposing students to the principles involved and (2) the impracticality of having the students actually perform the experiment for reasons of safety or constraints of time or equipment.

The basic materials for each simulation include: (1) a papertape copy of the simulation program, (2) a student manual, which gives a brief background of the topic and information on using the simulation, and (3) a teacher manual, which describes briefly how to use the program, suggests preparatory activities, lists some questions that could be used to stimulate follow-up discussion, and provides sample runs to give the teacher an understanding of the way the simulation works. In addition, a resource manual for each simulation gives a detailed description of the model, including underlying assumptions and what happens when the assumptions are violated, an in-depth discussion of the theoretical background in the subject where appropriate, instructions for changing parameters or making program modifications, and an extensive bibliography in the subject area of the simulation to provide additional reading material for teacher or student use.

Materials Available. Simulation materials may be purchased from the Software Distribution Center, Digital Equipment Corporation, Maynard, Massachusetts 01754.

A filmstrip and cassette recording entitled *Simulation, An Educational Tool* explains the nature and rationale of simulation and cities experiences of some teachers who have used simulation in the classroom. This package may be obtained from the Digital Equipment Corporation or borrowed from the project director.

Information on simulation packages now available or in preparation may be obtained by writing to the project director.

Unified Modern Mathematics: Secondary School Mathematics Curriculum Improvement Study (SSMCIS). 1969- . Howard F. Fehr, Teachers College, Columbia University, New York, N.Y. 10027.

Digest. The mathematics program that has been developed eliminates the customary separation of the field of mathematics into the several different branches of arithmetic, algebra, geometry, and analysis, and unifies instruction through fundamental concepts and structures. Materials for the six-year secondary school program are now available to schools generally. This program is intended for high ability students.

Discussion. Although mathematicians have known for some years that formal mathematics can be organized in terms of fundamental concepts and structures, it has not been clear until recently whether or not mathematics instruction at the secondary school level could be organized effectively in that manner. The unified mathematics program designed by this project has demonstrated its feasibility for grades seven through twelve. The unification is brought about by constructing the curriculum around fundamental concepts (such as set, relation, mapping, operation) and basic structures (such as group, ring, field, vector space). The instructional efficiency of this construction permits introduction into high school of much mathematics usually reserved for the college undergraduate years. The unified organization, along with elimination of certain traditional topics no longer considered useful, permits teaching of the calculus, in the 5th and 6th years of the course, to all college-bound students. Probability and Statistics appear as chapters of instruction in each grade. A feature of the twelfth grade program is a set of booklets for individualized teacher-student instruction. Course materials were released for publication only after two revisions based on supervised tryouts. Courses 1, 2, and 3 were produced under a grant from the United States Office of Education.

Materials Available. Information Bulletins and Technical Reports are available from the project director.

Textbooks and teacher commentaries for Courses 1-6 are available from Teachers College Press. 1234 Amsterdam Avenue, New York, New York 10027. Supplementary booklets for Course 6 published by the Press are: A. Introduction to Statistical Inference, B. Determinants, Matrices, and Eigenvalues, C. Algebra Structures, Extensions, and Homomorphisms, D. An Introduction to Differential Equations, and E. Geometric Mappings and Transformations.

Textbooks and teacher commentaries for Courses 1, 2, and 3 are available from Addison-Wesley Publishing Company, Inc., Sand Hill Road, Menlo Park, California 94025.

Demonstration and Experimentation in Computer Training and Use in Secondary Schools. 1967-1971. Thomas E. Kurtz, Kiewit Computation Center, Dartmouth College, Hanover, New Hampshire 03755.

Digest. This project identified and sought ways to overcome the major obstacles to effective computer utilization at the secondary level.

Discussion. The project was carried out in a number of New England high schools to which Dartmouth College provided computer service. Specific areas on which attention was focused were (1) the preparation and training of teachers in all relevant subjects and (2) the preparation of teacher-written curricular materials. Among the noteworthy outcomes were: (a) A viable computer-using community of secondary schools was established in New England. That the cost benefit ratio is reasonable is demonstrated by the fact that these schools are now supporting the cost largely on their own. (b) The large number of teachers successfully trained in 2- to 4-week short courses indicates that this "basic training" on the computer could require as little time as is ordinarily required by a university half course. (c) Over 40 topic outlines were produced, providing evidence that teachers, with some support from a central institution, can develop parts of courses and prepare their own materials. Many of these topic outlines are in current regular use at schools both in and out of the project group of schools. Eight of the best outlines are available in printed form as "course booklets."

The question of how a university computer center branches out to become a regional computing center for secondary schools and colleges was also addressed by the project. Some comments on the question can be found in the reports listed below.

Materials Available. Available without charge from the Documents Center, Kiewit Computation Center, Dartmouth College, Hanover, New Hampshire 03755: Interim Report I (1968) and II (1969), and the Final Report (1970). Also available from the Center for a nominal charge are eight Course Booklets. *Computer Course for Business students, Computer Use in a General Math Course, Data Reduction Experiments for Introductory Physical Science, School BASIC, BASIC in Ten Minutes a Day, Orbital Mechanics, Suggestions for Programs,* and *n Equations in n Unknowns.*

Modern Coordinate Geometry. 1964-1967. Robert A. Rosenbaum, Wesleyan University, Middletown, Connecticut 06457.

Digest. *Modern Coordinate Geometry* was prepared as a textbook for a 10th grade mathematics course. It was based on an earlier experimental text of the same name developed by the School Mathematics Study Group. Coordinates are used in a natural way from the outset, yielding a body of knowledge unlike that of the traditional high school geometry course, but much like the kind of geometry actually used in scientific work. A distinctive feature of the text is the development of affine geometry before Euclidean.

Materials Available. Commercial editions of *Modern Coordinate Geometry* and the *Teacher's Commentary and Solution Key* were published in 1969 and are available from Houghton Mifflin Company, 110 Tremont Street, Boston, Massachusetts 02107.

The Man-Made World (TMMW): Engineering Concepts Curriculum Project (ECCP). 1964- . John G. Truxal, State University of New York, Stony Brook, N.Y. 11790. (Prior grantees: Commission on Engineering Education, Washington, D.C. 20036. 1964-1967; Polytechnic Institute of Brooklyn, Brooklyn, N.Y. 11201. 1967-1972.)

Digest. The ECCP has developed and interdisciplinary course that is intended to enhance the technological literacy of upper-level high school students who do not plan careers in science or engineering. Accordingly, the course, *The Man-Made World* (TMMW), does not place primary emphasis on the scientific method, and the process of logical thinking is given preference over mathematical problem-solving ability.

