# Mathematics Education — 1955-1975: A Summary of the Findings*

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*A national study of mathematics education reveals mostly traditional content, textbook teaching, and little supervision.*

According to the National Science Foundation study, mathematics instruction changed very little from 1955 to 1975. A single textbook was the main source of content with few other teaching materials used or requested by teachers. Most instruction occurred with total-class groups and tell-and-show followed by seatwork at the elementary school level, and homework-lecture-new homework at the secondary school level. The self-contained classroom at the elementary school level and the fixed period schedule of the secondary school are still the predominant patterns for mathematics instruction.

*What major changes have taken place in mathematics curriculum offerings?*

## Content

Mathematics still remains a required course in elementary school and the content has expanded from arithmetic to mathematics with the topics of geometry, measurement, probability and statistics, graphs, equations, inequalities, and properties of number systems included in textbooks. Computation with whole numbers, fractions, and decimals remains the core of the elementary school curriculum. In the 11 districts studied, various forms of pencil and paper mathematics dominated the scene in the elementary schools with little evidence of manipulatives, sets, and so on being used (Stake and Easley, 1978, 13:18).

The number and variety of courses offered at the secondary school level have increased since 1955; however, the most frequently taught courses are general math, algebra, and geometry (Stake and Easley, 1978, 18:21). Among the new topics were functions, vector approaches to geometry, computer techniques, and calculus. Most of this increase occurred during the first part of the 1955-1975 period with the 1970s recording small increases in advanced courses and in basic or remedial mathematics (Suydam and Osborne, 1977, p. 36).

## "New Math"

The "new math" phenomenon was a two-decade series of developments that evolved and

* The material in this report is based upon work supported by the National Science Foundation under Purchase Order No. 78-SP-1131. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author and do not necessarily reflect the views of the National Science Foundation.

changed constantly. Some topics disappeared, and new ones emerged; some topics emerged and disappeared (Suydam and Osborne, 1977, p. 48). New materials were widely used by the mid-1960s with content and methodology changes attempted. Federal funding through such agencies as NSF, NIE, R&D Centers, and regional laboratories encouraged the implementation of new mathematics topics, materials, courses, and programs. Despite the "new math" thrust, and although it is evident that the number and variety of mathematics courses offered in secondary schools has increased since 1955, there appears to be little change in mathematics instruction in grades K-12. Few efforts were made to educate elementary or secondary teachers concerning the new changes in content and methodology with the result that the single textbook is still the primary source of mathematics curricula with most teachers using no instructional materials except the textbook and the chalkboard.

Few instances of modern mathematics were found in the case studies. For most classrooms around the country, modern math never touched down. In one city, for example, conventional textbooks with 1960 copyright dates were used in 1977. Over one-third of the principals and approximately one-fourth of the supervisors and teachers stated that new math had been a waste of time and money (Stake and Easley, 1978, 13:65 and 18:34).

**Back to Basics**

Much discussion concerning the back-to-basics movement has come from the public's belief that pupils have failed to learn minimal computational skills. The issue of back-to-basics seems to be emphasized more by school board members running for election or candidates for educational administrative positions than by teachers of mathematics. The Gallup Poll of the public's attitudes toward education revealed that the public's most frequent concerns are: to devote more attention to teaching of basic skills and to enforce stricter discipline. School board members and parents define back-to-basics as instruction that concentrates upon skills development in reading, writing, and mathematics.

Most schools define basics in terms of the "barebones" technical skills of reading and simple arithmetic operations (Stake and Easley, 1978, 13:34). The studies found the elementary math curriculum is traditional and dedicated to helping children learn to compute (Stake and Easley, 1978, 13:20).

The conclusion of reviewing 20 years of mathematics teaching in grades K-12 is that teachers have been and are still stressing mathematics skills at all grade levels, but the time spent teaching mathematics in grades K-6 is less than it was 20 years ago because of many new topics that have been added to the elementary curriculum.

