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ABSTRACT

The aim of the Title I math program was to improve the teaching of mathematics at the primary level in Title I schools. School staff and Parent Advisory Committee members had suggested and helped plan the focus of the project. It was expected that improved teaching would raise the level of understanding of basic mathematics skills and concepts of primary pupils. Testing of the children, however, was incomplete and inconclusive. All Title I primary teachers were eligible for the project. Most of the teachers from 25 public and 9 nonpublic schools availed themselves of the services offered by the project during the two years, 1972-74, covered by this report. This evaluation concentrated on the activities of the project and teachers' responses to those activities. Teachers received over 11,000 hours of inservice training. More than 900 demonstration lessons were given by the Math Team and more than 10,000 sets of instructional materials were distributed. These activities were supported by Title I funds of $155,408 for the two year period. Participation in the project was voluntary. The high number of requests for the Math Team's services was an indication of the need felt by the teachers for assistance in teaching math. Recommendations were made. These included clarification of objectives and development of criterion-referenced tests to measure those objectives. (Author/BJG)

Minneapolis Public Schools

Title I Elementary Math Program of Minneapolis 1972-74

A Title I, ESEA Project

Sara H. Clark, Research Specialist

Ideas expressed in this report do not necessarily reflect the official position of the Minneapolis Public School Administration nor the Minneapolis School Board

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C-74-34

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Special School District No. 1
MINNEAPOLIS PUBLIC SCHOOLS
Minneapolis, Minnesota 55413

Minneapolis Public Schools

Title I Elementary Math Program
1972-74

Summary

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About 65% of the participating teachers rated the Title I Math Program as either very worthwhile or outstanding for the two years covered in this report. They found the materials produced for classroom use to be the most helpful. Other services offered by the project staff, including demonstration lessons and inservice training, were also well received.	26
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All evaluation reports prepared by the Research and Evaluation Department of the Minneapolis Public Schools follow the procedures and format described in Preparing Evaluation Reports, A Guide for Authors, U. S. Department of Health, Education and Welfare.

Readers who are familiar with these Evaluation Reports may wish to skip the sections describing the City of Minneapolis and the Minneapolis Public Schools since these descriptions are standard for all reports.

The City of Minneapolis

The program described in this report was conducted in the Minneapolis Public Schools. Minneapolis is a city of 434,400 people located on the Mississippi River in the southeastern part of Minnesota. With its somewhat smaller twin city, St. Paul, it is the center of a seven-county metropolitan area of over 1,874,000, the largest population center between Chicago and the Pacific Coast. As such it serves as the hub for the entire Upper Midwest region of the country.

The city, and its surrounding area, long has been noted for the high quality of its labor force. The unemployment rate in Minneapolis is lower than in other major cities, possibly due to the variety and density of industry in the city as well as to the high level capability of its work force. The Twin City metropolitan area unemployment rate in June of 1974 was 4.0%, compared with a 5.2% national rate for the same month. As the economic center of a prosperous region rich in such natural resources as forests, minerals, water power and productive agricultural land, Minneapolis attracts commerce and workers from throughout the Upper Midwest region. Many residents are drawn from the neighboring states of Iowa, Wisconsin, Nebraska and the Dakotas as well as from the farming areas and the Iron Range region of outstate Minnesota.

More Minneapolitans (32%) work in clerical and sales jobs than in any other occupation, reflecting the city's position as a major wholesale-retail center and a center for banking, finance and insurance. Almost as many (26%) are employed as craftsmen, foremen and operatives, and 23% of the work force are professionals, technicians, managers, and officials. One out of five workers is employed in laboring and service occupations.

Minneapolis city government is the council-dominated type. Its mayor, elected for a two year term, has limited powers. Its elected city council operates by committee and engages in administrative as well as legislative action.

Minneapolis is not a crowded city. While increasing industrial development has occupied more and more land, the city's population has declined steadily from a peak of 522,000 in 1950. The city limits have not been changed since 1927. Most homes are sturdy, single family dwellings built to withstand severe winters. Row homes are practically non-existant even in low income areas. In 1970, 48% of the housing units in Minneapolis were owner-occupied.

Most Minneapolitans are native born Americans, but about 35,000 (7%) are foreign born. Swedes, Norwegians, Germans, and Canadians comprise most of the foreign born population.

Relatively few non-white citizens live in Minneapolis although their numbers are increasing. In 1960 only three percent of the population was non-white. The 1970 census figures indicate that the non-white population had more than doubled (6.4%) in the intervening 10 years. About 70% of the non-whites are black. Most of the remaining non-white population is American Indian, mainly Chippewa and Sioux. Only a small number of residents from Spanish-surnamed or Oriental origins live in the city. In 1970 non-white residents made up 6.4% of the city's population but accounted for 15% of the children in the city's elementary schools.

Minneapolis has not reached the stage of many other large cities in terms of the level of social problems. It has been relatively untouched by racial disorders or by student unrest. Crime rates are below national averages.

One's first impression is that Minneapolis doesn't really have serious problems of blight and decay. But the signs of trouble are evident to one who looks beyond the parks and lakes and tree-lined streets. As with many other larger cities, the problems are focused in the core city and are related to increasing concentrations there of the poor, many of them non-whites, and of the elderly. For example, nine out of 10 black Americans in Minneapolis live in just one-tenth of the city's area. While Minneapolis contains 11% of the state's population, it supports 28% of the state's AFDC families.

There has been a steady migration to the city by American Indians from the reservations and by poor whites from the small towns and rural areas of Minnesota. They come to the "promised land" of Minneapolis looking for a job and a better way of life. Some make it; many do not. The American Indian population is generally confined to the same small geographic areas in which black Americans live. These same areas of the city have the lowest median incomes in the city and the highest concentrations of dilapidated housing, welfare cases, and juvenile delinquency.

The elderly also are concentrated in the central city. In 1970, 15% of the city's population was over age 65. The elderly, like the 18 to 24 year old young adults, live near the central city because of the availability of less expensive housing in multiple-unit dwellings. Younger families have continued to migrate toward the outer edges of the city and to the surrounding suburban areas.

The Minneapolis Schools

About 65,456 children go to school in Minneapolis. Most of them, about 57,715, attend one of the city's 98 public schools; 7,741 attend parochial or private schools.