Discussion. TMMW stresses the interactions between man and machine and between society and technology. The appoach used in this study has three basic components: (1) Decision-making, Modeling, Optimization, and the use of Simulation, in order to better understand problems and final solutions to them. (2) Logic and Computers, concerning the extension of man's mental abilities through logic circuits and computers, as well as the processing of information. (3) Dynamic Systems, dealing with stability, feedback, and amplification concepts as used in controlling systems. These systems might be the human body and social systems, as well as mechanical or electrical systems.

For students having less ability or motivation, a modified version of the course is available. *Technology—People—Environment. An Activities Approach to TMMW* consists of an introductory unit and eight minicourses comprising a total of 121 activities, most of which require only a single class session. This structure makes the course especially adaptable to students whose attendance patterns are irregular.

Materials Available. Basic course materials are available from the Webster Division of the McGraw-Hill Book Co., 1221 Avenue of the Americas, New York, N. Y. 10020. Among the materials are: (1) *The Man-Made World,* a student text that incorporates a laboratory guide; and (2) teacher aids such as a *Teacher's Manual,* masters for making overhead transparencies, tape cassettes, and a package of tests covering the entire student text.

Laboratory equipment for TMMW may be ordered from AMF Electrical Products Development Division, 1025 North Royal Street, Alexandria, Va. 22314.

A sound filmstrip about the course may be borrowed or purchased from the project. Requests for the free ECCP Newsletter and other information about the courses should also be directed to project headquarters.

PREPARATION OF TEACHERS

Preservice (Elementary)

A Combined Program of Teacher Training and Model Elementary School Laboratory in Mathematics. 1971- . John F. LeBlanc, School of Education, Indiana University, Bloomington, Indiana 47401.

Digest. The philosophy of the project is that there should be a laboratory atmosphere in teaching mathematics and therefore in learning to teach mathematics at the elementary level. The project has designed a laboratory approach to teaching teachers through concrete aids and through activity centered learning for both mathematics and elementary mathematics methods. Eighteen units or modules have been completed. Units include mathematics for elementary teachers and for elementary students, with laboratory materials present or with instructions for production.

Materials Available. Information on the units can be obtained from the project director. Addison-Wesley will publish the units beginning in 1975.

Pre-service (Secondary)

Experimental Teaching Program in Algebra. 1961-1964. Robert J. Walker, Department of Mathematics, Cornell University, Ithaca, N.Y. 14850.

Digest. Curricula for three one-term courses have been developed: Basic Concepts of Mathematics; Linear Algebra; and Number Theory. The courses are designed primarily for future high school teachers. The goal is for students to have a thorough grasp of the fundamental concepts of modern abstract algebra and their relevance for other fields of study.

Geometry Course for Prospective High School Mathematics Teachers. 1964- . Seymour Schuster, Minnesota School Mathematics and Science Center, University of Minnesota, Minneapolis, Minn. 55455.

Digest. Materials for a college geometry course for the training of prospective high school teachers have been developed with emphasis on visual media and programmed instruction. The content includes material recommended in Course Guides for the Training of Teachers of Junior High and High School Mathematics, published by the Committee on the Undergraduate Program in Mathematics of the Mathematical Association of America.

Project on Logic and Proof. 1969-1971. Russell E. Zwoyer, University of Illinois Committee on the Study of Mathematics, University of Illinois, Urbana, Ill. 61801.

Digest. The needs of prospective secondary school teachers of mathematics and of advanced undergraduates in mathematics lacking adequate training in the formulation of mathematical proof stimulated the development of this project. Paragraph proofs are the focus of the course development effort and the textual materials used a "guided discovery" approach.

Films and Other Teaching Materials for College Mathematics. 1963-9167. A. B. Willcox, Executive Director, Mathematical Association of America, 1225 Connecticut Avenue, N.W., Washington, D.C. 20036.

Digest. This project investigated the production, use and evaluation of new media-films, television, programmed learning, etc., in mathematical instruction at the college level. Films and written materials are suitable for pre-service training of prospective mathematics high school teachers.

Materials Available. Texts: W. A. Benjamin, Inc., 1 Park Avenue, New York, N.Y. 10016. Films: Modern Learning Aids, 1212 Avenue of the Americas, New York, N.Y. 10036.

In-service (Elementary)

Teachers' Centers in Mathematics Education. 1972- . Thomas C. O'Brien, Department of Elementary Education, Southern Illinois University, Edwardsville, Illinois 62025.

Digest. Two teachers' centers in mathematics education have been underway successfully in the St. Louis metropolitan area. The first, the Belleville Area Teacher's Center (BATC), was started in spring 1972 in Belleville, Illinois. The second, the St. Louis Area Teachers' Center (StLATC) was begun in September, 1972.

Discussion. There are no fees for participation in Teachers' Center activities. Both centers are grass-roots, continuing, collaborative, coherent enterprises: 1) grass-roots in the sense that they are congregations of classroom teachers convening because of common interest in improving their work in mathematics education, 2) continuing in the sense that the centers are operated in 12-week sessions (one meeting per week) during which themes are initiated and developed, 3) collaborative in the sense that teachers continually work, problem-solve, share ideas, and build together and, in general, learn early that fellow teachers are a major and often heretofore untapped resource in their professional and intellectual activity; and 4) coherent in the sense that the activity of teachers in both centers takes place under the general "umbrella" of Piagetian research and theory.

The position of the Teachers' Centers is that mathematics education is concerned with children's thinking (not with merely the facts, rules, procedures, nomenclature and notation of elementary school arithmetic as is widely the case in American schools at present) and that children's thinking needs to be attended to in terms of curricular activities and research.

Materials Available. A Teachers' Center Newsletter and numerous occasional papers are available from the project director.

Teacher Center. 1975- . Leonard M. Warren, Center for the Improvement of Mathematics Education, P.O. Box 81594, San Diego, California 92138.

Digest. The Center for the Improvement of Mathematics Education (CIME) supports instructional development activities in mathematics for elementary school teachers in the greater San Diego area through its Teacher Center.

Teachers can individually examine the supplementary materials, design and make teaching aids, discuss particular problems with other teachers and resource personnel at the Center, as well as participate in small-group workshops organized in response to the expressed needs of children.

Materials Available. None.

The Arithmetic Project. 1965-1970. David A. Page, Education Development Center, Inc., 55 Chapel Street, Newton, Massachusetts 02160.

Current Contact: Jack Churchill

Digest. The Arithmetic Project produced a package of in-service materials and activities specifically designed for use by local school systems in upgrading the understanding of content and the teaching of mathematics by groups of elementary school teachers. The course is designed to be directed by a local elementary school faculty member whose background is better than average. (The material may also be used in pre-service training of teachers.)