*What impact has the new math approach had on what happens in classrooms?*

**Instructional Strategies**

In most classrooms the teacher is in charge (Stake and Easley, 1978, 13:59). It was observed that teachers had great freedom to teach largely what they pleased (Stake and Easley, 1978, 13:37). This type of freedom may have led to the generalized criticism that very little vertical articulation exists within the mathematics curriculum. Articulation between elementary and secondary schools seemed to be a universal problem (Stake and Easley, 1978, 13:19-20). It is clearly mental discipline that is the focus of the vast majority of teachers of mathematics at all levels beyond the second grade (Stake and Easley, 1978, 13:18). In the 1960s, hands-on curriculum projects were developed and promoted. Now the pendulum seems to be swinging back to one teaching source—the textbook (Stake and Easley, 1978, 15:5).

**Classroom Size and Management**

Research during the 20-year period from 1955-1975 provided little evidence that mathematics achievement was affected by total class size, but the size of the group with which the teacher works on a particular topic may be of importance. Approximately 20 percent of the elementary school day is allocated to mathematics time, but far less time is spent on actual instruction. All teachers studied spent a large proportion of their time on noninstructional activities such as discipline, classroom routines, money collections, filling out various forms, and so on.

Achievement was found to be higher in elementary classes where the greater proportion of time was spent on developmental activities and actual instruction by the teacher (Suydam and Osborne, 1977, p. 76).

### Evaluation

The use of standardized tests was more common in mathematics than in science or social science, and more common in grades K-6 than in grades 7-12 (Weiss, 1978, p. 27). The greatest change in testing over the past 20 years has been the concern for objective-referenced or criterion-referenced tests rather than norm-referenced tests (Suydam and Osborne, 1977, p. 83). Also, evaluation is now expected to provide information for curriculum decisions, whereas in 1955 the primary use of standardized tests was to help with decisions concerning individual students.

### Inquiry Teaching

Although much emphasis has been given to the development of inquiry teaching, little is taking place (Stake and Easley, 1978, 12:8). Many of the materials designed to promote inquiry were still in the schools but seldom used (Stake and Easley, 1978, 12:5). Teachers felt that higher level study for students was very hard work (Stake and Easley, 1978, 12:7). In mathematics at all levels, the teaching method was going over the problems assigned with either the teacher or students working at the chalkboard while others observed (Stake and Easley, 1978, 19:7).

### Materials

Mathematics instruction and mathematics teachers remain rather traditional. The textbook is the course of study, and the teacher's manual is the most extensively used supplement to the textbook. Hands-on-materials that accompany textbooks are used in about one-third of the K-3 mathematics classes, but little thereafter in grades 4-12. From third through twelfth grade, students had few materials to manipulate. In most classrooms the source of knowledge certainly is still the textbook (Stake and Easley, 1978, 13:59, 65). Mathematics teachers hardly ever use other materials such as film loops, slides, television, programmed instruction, CAI, field trips, guest speakers, and so on (Weiss, 1978, p. 102).

Federally funded curriculum materials in mathematics were being used less in 1976-77 than in previous years. This may imply that many of the ideas and approaches of these materials may now be found in the "conventional" mathematics textbooks (Weiss, 1978, p. 78). More than 500,000 nonprint instructional materials and an additional 5,000 print materials were marketed for use in the K-12 curriculum in 1976. Of the approximately 28,000 textbook titles marketed for use in mathematics, science, and social studies, a relatively small portion of that total was in use in the majority of the nation's classrooms. The ten most-used materials in math in the U.S. are clearly traditional programs all quite similar to each other in terms of instructional design, and social and personal value systems (Stake and Easley, 1978, 13:60).

*What type of supervisory support are teachers receiving in mathematics instruction?*

Supervisors at the secondary level revealed a preponderance of administrative and teaching loads over supervisory tasks. Between 62 and 96 percent of curriculum supervisors indicated that their primary responsibility is something other than curriculum supervision (Stake and Easley, 1978, 18:106). About half of the elementary supervisors had supervision as their primary assignment. On the average, supervisors had in excess of 200 teachers with whom they worked. There were very few people available outside the classroom to provide quality control for the curriculum and assist teachers with pedagogical problems (Stake and Easley, 1978, 16:42-43).