The Minneapolis Public Schools, headed by Dr. John B. Davis, Jr., who became superintendent in 1967, consists of 67 elementary schools (kindergarten-6th grade), 15 junior high schools (grades 7-9), nine high schools (grades 10-12), two junior-senior high schools, and five special schools. Nearly 3,500 certificated personnel are employed.

Control of the public school system ultimately rests with a seven-member board which levies its own taxes and sells its own bonds. These non-salaried officials are elected by popular votes for staggered six-year terms. The superintendent is selected by the board and serves as its executive officer and professional adviser.

Almost 40 cents of each local property tax dollar goes to support a school system whose annual operating general fund budget in 1974-75 is $78,008,036 up from $75,493,430 in 1973-74. Minneapolis received federal funds totaling 11.4 million dollars in 1973-74 from many different federal aid programs. The Elementary and Secondary Education Act provided about 5.1 million dollars, of which 3.9 million dollars were from Title I funds. The adjusted maintenance cost per pupil unit in the system was $1,038 in 1972-73 while the range of per pupil unit costs in the state for districts maintaining elementary and secondary schools was from $548 to $1,316.

One of the superintendent's goals has been to achieve greater communication among the system's schools through decentralization. Initially, two "pyramids" or groups of geographically related schools were formed. First to be formed, in 1967, was the North Pyramid, consisting of North High School and the elementary and junior high schools which feed into it. In 1969 the South-Central Pyramid was formed around South and Central High Schools. Each pyramid had an area assistant superintendent as well as advisory groups of principals, teachers, and parents. The goals of the pyramid structure were to effect greater communication among schools and between schools and the community, to develop collaborative and cooperative programs, and to share particular facilities and competencies of teachers.

In the summer of 1973 decentralization was carried one step further when the entire school district, with the exception of five schools involved in an experimental program called Southeast Alternatives, was divided into three areas.

Each of these areas -- East, West and North -- is headed by a superintendent who has autonomous decision-making power within the guidelines of school district policies and philosophies.

Based on sight counts on October 16, 1973 the percentage of black American pupils for the school district was 11.7%. Nine years before, the percentage was 5.4%. American Indian children currently comprise 4.3% of the school population, more than double the proportion of nine years ago. The proportion of minority children in the various elementary schools generally reflects the prevailing housing pattern found in each school area. Although some non-white pupils are enrolled in every elementary school, non-white pupils are concentrated in two relatively small areas of the city. Of the 67 elementary schools, 12 have more than 30% non-white enrollment and seven of these have over 50%. There are no all-black nor all-white schools. Eighteen elementary schools have non-white enrollments of less than 5%.

The Minneapolis School Board has approved a desegregation plan involving busing which has operated smoothly since taking effect in September 1973.

The proportion of school age children in AFDC homes has more than doubled from approximately 12% in 1962 to 28% in 1972.

While the median pupil turnover rate for all the city schools in 1971-72 was about 24.5%, this figure varied widely according to location (turnover rate is the percentage of students that comes new to the school or leaves the school at some time during the school year, using the September enrollment as a base figure). Target Area schools generally experience a much higher turnover rate; in fact only four of the Target Area schools had turnover rates less than the city median. Compared with the city, the median for the Target Area schools was 36.1%.

The Target Area

The Target Area is a portion of the core city of Minneapolis where the schools are eligible to receive benefits from programs funded under Title I of the Elementary and Secondary Education Act (ESEA). A school is eligible to receive Title I aid if the percentage of families residing in that school's district which receives AFDC payments (in excess of $2,000 a year) -- or has an annual income under $2,000 -- exceeds the citywide percentage for families in those categories.

In 1972-73, nearly 26,871 children attended the 25 elementary schools, five junior highs, three senior highs and seven parochial schools that were eligible to receive this aid. One-third of these students were from minority groups and one-third were defined by the State Department of Education as

educationally disadvantaged, i.e. one or more grade levels behind in basic skills such as reading and arithmetic. Federal programs are concentrated on the educationally disadvantaged group.

According to 1970 census data, over 170,000 persons resided in the Target Area. Of that group, 11 percent were black and 3½ percent were Indian, more than double the citywide percentage of minority group members. Over half of the Target Area residents over 25 years old had not completed high school, compared to the 35 percent of the non-Target Area residents who did not have high school diplomas. One out of five Target Area residents over the age of 25 had gone to college, and nine percent had completed four or more years. One out of four of the non-Target Area residents had gone to college, and 15 percent had completed four or more years.

The income for an average Target Area family was $9,113 in 1970, about $2,000 less than the citywide average. The homes they lived in had an average value of $10,385, over 40 percent less than the average value of a single family residence in Minneapolis. One out of five Target Area children between the ages of 6 and 17 was a member of a family that was below the poverty level, while only 6 percent of the non-Target Area children had such a family status.

Historical Background

The Title I Elementary Math Team preproject activities started in the spring of 1972 with Title I funds left from other projects. Requests had been received from staff, principals and the Title I Parent Advisory Committee for greater emphasis on mathematics at the primary level of instruction. It was suggested that primary teachers had received much more training in the teaching of reading than in math and that the project should concentrate on upgrading the teaching of mathematics.

The initial planning of the project included meetings of the elementary math consultant and resource teachers with various advisory groups which involved principals from the North and South Pyramids (the two target areas), members of the Title I Parent Advisory Committee and representatives from Title I parochial schools. Teachers, aides and interested parents from the target communities were also given opportunities to be involved in planning the project.

State Title I guidelines and policy stressed early intervention for the prevention of learning problems. In accord with this, the focus of the project was on grades K-3. The work of the project was to be both developmental and supplemental. It was thought that special help in learning the basic skills of mathematics might prevent problems when the children reached the higher grades.

In September 1972 funds from Title I, Part C, became available. This money was used to develop math labs in four of the Title I schools. The Title I Elementary Mathematics Project staff coordinated the math labs during 1972-73. In this report the activities of the labs are treated in a separate section.

Goals and Objectives

The general goal of the Title I Math Program for 1972-73 was to help the Title I primary children improve their understanding of mathematical concepts and basic math skills to enable them to function at grade level. In an effort to achieve that goal a stated objective was to improve the teaching of mathematics at the primary level in Title I schools. The project's aim was to have the primary teachers feel more "comfortable" teaching math. The staff intended to emphasize process rather than product and to illustrate, by example, how the teachers could deal more effectively with pupils, materials and content in mathematics instruction.