Discussion. The in-service course is made up of separate mathematical topics or problems—for example, "effects of using rules in different orders" and "maneuvers on lattices." No grade

level is prescribed for consideration of any given topic, and the course is not adapted for any specific textbook series or course of study. The intent is that elementary school teachers who take the course will use its ideas and content to modify and enrich their mathematical instruction, regardless of grade or student ability level. It is expected that they should be enabled to devote a third or more of arithmetic class time to project-derived content and activities.

The course package includes written lessons for study by teachers between institute sessions, films showing mathematics being taught to classes of children by a variety of teachers, and supplementary materials providing further mathematical exposition and suggestions for the classroom. Discussion notes and detailed guides for correcting the written lessons are also included.

Materials Available. From Agathon Press, 150 Fifth Avenue, New York, N.Y. 10011:

1. The course, as a package consisting of written materials for participants, discussion notes for workshop leaders, and rented films.
2. General information about the course, and sample materials.

Number Lines, Functions, and Fundamental Topics, by David A. Page, is published by the Macmillan Co., 866 Third Avenue, New York, N.Y. 10022.

In-Service Films in Mathematics for Elementary School Teachers. 1963-1966. Harry D. Ruderman, Hunter College High School, 930 Lexington Avenue, New York, N.Y. 10020. (Grantee: National Council of Teachers of Mathematics (NCTM), 1906 Association Drive, Reston, Virginia 22091.)

Current Contact: James D. Gates, Executive Secretary, NCTM.

Digest. A series of ten 30-minute films was prepared for in-service training of teachers of elementary school mathematics.

Discussion. The film series treats the system of whole numbers, the operations in this system and the properties of these operations, our common decimal notation for whole numbers, and the usual algorithms. Each film is accompanied by text materials and there is a teacher manual for the entire series. The presentation is consistent with the recommendations of the Committee on the Undergraduate Program in Mathematics of the Mathematical Association of America.

Materials Available. The films (16 mm in color) are distributed by Universal Education and Visual Arts, 221 Park Avenue South, New York, N.Y. 10003. The related text, *Mathematics for Elementary School Teachers,* is available from the NCTM.

Madison Mathematics Project (MAD-M). 1961- . Robert B. Davis, Curriculum Laboratory, University of Illinois, 1210 West Springfield Avenue, Urbana, Illinois 61801. (Grantee: Webster College, St. Louis, Missouri 63119.)

Digest. The Madison Project was concerned with curriculum change in school mathematics, primarily in grades K-9, and with the relation of mathematics to other studies. Objectives included the study of cognitive growth in children and the study of effective learning environments. The project moved toward programs that are very different from those commonly in use. That portion of the project supported by NSF was primarily for the production of 16 mm films showing children in actual classrooms. The films and related printed materials are for use in the in-service training of teachers.

Materials Available. The following project materials are available at Curriculum Laboratory, University of Illinois, 1210 West Springfield Avenue, Urbana, Illinois 61801:

In-Service Course I—A package of films and printed materials for teacher workshops.

In-Service Course II—A sequel to *In-Service Course I.*

Journal of Children's Mathematical Behavior, Vol. 1, No. 1. Contains a recent overall description of Madison Project activity. Vol. 1, No. 2. Contains analytical studies of children's mathematical thinking.

Assorted films (e.g., *A Lesson with Second Graders; Graphing a Parabola; Outdoor Mathematics).*

The following film series is available from Houghton Mifflin Company, 110 Tremont Street, Boston, Massachusetts 02107: *A Concrete Approach to Elementary Ideas in Mathematics*. A series of 12 black and white 16 mm films (with sound) on arithmetic and an accompanying booklet of the same title.

The following printed materials are available from Addison-Wesley Publishing Company, Inc., Sand Hill Road, Menlo Park, California 94025:

Discovery in Mathematics (teacher text and student discussion guide). Provides a supplementary program in coordinate geometry and axiomatic algebra especially suitable for grades 4-8.

Exploration in Mathematics (teacher text and student discussion guide). Develops introductory ideas in algebra, statistics, logic, and some application to physics, and is especially suitable for students in the grade 6-9 range.

In-service (Secondary)

University of Illinois Committee on School Mathematics (UICSM): Films for Training Ninth-Grade Algebra Teachers. 1962-1967. Russell E. Zwoyer, University of Illinois Committee on School Mathematics, 1210 West Springfield, Urbana, Illinois 61801.

Digest. UICSM has prepared a series of 50 films intended to acquaint teachers with the content of modern secondary school algebra courses and to exemplify pedagogical techniques which have proven effective with such content. The films have been produced for flexible use in pre-service, in-service, or institute training employing either the whole series or selected subseries. Extensive written materials accompany the films.

Materials Available. Films: Modern Learning Aids, 1212 Avenue of the Americas, New York, N.Y. 10036.

Mathematics Teachers' Center. 1974- . Phil Makurat, University of Wisconsin-Whitewater, Whitewater, Wisconsin 53190.

Digest. The Mathematics Teachers' Center is a group of secondary school teachers who meet informally every Wednesday evening in the education wing of a Lutheran Church in Muskego, Wisconsin. The activities of the Center are: (1) to give and receive moral support regarding classroom activities being attempted. (2) To share ideas, materials, philosophies, games, and problems with other teachers of mathematics. (3) To relate mathematics to other curriculum areas and relate external happenings to the teaching of mathematics. (4) To build a resource file of current materials. (5) To become aware of current developments in the mathematics education community. (6) To evaluate, critically analyze and try to improve existing math programs. (7) To drink a cup of coffee and relax with associates.

A typical session will last from 2 to 2½ hours. The general pattern of activity is usually a coffee and light conversation time, followed by a sharing of materials and ideas, followed by either a large group discussion or several small group discussions. The topic is determined by the participants. The conclusion is a summary with questions, or some suggestion of some things to try, or simply departing.

Materials Available. None

Films for Training Ninth Grade Algebra Teachers. 1962-1967. Max Beberman (deceased), University of Illinois Committee on School Mathematics, 1210 West Springfield, Urbana, Ill. 61801.

Current Contact: Russell E. Zwoyer, University of Illinois Curriculum Laboratory, 1210 West Springfield, Urbana, Illinois 61801.

Digest. UICSM, under the direction of Professor Beberman, perpared a series of films to acquaint teachers with the content of modern secondary school algebra courses and to exemplify pedagogical techniques proven effective with such content.