The number of statewide subject area coordinators has been reduced, and many coordinators have been assigned additional duties so that they have less time to spend on mathematics education (Weiss, 1978, p. 33). Approximately two-thirds of the local school districts have no district supervisors (Weiss, 1978, p. 36) and very few districts have fulltime mathematics coordinators (Weiss, 1978, p. 39).

Very few principals K-12 have majored in mathematics, and a considerable number of principals indicated that they are "not well qualified" to supervise mathematics instruction, particularly in the secondary school. Most mathematics teach-

ers believe they do not need help in lesson planning, teaching lessons, or discipline, but they do request help in obtaining information about instructional materials, learning new teaching methods, and using hands-on or manipulative materials (Weiss, 1978, p. 144; Stake and Easley, 1978, 18:112). Teachers rate other teachers as their best source of information about new developments in education, while principals rate other principals as their best source of information (Weiss, 1978, p. 150). Local inservice programs appear to be more useful to educators in grade K-6 than to those in grades 7-12 (Weiss, 1978, p. 154).

Asked, "What support do math teachers in your schools need?" math teachers and supervisors both gave emphasis to teacher centers where teachers could take their concerns (Stake and Easley, 1978, 18:61). Staff meetings appeared to be for the purpose of improving organizational arrangements and distributing information rather than for the purpose of giving assistance to teachers with pedagogical problems (Stake and Easley, 1978, 16:48). Many of the teachers and supervisors reported having attended a number of institutes and in-service courses. About 30 percent of the high school math teachers surveyed in the study indicated that they had attended at least one NSF summer or academic year institute (Stake and Easley, 1978, 12:7). Most felt they were useful, and many would like more such opportunities (Stake and Easley, 1978, 18:112; Stake and Easley, 1978, 16:51).

## Looking Ahead

Public dissatisfaction with declining achievement scores in mathematics shows a need for changing roles for federal agencies, professional organizations, administrators, supervisors, teachers, and parents in curriculum development and teacher pre-service and in-service education. It seems evident that hand calculators, computers, metric education, and research on pupil learning are going to be sources of change in the future of mathematics education. National and state assessments and competency requirements will also influence the mathematics teaching-learning process.

Areas of teaching performance that will be critical are those related to how mathematics instruction is organized, how mathematics materials are used, and how much time is spent in direct mathematics instruction. Leadership will be needed to see that adequate supervision is available from supervisors and/or administrators to assist teachers in organizing mathematics instruction and in the proper utilization of mathematics materials.

Each school district must evaluate its priorities in terms of its instructional time allotments. If mathematics is a high priority subject, then sufficient time must be allotted for mastery and application of basic skills. If the public expects teachers to stress mathematics skills, the mathematics instructional periods cannot be shortened or supplanted by other activities. If teachers are given adequate time to teach mathematics and proper supervision, they and their pupils will perform well. To help promote this environment is a major goal of the future.

### *References*


Robert E. Stake and Jack A. Easley. *Case Studies In Science Education:* Findings I, Booklet XII, Chapters 12, 13, and 14. National Science Foundation, 1978.

Robert E. Stake and Jack A. Easley. *Case Studies In Science Education:* Findings II, Booklet XIII, Chapters 15, 16, and 17. National Science Foundation, 1978.

Robert E. Stake and Jack A. Easley. *Case Studies In Science Education:* Booklet XIV, Chapter 18. Survey Findings and Corroborations, National Science Foundation, 1978.

Marilyn N. Suydam and Alan Osborne. *The Status of Pre-College Science, Mathematics, and Social Science Education: 1955-1975, Volume II: Mathematics Education.* Center For Science and Mathematics Education, The Ohio State University. National Science Foundation, 1977.

I. R. Weiss. *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education: Final Report, Contract No. C7619848.* Center For Educational Research, Triangle Park, North Carolina. National Science Foundation, 1978.



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