According to these objectives, participating teachers were the primary recipients of the project's services and students were secondary beneficiaries of the program. Although the project was designed to provide inservice training and resource materials to teachers, the following objective was set for the Title I students of the participating teachers: Fifty percent of the students receiving assistance from the Title I Primary Mathematics Program in each primary grade (1-3) will achieve the following mastery levels on the four parts of the Placement Test (a mastery test by Houghton-Mifflin Company, 1970 edition) for their respective instructional levels: 85% mastery of part 1, 80% mastery of part 2, 75% of part 3, and 70% of part 4. These levels were set on the basis of teacher and consultant judgment since no base data were available.

The means by which the project staff intended to achieve its objectives included the creation and production of support and supplementary materials, inservice training of teachers and teacher aides, and curriculum implementation services such as demonstration lessons and conferences. In order to identify the felt needs of the Title I K-3 teachers, questionnaires were distributed at the beginning of the school year, 1972-73. Personal contacts were also made by the project staff which visited each Title I school and described the project at the beginning of the year. Responses to the question, "In which topics in math do you feel the children experience the greatest difficulty and in which the least difficulty?" served as guidelines for planning much of the service which was offered during the year.

Personnel

The full-time professional staff in 1972-73 was headed by the coordinating resource teacher who coordinated the work of the project and worked with two additional resource teachers. (Funds had been provided for an additional resource teacher but the position was not filled during the school year.) These staff members had full-time responsibility for the project which included helping with the planning and leadership of all inservice sessions, the development of supplementary materials, and giving demonstration lessons. These three resource teachers were known as the Math Team.

The Minneapolis Public Schools' Elementary Mathematics Consultant worked with the Team on a part-time basis as adviser, project administrator,

and as a liaison person between the curriculum office, the Federal Projects office, and the members of the Math Team. The responsibilities of the Math Team as established in the fall of 1972 are given below.

Math Team Personnel

A. Consultant
   1. Overall program administration
   2. Coordination of lab teachers after labs are established

B. Coordinating Resource Teacher
   1. Coordinate Title I mathematics program with the Elementary Mathematics Consultant and the Assistant Superintendents.
   2. Organize and coordinate efforts of the other Title I Math Resource Teachers.
   3. Assist in administrative duties for the project such as planning budgets, writing final reports, and attending Title I meetings, in cooperation with the Elementary Mathematics Consultant.
   4. Plan and conduct in-service meetings for teachers in Title I schools.
   5. Identify areas in which supplemental math materials are to be developed.
   6. Review and edit materials developed.
   7. Plan overall evaluation procedures to be used, with assistance of research office.
   8. Disseminate information about program to parents, principals, community and math educators.

C. Mathematics Resource Teachers
   1. Assist in selecting areas in which supplemental math units and materials are to be developed under the direction of the Coordinating Resource Teacher and Elementary Mathematics Consultant.
   2. Develop instructional units and supplementary math materials for Title I children which will promote learning of basic math skills.
   3. Review, select, and disseminate existing math materials to supplement the base program for Title I children.
   4. Plan and conduct in-service meetings for teachers in Title I schools.
   5. Conduct demonstration lessons with Title I children in classrooms using developed materials and the base program.

6. Gather and analyze teacher comments on new materials and revise materials accordingly.
7. Assist in program evaluation, working with Consultant and Coordinating Resource Teacher.
8. Provide information about program to parents, principals, community and math educators.
9. Each resource teacher to work with specified segment of Title I schools.

A professor of mathematics education from the University of Minnesota was hired as an outside mathematics specialist. He acted as a consultant to the project. He also served as an instructor for the basic inservice course offered to Title I primary teachers by the project.

The project had the full time services of a clerk-typist throughout the year who was provided by the Instructional Materials Center.

In 1973-74 several changes were made in the staff. A new coordinating resource teacher and two new resource teachers were hired, although one of them did not join the project until the middle of the school year. One teacher continued on the staff for the second year. Because of decentralization in the school system shifts in the responsibilities of consultants occurred. In 1973-74 the project staff reported to the system's Mathematics Consultant who had previously been the consultant for secondary math. The former Elementary Mathematics Consultant was, however, still involved with the project and continued as a leader for the maxi- or basic inservice course.

Full time clerical assistance was again available in 1973-74.

Supplemental services were received from Title I monitors in interpreting Title I guidelines and selecting the children who were eligible for the program. Various services were provided by the Instructional Materials Center in production of materials for classroom use and in the production of audio-visual materials for demonstration purposes. A VISTA volunteer provided art work for new materials.

Project Operations

This report covers the first two years of the Title I Elementary Mathematics Project from the spring of 1972 through the spring of 1974. The project staff had its office in the Lehmann Educational Center, although many of its activities took place in the various Title I schools.

Primary teachers from all Title I schools were eligible to receive the services of the project's staff. Project activities are described in the following sections.

Team Training and Planning

Inservice training of the newly formed Math Team and the four teachers who were to be in charge of math labs began on September 25, 1972. It consisted of fourteen sessions, the last of which was held on November 1, 1972. The first two sessions were used for presentations and discussions of the total Title I math program, the Houghton-Mifflin math curriculum which was to be used in almost all of the Title I schools, and the definition of job descriptions and responsibilities. The other twelve training sessions were related to content in various areas such as sets, numeration, problem solving, Cuisenaire rods, measurements, geomentry, drill devices and techniques as well as the four basic mathematics functions. Participants in these training sessions found them very helpful. On a rating scale, on which five was the best, the median rating over all sessions was 4.5 with a range of 3.7 to 5.

During the first few weeks of the school year the Team tried to identify the needs of the Title I teachers whom they were to serve. Introductory meetings were held at all Title I schools to acquaint the primary teachers with the Math Team services. Teachers were asked to identify their needs on questionnaires. The Team also made an analysis of the Houghton-Mifflin texts which were being used in most of the Title I schools so that materials could be developed to supplement areas in which additional instruction was needed.

Maxi-inservices

The basic course of inservice offered to the teachers consisted of thirty hours of training. These courses were known as maxi-inservices. In the two years covered by this report six such inservices were held.