Discussion. The films are designed for flexible use in pre-service, in-service, or institute training, such that users may employ either the whole series or selected sub-series. Extensive written materials accompany the films. They include the following sub-series:

1. Fourteen films which trace the developments of concepts and principles that lead to an understanding of equations. This sub-series is appropriate for a three-week institute or workshop.
2. Ten films on operations with real numbers appropriate for a concentrated two-week workshop or for an in-service seminar meeting once each week.
3. Sixteen films on deductive justifications for algebraic manipulation, a topic common to all the new mathematics programs. Such a series is useful for a one-month institute or for a one-semester pre-service course for teachers.
4. Ten films on inequality relations in elementary algebra.
5. Ten films pertaining to the relation of algebra to its applications.
6. Three films on pedagogy.

Materials Available. The films are available for purchase or rental, individually or as a series, from Modern Learning Aids, Inc., 1212 Avenue of the Americas, New York, N.Y. 10036.

IMPLEMENTATION ACTIVITIES

Activities associated with improving classroom instruction are directed toward the implementation of new course materials in the classroom. Although projects are supported which resemble in format some of the teacher training activities supported in the past, their emphasis and structure are now substantially different. There are now opportunities to combine these past formats in new ways and to develop new approaches for implementing science education improvements. Attention is focused on working with key individuals and with groups of schools and school systems.

All activities, including in-service teacher education, are directed toward fostering successful implementation of major curriculum and course developments in school systems. Attention is generally given to new curriculum approaches developed with Foundation support. However, assistance is also provided for the implementation of other educational programs developed through non-NSF support when such programs, through comprehensive evaluation, demonstrate their effectiveness.

Instructional Improvement Implementation programs are organized into four broad areas of science curriculum improvement activities—In-Depth Leadership Training, Information Activities, School System Projects, and Teacher-Centered Projects.

Below is a listing of mathematics projects supported by the Foundation for the summer of 1975 and the 1975-76 school year.

In-Depth Leadership Training

In-Depth Leadership Training is designed to develop expertise in new materials among leaders and resource persons in science education; these may be State or local science supervisors, curriculum specialists, or college level science educators. They learn in depth the characteristics of one or two of the new courses to enable them to organize teacher training and other implementation efforts.

Secondary Level

Brooklyn College, Brooklyn, New York 11210; Secondary School Mathematics Curriculum Improvement Study (SSMCIS); spring 1975: 2-day leadership specialist conference in March 1975; summer: 6 weeks, June 30—August 8, 1975; academic year 1975-76: 5 bi-monthly meetings; back-up program: September 10, 1975—June 2, 1976; 5 administrators for spring conference 40 secondary school teachers for summer; 40 secondary school teachers for academic year "back-up" program. Participants will be chosen from Board of Education of the City of New York, Catholic Diocese of Brooklyn, Yeshiva English Principals Association of the Board of Jewish Education, and other school systems in the New York metropolitan area. Following the Leadership Specialist Conference in March, 40 teachers will be trained in the summer project to introduce the SSMCIS materials into their classrooms. An additional 40 teachers will be trained in a back-up program during the 1975-76 school year. Dr. Lester L. Gavurin, Department of Mathematics.

University of Colorado, Boulder, Colorado 80302; A Course in Algebra-Trigonometry with Computer Programming (Colorado Schools Computing Science); summer: 2 weeks, June 16—June 27, 1975; academic year 1975-76: follow-up visits to local programs, 30 college faculty, school administrators, teacher leaders. The project is designed to disseminate the philosophy, instructional methods and CSCS materials related to classroom computer usage. Leadership teams capable of conducting local teacher training programs or regional leadership programs will be developed. Professor Chuan C. Feng, Department of Civil and Environmental Engineering.

Elementary Level

State University of New York at Buffalo, Buffalo, New York 14214; Unified Science and Mathematics for Elementary Schools (USMES), Developing Mathematical Processes (DMP), Developmental Project for Resource Books for Middle School Mathematics Teachers, Project for Mathematical Development for Children (PMDC), Problem Solving Strategies and Applications of Mathematics in the Elementary School, Madison Mathematics Project, Nuffield Mathematics Project, Comprehensive School Mathematics Project (CSMP); summer: 3 weeks, July 7—July 25, 1975; 25 key elementary teachers and college personnel from Buffalo, Niagra Falls, and the 21 School Districts in BOCES I. Twenty-five key persons will be trained to work with a 28-foot mobile van equipped with developmental projects in mathematics. The van is used to present materials, video-taped lessons and interviews of development project directors. Dr. C. Alan Riedesel, Department of Teacher Education.

University of Illinois, Urbana, Illinois 61820; The Madison Project Mathematics Curriculum; summer: 3 weeks, June 16—July 4, 1975; 24 college personnel and pre-college (mainly elementary) teachers. Through reviewing, planning and continued professional training, the participants will gain an increased sophistication of the latest educational developments of the Madison Project Mathematics Curriculum. Dr. Robert B. Davis, The Curriculum Laboratory.

University of New Hampshire, Durham, New Hampshire 03824; Madison Mathematics, Unified Science and Mathematics for Elementary Schools (USMES), UICSM Motion Geometry, summer: 2-day conference for administrators; 6 weeks, July 2—August 10, 1975 for key teachers; academic year 1975-76: 10 meetings; 130 administrators, supervisors and key elementary school teachers from New Hampshire. A state-wide cooperative project will assist schools in the implementation of curricular materials in elementary mathematics. Dr. Richard H. Balomenos, Department of Mathematics.

Northern Illinois University, DeKalb, Illinois 60115; Developing Mathematical Processes (DMP); spring 1975: 5 one-day workshops; summer: 1 week, June 16—June 20, 1975 plus one day (June 20) for administrators; 30 mathematics supervisors, curriculum coordinators, key elementary school teachers and administrators from a 75-mile radius of DeKalb. Preference for the summer program will be given to participants from the spring conferences. Participants will receive training in DMP materials and strategies and will be assisted in presenting in-service awareness workshops during Fall, 1975. Dr. Margariete Montague, Department of Mathematical Sciences.

University of Wisconsin, Madison, Wisconsin 53706; Developing Mathematical Processes (DMP); summer 1975: 1 week; academic year 1975-76: two conferences; 15 college and university mathematics educators. This leadership training program will prepare 15 college and university mathematics educators to engage in all of the stages of implementation of DMP: awareness, installation, maintenance and refinement. They will be trained at a one-week intensive conference and on-the-job at other DMP conferences. Dr. John G. Harvey, Wisconsin R&D Center.

Information Activities

Information Activities are designed to bring current information to school decisionmakers about new materials, their costs, and other characteristics. These conferences are primarily for administrators who need an overview of new curricular materials without much need for in-depth training.

Ohio State University, Columbus, Ohio 43210; Nationally Recognized Junior High Science and Mathematics Curricula; summer: 2 weeks, July 27—August 7, 1975; 40 college science and mathematics teacher educators and teams of such educators and secondary school cooperating teachers. This program will acquaint teacher-educators and cooperating teachers with current curriculum materials in science and mathematics for the junior high school and with strategies for preparing undergraduates in-service teachers for teaching the newer curricula. Dr. Victor J. Mayer, Department of Science and Mathematics Education.