Feedback from the three maxi-inservices given in the spring and summer of 1972 was used in planning the sessions held in the 1972-73 school year. The general format remained the same. A typical course outline is shown in Figure 1. Each inservice consisted of ten 3-hour sessions. The staff included a Professor of Education at the University of Minnesota, the Minneapolis Public Schools' Elementary Mathematics Consultant, and the three members of the Math Team. The course was given

Fig. 1

MINNEAPOLIS PUBLIC SCHOOLS

Elementary School Mathematics

Title I Primary Math Inservice Calendar and Course Outline

Sequence V

Thursday January 18	Introduction Mathematics Education Today Group Discussions . Problem Identification . Teacher Needs Responsibilities and Assignments
Thursday January 25	Simulation Experience . Process/Product . Summary Responsibilities and Assignments
Thursday February 1	Implications for Learning - Piaget Film - "Conservation" Piaget Tasks Responsibilities and Assignments
Thursday February 8	Simulation and Involvement Activities . Place Value Experience Responsibilities and Assignments
Thursday February 15	Grade Level Groups . Discussion - Concerns . Discussion - Piaget Tasks . View Commercial Materials . Teacher Materials - Brainstorm Responsibilities and Assignments

Title I Primary Math Inservice Calendar and Course Outline — Sequence V

Thursday February 22	Interaction Analysis . A Look at Teacher Behavior . Television Demonstration Lesson . Demonstration with Participants Responsibilities and Assignments
Thursday March 1	Demonstration Lessons . Live . Television Reaction Discussions Responsibilities and Assignments
Thursday March 8	Teacher Made Materials . A Making Session Responsibilities and Assignments
Thursday March 15	Simulation and Involvement Activities . Graphing Experience Responsibilities and Assignments
Thursday March 22	Diagnosis and Evaluation Comparing Notes/Experiences Film - "I Do and I Understand"

at the Educational Service Center (the former School Administration Building at 807 N.E. Broadway). Teachers who enrolled were paid at the usual rate for inservice training. There was an option open to the participants in the maxi-inservices for obtaining University of Minnesota credit. If the teachers took that option they had their tuition ($45) paid in lieu of receiving the stipend ($150). A fair number did take the course for credit which saved the project money in that the tuition was considerably less than the stipend.

The inservices encouraged the use of manipulatives and discovery or pupil involvement in the learning process. The five-member leadership team, when working with small groups of teachers, emphasized processes and techniques for improving pupil involvement more than the content of the instructional unit. Techniques used in the course presentation included not only lecture, but also large and small group discussions, films, demonstration lessons (live and televised), simulation activities and participation in a teacher-made materials session.

At the first meeting of the course, after small group discussions, efforts were made by the total group to identify problems and teacher needs. The participants were asked to evaluate the inservice, and in some cases the individual leader's presentations, at the end of each session. The medians (on a scale from 1 to 10, 10 high) ranged from 7 to 10 for different sections of the inservices. The few lectures and the taped demonstrations were given the lowest ratings whereas the teacher "make-it" sessions received top ratings.

Although 74 teachers applied for the fall 1972 inservice, only 50 were accepted. The five-member staff had found from previous experience that it was best to work with no more than 10 teachers at a time in the small group activities. Forty-five teachers registered for the sequence presented in the winter of 1972-73 and the ratings given the course by the participants were again very favorable.

It had been estimated that there were about 300 teachers in the project's target group. As of the fall of 1973, 264 teachers had taken the project's maxi-inservice basic course. So that those new to the system, as well as others eligible, could still take the course, it was offered again in the winter of 1973-74 when 46 registered. The

ratings were again favorable.

Reactions to the course as a whole were requested at the end of the tenth session in each sequence. The questions asked and a few typical replies are given below.

1. What did you like most about this course?
   ... The change brought about in me my seeing an active approach to math teaching. It really works and it makes sense.
   ... Along with new concepts we were given concrete materials and specific instructions on their use.
   ... Gave me a whole new outlook on math teaching.
   ... Active involvement of participants.
   ... Manipulative approach.
2. What did you like least about this course?
   ... Piaget session--repetition of college course work
   ... Being lectured at
3. Do you have any suggestions for improving the course?
   ... Additional time to make materials
   ... More discussion of specific topics such as place value
4. What specific applications have you made (or do you hope to make) in your math teaching as a result of this course?
   ... I've changed my whole format trying to incorporate more pupil involvement, less teacher talk.
   ... I have used many of the ideas and materials. I have begun small group work which is very satisfying.
   ... My teaching is better planned. I use more materials for children. Math is more fun.
5. What type of follow-up would you like to have?
   ... Demonstrations
   ... Mini-inservice dealing with specific topics
   ... Additional materials

Mini-inservices

On the basis of teacher request, two to three hour inservice sessions on individual topics in mathematics were offered. These sessions were known as mini-inservices. A total of 17 two-hour mini-inservices for primary teachers were held during the period of January through May in 1973. Presentations were made by the Math Team. The average attendance at the workshops was 32. Each session concentrated on one subject. Sessions offered three times were: Use of Materials, Regrouping, Addition,

Drill Techniques, and Place Value. The inservice on Subtraction was given twice. A teacher had to complete the basic course of maxi-inservice to be eligible for the mini-inservice.

The locations for these workshops were selected so as to make them convenient for the participants. One was centrally situated in the North Target Area and the other in the South Target Area. Very positive reactions to these mini-inservices were received. Many of the comments said that the teachers found the sessions to be both relevant and practical.

In the 1973-74 school year, 30 mini-inservices were offered. Average attendance was 22. The sessions lasted from two to three hours. Subjects offered included: Classification, Measurement, Addition, Subtraction, Sets, Numeration, Place Value and Regrouping and more. Evaluations were obtained from the participants for 14 of the workshops. Again the responses were favorable. The sessions on Place Value and Regrouping received the highest ratings when 90% of the teachers checked that the course was either very worthwhile or outstanding and 87% said they would use the new materials or approaches in their classrooms either quite a bit or a great deal. The Classification sessions received the lowest ratings when 44% thought the course was adequate and 43% thought it very worthwhile or outstanding. However, 60% said they would use the new materials and approaches either quite a bit or a great deal.