Ohio State University, Columbus, Ohio 43210; All NSF-Supported Science and Mathematics Curricula Suitable for the Middle and Junior High School; summer: 2 weeks, July 6—July 17, 1975; 50 school administrators, curriculum specialists, and science or mathematics department chairmen. Preference will be given to applicants who apply as teams from Ohio and surrounding states. Problems of implementation and coordination and integration between science and mathematics will be studied. Dr. Jon L. Higgins, Department of Science and Mathematics Education.

Washington State University, Pullman, Washington 99163; UICSM Stretchers and Shrinkers, UICSM Motion Geometry, UICSM Introduction to Mathematical Methods in Algebra, Geometry and Probability, Secondary School Mathematics Curriculum Improvement Study (SSMCIS), Unified Science and Mathematics for Elementary Schools (USMES), Madison Mathematics Project, NCTM Source Book on Applications of Mathematics; summer: 3 weeks, June 16—July 4, 1975; academic year 1975-76: 1 meeting, March 26—28, 1975; 60 administrators, mathematics specialists, and classroom teachers from Washington, Idaho, Alaska, and Hawaii. Specialist centers for modern secondary mathematics programs will be developed at key sites. Teams at the centers will include administrators, mathematics specialists and classroom teachers knowledgeable about all phases of programs studied. Dr. Jack M. Robertson, Department of Pure and Applied Mathematics.

Wichita State University, Wichita, Kansas 67208; Elementary Science Study (ESS), Unified Science and Mathematics for Elementary Schools (USMES), Man: A Course of Study (MACOS), Exploring Human Nature (EHN), Sociological Resources for the Social Studies (SRSS), Unified Science (FUSE), Secondary School Mathematics Curriculum Improvement Study (SSMCIS), Geography in an Urban Age (HSGP); academic year 1974-75: 3 two-day meeting; 400 administrators, curriculum coordinators, and teachers from northeast, south central, and southwest Kansas. Leadership workshop-conferences will be held to provide information to school district administrators and teachers about curriculum development projects in science, mathematics, and social studies at both the elementary and secondary levels. Dr. Bruce D. Ingmire, Department of Instructional Services.

School System Projects

School System Projects are aimed at bringing about specified curriculum or course changes in designated classrooms through the direct cooperation of colleges and universities and school systems willing to commit funds, personnel, and other resources in effecting these changes.

Secondary Level

Bishop College, Dallas, Texas 75241· University of Illinois Committee on School Mathematics (UICSM), Ninth Grade Materials; spring 1975: 2 awareness conferences, February 28 and March 14, 1975; summer: 6 weeks, June 16—July 25, 1975; academic year 1975-76: 18 meetings; 60 administrators, supervisors, and teachers from Areas I and III of Dallas Independent School District. Dr. Argelia Velez Esquivel, Department of Mathematical Sciences.

Drexel University, Philadelphia, Pennsylvania 19104; Unified Mathematics (SSMCIS); summer: 6 weeks, June 27—August 8, 1975; academic year 1975-76: 8 Meetings; 75 mathematics teachers from School District of Philadelphia. Participants will be trained to teach Courses 2 through 5 of SSMCIS Unified Mathematics. The project will stress methods of justification along with mathematical content. Professor John H. Staib, Department of Mathematics.

Seattle Pacific College, Seattle, Washington 98119; Algebra and Trigonometry with Computer Programming (Colorado Schools Computing Science Project); summer: 2 weeks, August 11—August 22, 1975; academic year 1975-76: 15 meetings; 30 supervisors and teachers from Bellevue, Everett, Highline, Issaquah, Kent, Lake Washington, Mercer Island, Renton, Seattle and Shoreline Schools. Dr. Max Jerman, Department of Education.

Utah Academy of Sciences, Arts and Letters; Secondary School Mathematics Curriculum Improvement Study (SSMCIS); summer: 6 weeks, June 16—July 25, 1975; academic year 1975-76: meetings; 128 teachers from 19 school districts in Utah. Dr. Ted Wight, Department of Mathematics, Brigham Young University, Provo, Utah 85602.

College of William and Mary, Williamsburg, Virginia 23185; Algebra-Trigonometry with Computer Programming (Colorado Schools Computing Science Project); summer: 2 weeks, June 10—June 21, 1975; academic year 1975-76: 3 meetings; 35 teachers from Fairfax, Chesterfield, Henrico and Richmond Schools. Dr. S. Stuart Flanagan, School of Education.

William Paterson College, Wayne, New Jersey 07470; The Computer as an Instructional Tool and Modeling Device in Algebra (Colorado Schools Computing Science Project); summer: 2 weeks, August 18—Ausust 29, 1975; 6 meetings; 30 Algebra II teachers from 18 high schools in northern New Jersey. Dr. Robert L. Stevenson, Department of Mathematics.

Combined Secondary/Elementary Levels

University of Arkansas at Fayetteville, Fayetteville, Arkansas 72701; The "Hands-On" Approach to Teaching Mathematics, Games and Activities Selected from Madison Mathematics, Nuffield Foundation Mathematics, Minnesota Science and Math Teaching Project (MINNEMAST), UICSM Mathematics; summer: 6 weeks, June 2—July 11, 1975; academic year 1975-76: 32 meetings; 1000 mathematics teachers (grades 1-12) from the State of Arkansas. This is a program of in-service classes, summer classes, workshops, and consultant services designed to implement the use of mathematics games and activities in teaching secondary school mathematics. Summer workshops will be held in Little Rock, Fayetteville, and Monticello. Dr. William R. Orton, Department of Mathematics.

Georgia State University, Atlanta, Georgia 30303; Unified Science and Mathematics for Elementary Schools (USMES), Secondary School Mathematics (SSM); summer: 7 weeks, June 9—July 24, 1975; academic year 1975-76: 32 meetings for summer participants; 10 meetings for 300 additional teachers; 60 elementary and secondary teachers, administrators, and supervisors from Fulton County School System. The main purpose of this project is to implement real-world problem-solving programs into both elementary and secondary schools. The main agents for this implementation project will be specially trained instructional teams. Dr. John P. Downes, Department of Mathematics and Curriculum and Instruction.