Aide Inservice

In 1972-73 an inservice was attended by 35 aides. The course consisted of five two-hour sessions. Presentations were made by members of the Math Team.

Materials

Selection, creation and production of support and supplementary materials, as needs were identified by teachers, was seen by the Team to be a major element of the program. These units and materials were intended to supplement the base program for Title I children and to promote the learning of basic mathematics skills. These materials included not only Team designed materials produced at the Instructional Materials Center but also video tapes, cassette tapes, transparencies and teacher guides. A few commercially produced materials, such as

plastic fruit, rulers and individual number lines were purchased when cost estimates showed them to be less expensive than it would have been to have had them made locally. Over four thousand sets of materials were distributed to teachers during the 1972-73 school year. The Title I Math Catalog of Materials is shown in Figure 2.

In 1973-74 the Team continued the development of supplementary materials. Nearly six thousand sets were distributed.

Demonstration Lessons

The Team conducted demonstration lessons with the Title I children in their home classrooms using the newly developed materials and the base program. Demonstrations were available on request to any Title I primary teacher. Emphasis was on the use of manipulatives and discovery learning. Processes and techniques were used to increase pupil involvement.

In 1972-73 the Team of three resource teachers gave 405 demonstration lessons, 375 of them in the period from December through May. Teachers were asked to evaluate the lessons on a scale from 1 (low) to 10 (high). The average of the evaluations was 9.4.

The expanded 1973-74 Team gave 510 demonstration lessons including 400 pre- or post-demonstration teacher conferences.

Participants

All Title I primary teachers were eligible to receive services of the project. Nearly 300 teachers from 26 public and 9 parochial schools availed themselves of the project services in the two years covered by this report. The students of these teachers were indirect recipients of the project services. Although all teachers came from Title I schools not all of their students were classified as Title I. The effects of teacher training carried over to all the children but materials developed by the Math Team were distributed only to those children who were classified as Title I eligible.

Other influences which might have affected the impact of the project included the fact that mathematics laboratories were active at five of the public Title I schools. Most of the schools used the basic Houghton-Mifflin mathematics series. However IPI was used at Hall and

TITLE I MATH CATALOG - KGN. THRU GRADE 3

CODE #	NAME OF MATERIAL	GRADE LEVEL	DESCRIPTION
M-1	Giant Numerals	K-3	A set of numerals 1-10 to be used for classroom display. Suggested Activities Sheet for sets, ordering and basic facts included.
M-2	Perception Cards	K-3	Teacher set of cards with configurations to 10 to be used for more, fewer, set recognition, addition-subtraction facts and missing addends. Suggested Activities Sheet included.
M-3	EPR Numeral Cards	1-3	Contains numerals 0-9, (2 of each 0-6) and the signs +, -, <, >, =. (In sets of 15). Numeral cards contain set configurations on reverse side. Suggested Activities Sheet included.
M-4	Candy Jars	K-3	Set of 3 different shaped jars on one 9 x 12 oaktag to be used for conservation activities, comparisons, addition, subtraction and missing addends. (In sets of 10). Suggested Activities Sheet included.
M-5	Classroom Number Line	K-3	Laminated teacher number line with 18 unit markings. Two animals for use with number line included along with Suggested Activities Sheet.
M-6	Children Figures	K-3	Six girl and six boy figures laminated to be used with class for ordering, patterning, etc. Suggested Activities Sheet included.
M-7	Teacher Math Vocabulary Cards	K-3	Separate sets of cards for each grade K thru 3. The math words most frequently used and seen at each grade level are given. Problem solving phrases included with 2nd and 3rd grade sets. Packaged with complete list of all words.

TITLE I MATH CATALOG

CODE #	NAME OF MATERIAL	GRADE LEVEL	DESCRIPTION
M-8	Classroom Number-Numeral Cards	K-2	Classroom display cards showing the numerals, the number words and the sets 1-10.
M-9	Tens-Ones Figures	1-3	Two 18" wooden figures (each with 10 clothes-pin fingers) to represent tens place and ones place. May be used for place value, facts beyond 10 and regrouping.
M-10	Pupil's Tens-Ones Chart	1-3	Fifteen laminated 9" x 12" charts. Pupils use crayons to write or draw on charts. May be used for place value, facts beyond 10 and regrouping. Suggested Activities Sheet included.
M-11	Facts Triangles	1-3	One set of teacher triangles and two pupil sets for each basic fact through the sum of 18. Packaged as follows: Set I — Facts thru 6 Set II — Facts 7 thru 12 Set III — Facts 13 thru 18 To be used in drill and testing for addition subtraction. Suggested Activities Sheet included.
M-12	Missing Addend Game		
M-13	Drill Strip		
M-14	Facts Numberline Pad		
M-15	Ones-Tens Chart Pad		
M-16	Facts Beyond 10 Practice Pad		
M-17	Strips of 10 Pad		
M-18	Money Sets		
M-19	Facts Grid Pad		
M-20	Counting Numerals Reg. Cards		
M-21	Addition Subtraction Cards		

Transparencies

Tr-1 100's Chart
Tr-2 Ten-s-Ones Chart
Tr-3 Facts Grid Chart

Tapes

T-1 Problems

Video Tapes

Vt-1 Regrouping
VT-2 Addition
VT-3 Subtraction

Teacher Guide

G-1 Regrouping
G-2 Place Value

Distar was used in some classes at Harrison. Most of the non-public schools also used other texts.

Dissemination

The Team wrote weekly reports on its activities. The first year of the project the reports were sent to the Pyramid superintendents, the Elementary Math Consultant, the University of Minnesota consultant and the Research Department of the Minneapolis Schools. During the second year of the project, due to the decentralization which took place in the school system, the reports were sent to the three area superintendents, the three curriculum generalists, the University consultant, and the evaluator.

Newsletters telling of the activities of the Team were sent to the participating teachers several times a year. Information about the project appeared in school publications such as the North Area Capsule and several issues of the School Bulletin.

Presentations were made at various PTA meetings, the Title I Parent Advisory Committee, the WISE (Women in Service to Education) and to the Accountability Project, a citizen's group which was studying the teaching of basic skills in the Minneapolis Public Schools.