University of Iowa, Iowa City, Iowa 52242; Science—A Process Approach (SAPA), Elementary Science Study (ESS), Science Curriculum Improvement Study (SCIS), Unified Science and Mathematics for Elementary Schools (USMES), Technology—People—Environment (TPE), Developing Mathematical Processes (DMP), Intermediate Science Curriculum Study (ISCS), Environmental Studies (ES); summer: 2 or 3 weeks, June—August, 1975; academic year 1975-76: 15 meetings each semester for each curriculum 980 administrators and teachers (K-12) from independent school districts in each of 18 regional centers in Iowa. Assistance at the local level will be available to implement national curriculum programs in Iowa schools. Summer sessions will be followed with meetings throughout the academic year with extensive evaluation and assessment models included. Dr. Robert E. Yager, Department of Science Education.

Madison College, Harrisonburg, Virginia 22801; UICSM Motion Geometry, Madison Project Mathematics, Nuffield Project Mathematics, School Mathematics Study Group (SMSG); summer: 4 weeks, June 11—July 16, 1975; academic year 1975-76: 24 meetings; 30 teachers and supervisors from Clarke and Frederick Counties, and Winchester (city), Virginia and Berkeley and Jefferson Counties, West Virginia. The purpose of this program is to train teachers to select and utilize nationally-recognized curricula; to utilize laboratory techniques; to develop a sequence of supplementary instructional materials for classroom use; and to serve as specialists, demonstration teachers and resource persons. Dr. Charles R. Neatrour, Department of Education.

University of Pennsylvania, Philadelphia, Pennsylvania 19174; Intermediate Science Curriculum Study (ISCS), University of Illinois Committee on School Mathematics (UICSM), Man: A Course of Study (MACOS); summer: 6 weeks, June

30—August 8, 1975; 48 middle school teachers (5-8) from Greater Delaware Valley. The summer program is the conclusion of a 14-month program for the 48 participating teachers. During this six-week program, the participants work with middle school children in implementing the lessons from the three curricula. Dr. Kenneth D. George, Graduate School of Education.

University of Virginia, Charlottesville, Virginia 22903; Science—A Process Approach (SAPA), Elementary Science Study (ESS), Science Curriculum Improvement Study (SCIS), Developing Mathematical Processes (DMP), Project Physics Course (PPC), Introductory Physical Science (IPS), Earth Science Curriculum Project (ESCP); summer: 4 weeks, June 17—July 12, 1975 for elementary teachers, July 15—August 9, 1975 for secondary teachers; 8 weeks, June 17—August 9, 1975 for supervisory leadership trainees; academic year 1975-76: 20 meetings; 363 (63 summer, 300 academic year) elementary and secondary school teachers from Washington County, Roanoke-Alleghany County, Lynchburg, Chesterfield-Henrico-Richmond, Hampton-Newport News-Virgina Beach, and Albermarle County Schools. Dr. Ertle Thompson, Department of Science Education.

Elementary Level

Augustana College, Sioux Falls, South Dakota 57102; Arithmetic Project, Madison Mathematics Project, Nuffield Mathematics Project, Developing Mathematical Processes (DMP), JeffCo Mathematics Project, Cuisenaire Materials; summer: 4 weeks, June 9—July 3, 1975; academic year 1975-76: one two-day meeting during the fall term,35 elementary teachers from Bureau of Indian Affairs Schools in North and Sourth Dakota served by the Aberdeen, South Dakota Area Office. Dr. Verlyn L. Lindell, Department of Mathematics.

Eastern Michigan University, Ypsilanti, Michigan 48197; Selections from Madison Project Mathematics, Nuffield Foundation Mathematics Project and Unified Science and Mathematics for the Elementary School (USMES); summer: 3 weeks, June 16—July 4, 1975; academic year 1975-76: 15 meetings; 39 teachers, grades K-8, from Ypsilanti Public Schools. Dr. Donald A. Buckeye, Department of Mathematics.

Fort Lewis College, Durango, Colorado 81301; Navajo Area Mathematics Curriculum Guidelines; summer: 5 weeks, June 2—July 3, 1975; academic year 1975-76: 25 meetings, 130 teachers, administrators, and supervisors from Navajo Area Bureau of Indian Affairs school systems; Chinle, Eastern Navajo, Fort Defiance, Shiprock, and Tuba City. Dr. Richard A. Gibbs, Department of Mathematics.

University of Kentucky, Lexington, Kentucky 40506; Madison Mathematics Project, Nuffield Mathematics Project; summer: 4 weeks, June 10—July 8, 1975; academic year 1975-76: 6 meetings; 30 teachers and principals from Fayette County Public Schools. Dr. Donald B. Coleman, Department of Mathematics.

LaGrange College, LaGrange, Georgia 30240; Madison Project Mathematics; summer: 1 week, August 4—August 8, 1975; academic year 1975-76: 8 meetings: 40 teachers and principals from Muscogee County School System. Dr. Richard D. Jolly, Department of Mathematics.

University of Maine at Portland-Gorham, Gorham, Maine 04038; Madison Mathematics; summer: 4 weeks, June 23—July 18, 1975; academic year 1975-76: 7 meetings in each of three districts; 36 teachers and principals from School Administrative Districts #55, #57, and #72. Dr. Richard O. Kratzer, Department of Mathematics and Computer Science.

Miami University, Oxford, Ohio 45056; Developing Mathematical Processes (DMP); summer: 4 weeks, July 21—August 15, 1975; academic year 1975-76: 20 meetings plus classroom observations; 67 teachers, administrators, and supervisors from Cincinnati Public Schools. Dr. James B. Wesson, Department of Teacher Education.

University of Nebraska at Omaha, Omaha, Nebraska 78101; The Arithmetic Project; summer: 3 weeks, July 21—August 8, 1975; academic year 1975-76: 3 Saturday conferences; 60 teachers and supervisors, grades 3-6, from Omaha Public Schools, Omaha Catholic Schools and schools served by ESU #3-OSACS Science Center and ESU #2. Dr. Barbara Hancock, Department of Mathematics.

West Texas State University, Canyon, Texas 79016; Minnesota Math and Science Teaching (MINNEMAST) Program; summer: 6 weeks, June 2—July 11, 1975; academic year 1975-76: 3 meetings; 28 elementary teachers, grades 1-3, and principals from Amarillo, Canyon, and Hereford School Districts. Dr. Hollis L. Cook, Department of Mathematics.

West Virginia University, Morgantown, West Virginia 26506; Experiences in Mathematical Ideas, summer: 3 weeks, June 16—July 4, 1975; academic year 1975-76: 11 meetings; 90 5th and 6th grade teachers from Berkeley County, Cabell County, and Mineral County Public Schools. Dr. Alonzo F. Johnson, Department of Mathematics.

West Virginia University, Morgantown, West Virginia 26506; Experiences in Mathematical Ideas, summer: 4 weeks, June 17—July 16, 1975; academic year 1975-76: 16 meetings; 25 teachers, grades 3-6, from Preston County Schools. Dr. Boyd Holtan, Department of Curriculum and Instruction.