Parent and Community Involvement

The Title I Parent Advisory Committee (PAC) was informed of and approved the project's goals and objectives when the proposal was sent to the state for Title I funds. Members of the PAC were also included in the original planning sessions for the project. Members of the community were involved in the planning of the project but neither parents nor other community members were involved in the day to day activities for the project.

An open house held by the Team in the spring of 1973 was shown, briefly, on television news. Slides of project activities were included in a Federal Projects' slide show which included both reading and mathematics. Video tapes were made of several demonstration lessons. These shows were available upon request.

Math Labs

Math labs were set up in four schools with funds from Title I, Part C. A fifth school which had had a math lab the previous year also

received services from the Math Team. The laboratory centers were each staffed by a math supplementary teacher and two aides. They served Title I eligible children through individual tutoring and small group lessons in the laboratory setting. Lab teachers also assisted the regular classroom teacher improve math instruction by recommending and demonstrating the use of appropriate materials and teaching strategies to fit the needs of Title I children. Priority was given to the needs of the lowest achieving primary grade children.

In general, the staff was selected from the school where the lab was situated so that a building teacher was named as the lab teacher. These teachers had all had experience with Title I children. However, there was need for them to have further training in mathematics teaching. Lab teachers spent their first few weeks in inservice training with the Title I Math Team to strengthen their awareness of mathematics content. During this time they helped the Math Team do an initial survey of the Houghton-Mifflin series in terms of its strengths and weaknesses. The teachers surveyed suggested lists of materials and ordered those which they thought would be of special help in supplementing the classroom programs. Costs of equipment such as tables and chairs had not been included in the budget. The laboratory personnel spent some time in setting up the physical spaces where the labs were to be installed, borrowing tables and other necessary furniture wherever they could find them. Major problems in getting the labs started, however, were identification of those who should receive the services of the lab and scheduling the children. The idea was that the lab experience would supplement mathematical experiences the youngsters were getting during the regular class time. In general, the eligible children went to the labs on a daily schedule for a specified period of time. The amount of time varied with the age of the youngsters, anywhere from fifteen minutes to a half hour. At one of the schools, the plan was to service the youngsters in three week units of time. Later in the year the children were to attend for another three week period. However, even though more children would have been served, this approach proved to be very disconnected. The school then changed to the model used by the other schools in that the same children attended the lab throughout the remainder of the year.

The number of children in a lab at any given time varied. When children were assigned to a lab, notes were made as to whether their needs allowed them to function in small groups or if they needed one to one instruction with the teacher or an aide. From four to fifteen students attended a lab at any given time. Further individualization was possible in the choice of materials and supplementary texts. These were selected to provide experience with a variety of instructional materials. In addition to these commercially prepared materials, each math lab had five electronic calculators. The mechanical aspects of the calculators, with their flashing lights, proved to be very motivating. The calculators were used in a variety of ways including simple numeral recognition in kindergarten. The lab budget also provided calculators for all the other Title I schools. No school received less than two calculators and none got more than five. Manipulative items which were bought in quantities included balances, counters, and noisy number boxes. Lab teachers did not develop materials but used commercial materials and those developed by the Title I Team. The lab work was not text based. Instruction was based on information from the homeroom teachers as to what the individual students needed.

Since funds were not received until about the time school opened, the labs did not start functioning until sometime in December. The interim time was spent in developing the physical locations, inservice training of the lab teachers, and selection of materials to equip the labs. Training was also provided for the teacher aides in the labs.

The math labs operated in connection with the Title I Math Team during the 1972-73 school year. In 1973-74 they became responsible to their own building principals and so were no longer a part of the Title I Elementary Math Project.

Process Evaluation

The Minneapolis School System had contracted an outside organization with state (Title I) funds in 1972 to develop a model which could be used state-wide for implementation or process evaluation. The Title I Elementary Math Project was one of two projects selected to be used in the development of the model. Although the project staff found some utility in developing operational guidelines in terms of looking at the overall project, in general the participants were frustrated by the time necessary for working out details for the model. Much of the work seemed to duplicate what they had already done, especially

concerning the evaluations the Team had built into its own project, the inservices, and in the materials development.

The Team tried to reconstruct the number of manhours which were spent on the process evaluation activity, time that was taken away from their normal activities. A conservative tally of 300 hours, estimated from desk calendars, was spent on the process evaluation model between August and April (1972-73). The number of hours was based upon varying time inputs for from one to nine people. Members of the math labs, the Math Team, and the consultant felt that this was very expensive and excessive for the pay off which they, as a project, received.

Measures of Program Effectiveness

The Math Team offered services directly to all primary Title I teachers, and indirectly to the students of those teachers. In an effort to evaluate the effectiveness of the program several approaches were used. These included teacher responses and evaluations of services offered, testing of the teachers' Title I students, and, in the second year of the project, measures of student attitudes and self assessment in mathematics. Each of these approaches will be discussed in the following sections.

Teacher Responses and Evaluations

Project operations focused on the needs of the Title I teachers, both as seen by the Team and by the teachers themselves. In the fall of 1972, the Title I primary teachers were polled in order to identify the areas in which the teachers wanted the Team to concentrate its efforts (Figure 3). Teachers' responses guided the Team's activities, especially the choice of specific topics on which the teachers wished demonstration lessons, mini-inservices, and supplementary math materials.

Teacher feedback on the demonstration lessons given by the Team was also obtained. The Team then evaluated each lesson, many of which have been video taped, and incorporated teachers' suggestions for change when possible. Demonstration lessons were given at the request of the classroom teachers. The average member of demonstrations given in each teacher's classroom was two. According to the Team, requests for more demonstrations were received but time and staff limitations prevented their filling the requests. In 1973-74, with the help of an additional member on the Team, the number of demonstration lessons increased from about 400 to a little over 500.

Fig. 3

HELP US TO HELP YOU!