TEACHER-CENTERED PROJECTS

Teacher-Centered Projects are intended to bring about classroom change through teacher utilization of new instructional materials or practices. However, unlike School System Projects, participation is not necessarily restricted to personnel from a cooperating school system.

Secondary Projects

Bowling Green State University, Bowling Green, Ohio 43403; Colorado Schools Computing Science Project, Mathematics Curriculum Project of University of Denver, Huntington II Computer Project; summer: 2 weeks, June 16—June 27, 1975; 50 mathematics and science teachers from northwest Ohio. Dr. Leland R. Miller, Department of Computer Science

State University College at Brockport, Brockport, New York 14420; Colorado Schools Computer Science Curriculum Development Project, Engineering Concepts Curriculum Project (ECCP); summer: 5 weeks, July 7—August 8, 1975; academic year 1975-76: 6 meetings; 40 mathematics teachers from New York State. The project is designed to implement the use of the computer as an instructional tool in teaching 11th and 12th grade mathematics. Dr. Theron D. Rockhill, Department of Mathematics.

University of California, Santa Barbara, Santa Barbara, California 93106; Colorado Schools Computing Science; summer: 8 weeks, June 16—August 8, 1975; 40 mathematics teachers from San Luis Obispo, Santa Barbara and Ventura Counties.

The project consists of a core scheme of lectures, seminars, and small-group laboratories to train in the use—technical as well as educational—of desk-top computers and terminals, supplemented by two mathematics courses (with small-group problem-solving sessions adjoined) that both demonstrate and train how to dress high school mathematics for computer utilization. Dr. William H. Meyer, Department of Mathematics, University of Chicago. Write to: Dr. Vern Cotter, School of Education, University of California, Santa Barbara, California 93106.

Chicago State University, Chicago, Illinois 60628; University of Illinois Committee School Mathematics (UICSM) Stretchers and Shrinkers and Motion Geometry; summer: 4 weeks, June 30—July 29, 1975; academic year 1975-76: classroom visitations; 30 junior high teachers from Districts Eleven and Twenty-three, Chicago Public Schools. Dr. Ramona G. Choos, Department of Mathematics.

University of Denver, Denver, Colorado 80210; Innovative Techniques in the Teaching of Mathematics: Mathematics Laboratory, Computer-Extended Instruction, Multi-Media; summer: 4 weeks, June 16—July 11, 1975; academic year 1975-76: staff consultations; 30 teachers in teams of three from Colorado, Wyoming, Utah, Montana, Arizona, Nevada, Idaho, New Mexico. Dr. Ruth I. Hoffman, Department of Mathematics.

Drake University, Des Moines, Iowa 50311; Advanced Placement Calculus; summer: 6 weeks, June 23—August 1, 1975; 40 high school mathematics teachers. Dr. Wayne L. Woodworth, Department of Mathematics.

Fairfield University, Fairfield, Connecticut 06430; Colorado School Computing Science Curriculum Project; summer: 3 weeks, July, 1975; academic year 1975-76: 2 two-day meetings; 25 Algebra II teachers from Connecticut, Massachusetts, and Rhode Island. Dr. Michael P. Zabinski, Department of Physics and Engineering.

University of Houston, Houston, Texas 77004; Colorado School Computing Science Curriculum Development Project; spring, 1975: awareness conference, February 20-21 and March 7, 1975 (for 60 specialists); summer: 3 weeks, June—July, 1975; academic year 1975-76: 25 meetings; 30 superintendents, supervisors, teacher-leaders, and teachers from a seven-county area around Houston, Texas composed of school systems who are members of Region IV Education Service Center. Dr. John L. Creswell, Department of Curriculum and Instruction.

University of Illinois, Urbana, Illinois 61801; UICSM Introduction to Mathematical Methods in Algebra, Geometry and Probability; summer: 4 weeks, June 23—July 18, 1975; 25 mathematics teachers and college instructors. Participants will learn the content and pedagogy of materials in which the emphasis is on the way in which abstract systems arise from and are applied to specific contexts, that is, materials which reflect the user's point of view. Mr. Russell E. Zwoyer, Department of Secondary Education.

Illinois Institute of Technology, Chicago, Illinois 60616; Colorado Schools Computing Science Materials, Huntington II Computer Materials; summer: 8 weeks, June 16—August 8, 1975; academic year 1975-76: continuous; summer: 8 weeks, June 14—August 6, 1976; 192 teachers of mathematics, science and social science, and/or computer science from Greater Chicago with special emphasis on Chicago Public Schools. The Project is aimed at aiding schools to incorporate computer methods and materials in mathematics, social science and science curricula by developing interest and competence in their teachers. On-site teacher programs and advanced study are involved. Dr. L. R. Wilcox, Director, Center for Educational Development.

Marquette University, Milwaukee, Wisconsin 53233; Colorado Schools Computer Science Curriculum Development Project; summer: 2 weeks, August 11—August 22, 1975; academic year 1975-76: 8 meetings; 30 teachers from southeastern Wisconsin. Dr. Phillip R. Bender, Department of Mathematics and Statistics.

North Carolina State University, Raleigh, North Carolina 27607; Promoting Computer Literacy and Curriculum Awareness Using Huntington II, Colorado Schools Computing Project and Dartmouth Secondary School Project Materials; academic year 1975-76: continuous in 140 high schools in North Carolina. A mobile van will be utilized to visit high schools in North Carolina. It will be equipped with a mini-computer and other computer hardware components to use in making presentations to teachers and classes. Dr. James D. Powell, Department of Computer Science.

University of Notre Dame, Notre Dame, Indiana 46556; UICSM Mathematics and Selections from Other Mathematics Programs; summer: 6 weeks, June 23—August 6, 1975; academic year 1975-76: 30 meetings; 125 secondary school teachers of mathematics primarily from Indiana and Michigan. Professor Mario Borelli, Department of Mathematics.

Rutgers—The State University, New Brunswick, New Jersey 08903; Secondary School Mathematics Curriculum Improvement Study (SSMCIS); summer: 7 weeks, June 30—August 15, 1975; academic year 1975-76: 30 meetings; 30 teachers summer program, 40 teachers academic year primarily from within commuting distance of New Brunswick. Dr. Joshua Barlaz, Department of Mathematics.

University of San Francisco, San Francisco, California 94117; Secondary School Mathematics Curriculum Improvement Study (SSMCIS); summer: 3 weeks, July 7—July 25, 1975; 30 supervisors, curriculum specialists, and lead teachers of geometry. In-depth study of Courses I & II of the SSMCIS program with emphasis on transformation geometry and its applications will be the focus of this project. Dr. Edward J. Farrell, Department of Mathematics.