I. Please number, in order of importance, the areas in which you would like us to concentrate our efforts.

___ A. Materials (Creation and Production)

Please circle one - Type (Support - Supplementary)
Please circle one - For (Individual - Small Group-Large Group)

___ B. Demonstration Lessons (Please indentify specific topics)

1. _____

2. _____

___ C. Mini In-Service (Please identify specific topics)

1. _____

2. _____

___ D. Organization of materials for maximum use.

___ E. Any others. Please identify _____

II. In which topic(s) in Math do you feel the children experience the most difficulty?

_____

_____

III. In which topic(s) in Math do you feel the children experience the least difficulty?

_____

_____

IV. Any other comments? _____

_____

Thank You!
Title I Math Team
Anita Steinbicker
Mary Lou Knipe
Marjorie Ott
827-2868

Your Name _____

Grade _____

Building _____

Did you have the Title I Math Course? Yes _____ No _____

Do you intend to take it ? Yes _____ No _____ When? _____

Would you be willing to serve as a contact person for your grade level (in your building) for Title I Math? Yes _____ No _____

Teacher reactions to the mini-inservices offered on specific topics were obtained through use of the professional growth course evaluation form developed by the Minneapolis Public Schools. Data obtained from these evaluations were used for process evaluation by the Team of its activities and are not reported here. The teachers' responses were, however, used to improve and further develop later inservices. In 1972-73, 17 mini-inservices were attended by 524 teachers for a total of 1,048 hours. In 1973-74, 30 mini-inservices were attended by 673 teachers for a total of 1,655 hours of instruction. These figures indicate that the inservices were well received. The teachers thought the workshops were both relevant and practical according to comments received.

The development and production of manipulatives and support materials was another aspect of the Team's services. Before materials were ready for production, prototypes were developed. These models were used in a few classrooms and were rated by means of an evaluation scale (Figure 4). Teachers' evaluations and comments were used by the Team to make necessary changes or improvements in the materials before they were produced in large quantities. In 1972-73, nearly 5,000 pieces of materials were distributed. In 1973-74, nearly 6,000 pieces were distributed. The evaluations received from teachers indicated a high acceptance and use of these materials.

From the spring of 1972 to the spring of 1974, six sequences of the maxi-inservice or base course were offered. Ratings as to the degree of helpfulness and method of presentation were obtained from the attending teachers at each of the ten sessions in each sequence. Sessions were composed of from one to five different subjects or activities. These numerous figures are not presented here. The ratings were generally highly favorable. The median rating over all sessions was 8 on a scale with 10 high. The range of medians was from 7 to 10. The session most favorably received by the teachers in all sequences, was on teacher made activities in which the teachers participated in the making of new materials. Over all sequences this session had a median rating of about 9.5. The sessions looked upon with least favor by the teachers were those which consisted chiefly of lectures on topics such as "Mathematics Education Today" and "Piaget's Implications for Learning." These ratings were used somewhat to modify the course outline as time proceeded. However, no major changes were made in the course: lectures

Fig. 4

EVALUATION SCALE FOR A TEACHING AID IN MODERN MATHEMATICS

NAME OF MATERIAL USED _____

	Criteria	Comments
____	1. Suggested Activities	
____	2. Application of principles	
____	3. Usability by children	
____	4. Time use during the year	
____	5. Multigrade-level use	
____	6. Relationship to text in use	
____	7. Does the job	
____	8. Practicability (ease of handling, size and etc.)	
____	9. Storage potential	
____	10. Attractiveness of product	
____	11. Learning device vs. busywork	
____	12. Flexibility (variety of topics)	

Instructions: List the rating you wish to make for each criterion:

3-Excellent, 2-Good, 1-Fair, 0-Not Useful. Add all the ratings and determine the overall rating by using the following scale:

30-36	Excellent:	Highly recommended for purchase and use
21-29	Good:	Recommended for purchase and use with some reservations (see comments)
12-20	Fair:	Not recommended for purchase and use by evaluator
0-11	Not Useful:	Not considered useful by evaluator

_____ _____

Signature Date

_____

Grade

were still given, and time for making materials was not increased.

Reaction of the participating teachers to the overall Title I Math Project were sought in the spring of 1973 when only 45 teachers replied. However, 63% thought the program had been excellent and 20% said it had been good. In order of helpfulness, the teachers rated the materials first, the maxi-inservice second, the mini-inservices third, and the demonstration lessons last. A slightly expanded evaluation questionnaire was sent in the spring of 1974 to all teachers (N=382) who had received services from the Team in the two-year period of 1972-74. Replies were received from 40% of those questioned. The services offered by the Team, in terms of helpfulness, were again rated in the same order: materials, maxi-inservices, mini-inservices, and demonstration lessons. Sixty-six percent of the respondents said the program was either very worthwhile or outstanding, and 28% said it was good. When asked if the Title I project had changed how much they liked teaching math, 55% of the teachers said they liked it more and 45% said they liked it about the same.

Student Measures

The Houghton-Mifflin Placement Test had been specified as the measure of the students' mathematics achievement. Norms were not available for the test; rather, specified criteria were to be met. The objectives referred to the students' "respective instructional levels," a phrase which was interpreted differently by the project coordinator and the evaluator. The evaluator had taken the phrase to cover the grade placement of those who were in ungraded schools whereas the project coordinator interpreted it as meaning at least a year below grade level which was one definition of a Title I child. At any rate, over 1000 Houghton-Mifflin tests were given in the spring of 1973. It would be impossible to interpret the results according to the objectives (that 50% would achieve mastery of part 1 at the 85% level,.....and that 50% would achieve mastery of part 4 at the 70% level) since different parts of the test were given at different grade levels. Accordingly, percentages of those achieving master at four specified levels are given in Table 1. The grades at which the tests were given, the numbers of students for the different sections, the means and the standard deviations are included in Table 1.

The objectives were not met in five of the eight sections of the

Table 1

Houghton-Mifflin Placement Test Data

Test Level	Part	Grade Tested	N	% with 85% or more correct	% with 80% or more correct	% with 75% or more correct	% with 70% or more correct	No. of Items	Mean	s.d.
1	1	1 or	419	71%	80%	80%	87%	13	11.10	2.05
	2	1/2	420	28	28	36	46	17	10.56	4.04
1	3	2	274	63	77	77	87	13	10.70	2.06
	4		277	30	42	52	59	16	10.45	4.17
2	1	2/3	24	46	67	71	75	19	14.42	3.81
	2		24	12	17	25	29	21	12.50	5.13
2	3	3	302	10	21	35	35	14	8.57	2.41
	4		303	19	33	33	49	9	5.40	2.18

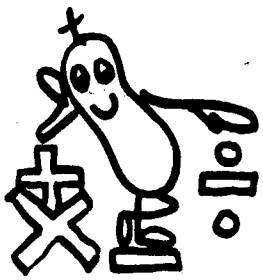
tests if the specified percentages for each part are observed. The means and standard deviations indicate the general level and variability of the groups which were tested. Many reports were received from teachers who said that the tests did not cover the same content which they had been emphasizing during the year.