Southern Methodist University, Dallas, Texas 75275; Colorado Schools Computing Science (CSCS); summer: 6 weeks, June—July, 1975; academic year 1975-76: 9 meetings; 20 high school science or mathematics teachers from Region X (Texas). Professor Louis Nardizzi, Institute of Technology.

Southern Methodist University, Dallas, Texas 75275; Secondary School Mathematics Curriculum Improvement Study (SSMCIS); summer: 5 weeks, July 7—August 8, 1975; academic year 1975-76: 6 meetings; 50 junior high or middle school teachers from Dallas and suburbs. Dr. Frank J. Palas, Department of Mathematics.

State University of New York at Stony Brook, Stony Brook, New York 11794; Secondary School Mathematics Curriculum Improvement Study (SSMCIS); summer: 4 weeks, July 7—August 1, 1975; academic year 1975-76: 4 meetings; 25 mathematics teachers primarily from Nassau/Suffolk Counties, New York. The program will be directed toward implementation of SSMCIS materials in seventh grade classrooms, with attention to both mathematical and pedagogical problems. Professor P. G. Kumpel, Department of Mathematics.

Utah State University, Logan, Utah 84322; Secondary School Mathematics Curriculum Improvement Study (SSMCIS); summer: 4 weeks, June 16—July 11, 1975; academic year 1975-76: 30 meetings; 50 teachers and mathematics supervisors form commuting distance of Salt Lake City. Professor Joe Elich, Department of Mathematics.

Combined Secondary/Elementary Levels

University of Hawaii, Honolulu, Hawaii 96822; Unified Science and Mathematics for the Elementary School (USMES), Project Physics (PPC), University of Illinois Committee on School Mathematics (UICSM), Exploring Human Nature (EHN); summer: 6 weeks, June 16—July 25, 1975; 60 supervisors, administrators, elementary and secondary teachers from Far East DOD school systems and American Schools in the Far East. Professor Katashi Nose, Department of Physics and Astronomy.

University of Illinois at Chicago Circle, Chicago, Illinois 60680; Investigative Approaches to Teaching Elementary Mathematics Using Selected Materials from Madison Project Mathematics, University of Illinois Committee on School Mathematics (UICSM), Elementary Science Study (ESS); academic year 1975-76: 30 meetings for 1st-year participants; 15 for 2nd-year participants; 60 teachers (48 1st-year participants and 12 2nd-year participants) grades K-8 from Metropolitan Chicago. An investigative approach to teaching elementary mathematics using a variety of materials for the purpose of preparing teachers as peer-leaders. The participant's classroom serves as a laboratory for testing, adapting and evaluating the investigative approach. Second-year participants will reinforce their peer-leadership abilities by working with first-year participants. Professor Alice Hart, Department of Mathematics.

Michigan State University, East Lansing, Michigan 58824; Madison Project Mathematics; summer: 2 weeks, June (1 week) and August (1 week), 1975; academic year 1975-76: 10 meetings; 30 teachers of grades 5 to 8 primarily from Grand Rapids Public Schools. Dr. Julian R. Brandou, Science and Mathematics Teaching Center.

Montana Superintendent of Public Instruction, Helena, Montana 59601; Elementary Science Study (ESS), Science Curriculum Improvement Study (SCIS), Intermediate Science Curriculum Study (ISCS), Earth Sciences Curriculum Project (ESCP), CHEM Study, Project Physics Course (PPC), Madison Project, Nuffield Project, Illinois Arithmetic Project, Developing Mathematical Processes (DMP), School Mathematics Study Group (SMSG), The Man-Made World (TMMW); summer: 12 weeks, June 2—August 22, 1975; academic year 1975-76: continuous; 1176 administrators and teachers, K-12, from Montana. The project will provide a series of summer workshops and a variety of in-service follow-up activities to assist teachers to implement new math and science curricula in their classrooms. The effort is a cooperative one involving the State Superintendent's Office, Montana University units and Montana Public Schools. Mr. Alan D. Nicholson, Math-Science Supervisor.

University of Wisconsin-Superior, Superior, Wisconson 54880; All K-12 NSF-Sponsored Curriculum Projects; summer: a series of four 2-week leadership conferences, June—August, 1975; academic year 1975-76: in-service workshops, awareness conferences, development workshops; 100 key teachers (summer program), 2,370 classroom teachers, administrators, curriculum coordinators, science supervisors and college science education personnel from public and private schools in Wisconsin and the State Department of Public Instruction. Seven centers are being established in Wisconsin to assure a more intensive and effective implementation of new curricular materials into the schools of the State. Professor Donald M. Dailey, Department of Physics/Science Education.

University of Wyoming, Laramie, Wyoming 82071; In-depth study of Selected Nationally Recognized Curriculum Projects in Science and Mathematics (A particular curriculum will be selected by each participating school district); summer: 3 weeks, staggered sessions; academic year 1975-76: 17 meetings for each in-service class; 200 in

summer, 1800 during academic year, K-12, as selected by school districts. Applications will be accepted from any interested school district in Wyoming, Colorado and adjacent parts of Idaho, Nebraska, Montana and Utah. All participants should apply through their school districts. This is a project designed to prepare teachers to meet local needs in science and mathematics education. Local leaders will be trained during the academic year. Dr. Samuel W. Harding, Science-Mathematics Teaching Center, University Station, Box 3992.

Elementary Level

Boston College, Chestnut Hill, Massachusetts 02167; UICSM Motion Geometry with Mira and Geoboard; summer: 4 weeks, June 30—July 25, 1975; academic year 1975-76: 15 meetings; 30 teachers and mathematics specialists from Greater Boston and Merrimack Valley area schools. Professor Stanley J. Bezuszka, S.J., Department of Mathematics.

Webster College, St. Louis, Missouri 63119; Unified Science and Mathematics for Elementary Schools (USMES); spring 1975; information workshop in April for 180 administrators and teachers; summer: 2 weeks, August 4—August 15, 1975; academic year 1975-76: weekly meetings; 75 teachers (grades K-8) from the Greater St. Louis Area. Dr. Andrea Rothbart, Department of Mathematics.

Office of the State Superintendent of Public Instruction, Old Capitol Building, Olympia, Washington 98504; Mathematics Teaching Strategies Using the Madison Project Approach; summer: 2-week workshops, June 23—August 15, 1975; 390 elementary teachers from all districts in eastern two-thirds of State of Washington and the Olympic peninsula area. Elementary teachers will be trained during two-week summer workshops. They will then disseminate this material in their buildings during the following year. Dr. Demitrios P. Prekeges, Mathematics Department, Eastern Washington State College, Cheney, Washington 99004.

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