The Team was asked to state its objectives for the 1973-74 school year before the spring of 1973 testing was completed. With many reservations, they agreed to renew the 1972-73 objectives although they questioned the appropriateness of the Houghton-Mifflin test for their program. It had been selected as "the least bad" for their purposes.

In order to establish base data, by grades, so that realistic criteria of achievement might be documented, a random sample of 38 teachers was asked to give only half of each test to their classes. The results were disastrous. Some teachers refused to administer the tests; some used only a few questions. Of the 31 teachers from whom any results were obtained many wrote that it was very frustrating to the children. Typical comments were, "It certainly teaches them the feeling of failure and inadequacy," and "It was a frustrating experience for them and for me." One teacher wrote that several of the children cried despite reassurances from her and her aide.

Continued use of the Houghton-Mifflin tests was thought to be unwise in view of the above experiences and also because the teachers, not the students, were the primary beneficiaries of the project's services.

Measures of student attitudes toward math and self-assessments of their instructional level were administered in the fall of 1973 and the spring of 1974. The self-assessment sheet (Figure 5) was originated by the 1973-74 Math Team. The sheets were distributed to all Title I primary teachers. Responses were received from 2295 students in September 1973 and from 3943 students in May 1974. Since the group who replied in the spring was not identical with that in the fall no statistical tests of changes between fall and spring polling may be made. Cross-tabulations of the liking math categories with those of the ease of math, reduced to percentages, are given in Table 2 for the September 1973 and the May 1974 returns. In the spring, more children were in the "I hate math" and "Math is hard" categories than had been in the fall. Possibly such reactions would be found for any school subject near the end of the school year.



My name is _____.

_____

I love Math.

I hate Math.

Math is OK.

Math is easy.

Math is hard.

Math is just right.

Thank you.

Pupil Self-Assessment of Attitude and Instructional Level

Table 2

Pupil Self-Assessment of Attitude and Instructional Level
Percentages in Cross-categories

September 1973
N=2295

	Math is easy	Math is just right	Math is hard	
I love math	20%	16%	4%	40%
Math is O.K.	10%	28%	7%	45%
I hate math	3%	2%	10%	15%
	33%	46%	21%	100%

May 1974
N=3943

	Math is easy	Math is just right	Math is hard	
I love math	19%	16%	4%	39%
Math is O.K.	9%	26%	7%	42%
I hate math	3%	4%	12%	19%
	31%	46%	23%	100%

Tabulations were not completed of the scale on which the children marked assessments of their instructional levels.

Budget

The amounts budgeted for different phases of the project are given in Tables 3, 4, and 5. Title I, ESEA provided all of the funds.

Table 3
Elementary Math Program, 1972-73
Title I

Salaries	$ 43,062
Inservice stipends	18,000
Supplies, instructional	5,201
Other (contracted services)	4,000
Fringe on salaries	4,737
	$ 75,000

Table 4
Expanded Elementary Math (Labs) 1972-73
Title I, Part C

Salaries	$ 86,242
Inservice stipends	1,302
Supplies, instructional	10,040
Fringe on salaries	9,630
Equipment (calculators for schools)	4,117
	$111,331

Table 5
Elementary Math Program, 1973-74
Title I

Salaries	$ 48,730
Inservice stipends	17,763
Supplies, instructional	5,000
Other (contracted services and mileage)	2,250
Fringe	6,029
Equipment, office	636
	$ 80,408

The first three maxi-inservice sequences offered in the spring and summer of 1972 were paid for with distillation funds from other federal projects. The Instructional Materials Center lent the Team the necessary office equipment so there were no start-up costs in that sense. The figures budgeted represent the costs of an on-going program.

The total budgets allocated were adequate although some reallocations were necessary or advisable. As an example, the Team was short one

resource teacher in 1972-73 so that salary was added to the mini-inservice section of the program. The persons responsible for expenditures included the coordinating resource teacher, the Math Consultant and director of the project, and the Federal Programs department.

Discussion and Summary

The specified measurable objectives set up for this project in the Title I proposal under which it was funded were not directly relevant to the project's planned activities as outlined in that same proposal. Title I primary teachers were the primary recipients of the project's services. Certainly one would hope that children would learn more readily from teachers whose mathematics teaching skills had been improved. However, the teachers availed themselves of the offered services in varying degrees and at different times of the year. There was no way of finding out how much of what the teachers learned at the inservices was used in their classrooms. It seems inappropriate to evaluate the efficacy of a program which was to provide inservice training and resource materials to teachers by testing their students.

The Math Team in the two years 1972-74, appeared to be very responsive to the needs of the teachers. Responses from the teachers at the beginning of the school year helped direct the Team's activities. Evaluations of the Team's services by the participating teachers were used in a constructive way to improve ensuing Team activities. At the end of each school year, a majority of the responding teachers indicated that they had found the services and materials offered by the project to be very worthwhile.

The problem of measuring the gains of the students remained unsolved. The published tests which were used were not appropriate measures of the teaching techniques and philosophy of learning which the Team promoted. Individualization of instruction, involvement of the child in discovery learning, and Piaget's theories of mathematical development in the child were emphasized by the project. There are some tests which could measure the child's readiness for math and understanding of basic concepts, but they must be administered individually and, as such, were prohibitive in both time and money for such large numbers of children.

The project was successful, in terms of subjective measures, with respect to the services it offered teachers. However, no specific outcomes were found for those teachers' students who were the long range beneficiaries of the program.

Recommendations

1. In proposals for funding of programs, make certain that the specified measurable objectives are appropriate to the project's planned activities. Increased consultation and communication among the director(s) of a project, the Federal Programs Office, and the Research Department should alleviate this problem which was apparent in the two years covered by this report. (See page 7.)

2. Develop criterion-referenced tests in mathematics to suit the scope and sequence of mathematics instruction in the Minneapolis Public Schools, since the "least bad" of the available commercial tests were not suitable measures of achievement according to project personnel and teachers. (See page 32.)