DOCUMENT RESUME

ED 108 970 SE 019 475

AUTHOR Schall, William; And Others
TITLE Developing Mathematical Processes (DMP). Field Test Evaluation, 1973-1974.
INSTITUTION Falconer School District, N.Y.; Saint Mary's Elementary School, Dunkirk, N.Y.; State Univ. of New York, Fredonia. Coll. at Fredonia. Teacher Education Research Center.
PUB DATE Jun 75
NOTE 52p.; marginal legibility in Appendix A; Best copy available. For previous document, see ED 097 290

EDRS PRICE MF-$0.76 HC-$3.32 PLUS POSTAGE
DESCRIPTORS *Activity Learning; *Curriculum; *Curriculum Evaluation; Elementary Education; *Elementary School Mathematics; Formative Evaluation; Geometry; Individualized Instruction; *Instruction; Objectives
IDENTIFIERS *Developing Mathematical Processes

ABSTRACT

The Developing Mathematical Processes (DMP) program was field-tested in the kindergarten and first three grades of one parochial and five public schools. DMP is an activity-based program developed around a comprehensive list of behavioral objectives. The program is concerned with the development of intuitive geometric concepts as well as arithmetic ability and provides for use of individual guidance and pacing. The evaluation reported here concerned achievement gains on the Stanford Achievement Tests and attitudes of pupils, teachers, and parents toward the program. The program was used in the 1973-74 school year. The previous years' standardized test scores were to predict grade equivalent means for the subsequent year. When scores obtained on the Spring 1974 test were compared with predicted scores, they were higher at all grade levels, but the differences were not statistically significant. Teachers, parents, and pupils all gave the program favorable ratings. Copies of the instruments with item-by-item responses are included in this document. (SD)

Developing Mathematical Processes

(Draft)

Table of Contents

School Personnel
1973-1974

Falconer Central School District

James H. Gassman - Supervising Principal
Elizabeth Alday - Elementary Coordinator

Harvey C. Fenner

Herbert Carlson, Principal

Mrs. Marian Palmer	K
Miss Marlene DeSantis	1
Mrs. Helen Baldwin	1
Miss Elizabeth Stocum	2

Paul B. D. Temple

Donald Lazarony, Principal

Mrs. Kathryn Scholeno	K
Mrs. Helen Condon	1
Mrs. Ruth Davis	2
Miss Helen Cronk	3

South Side

Richard Pond, Principal

Mrs. Eleanor Fitzpatrick	K
Mrs. Doris Patterson	1

North Side

Mrs. Lucy Mula, Principal

Mrs. Joan Rine	K
Mrs. Berdina Bolling	1
Mrs. Christine Watt	2
Mrs. Joanne Spiranec	2
Miss Celeste Coggiola	3

Ellington

Rudolf Donn, Principal

Mrs. Elizabeth Matthews	1
Mrs. Carol Stanton	2
Mrs. Frances Howard	3

St. Mary's School

Sister Robert Anne, Principal

Mrs. Helen Szczerbacki	K
Mrs. Mary Kirst	1
Miss Joan Tederous	1
Mrs. Marjorie McCaig	2
Miss Joanne Nazzaro	2
Mrs. Margaret Smith	3
Miss Lenore Catalano	3
Sister Claudia	3

Foreword

The Developing Mathematical Processes (DMP) program field test was supported jointly by the Falconer Central School; the St. Mary's Elementary School, Dunkirk; and the Teacher Education Research Center, State University College, Fredonia, New York.

DMP is a research-based, innovative, process-oriented elementary mathematics program that was developed at the Research and Development Center for Cognitive Learning, University of Wisconsin, Madison.

The project has fulfilled the following purposes: (1) for the schools involved, it has provided a change thrust to upgrade elementary mathematics instruction for children; (2) for the Teacher Education Research Center, it has provided another vehicle for the support of individualized instruction in collaboration with area schools; and (3) for the elementary mathematics program at the College at Fredonia, it has provided innovative mathematics materials and processes that can be offered to both pre and inservice educators.

We appreciate the assistance of Elizabeth Alday, Falconer Central School, and Sister Robert Anne, St. Mary's School, in providing on-site leadership in getting DMP initiated in their respective schools.

Special thanks are due Doris Hall for layout and duplication work and Marian Anderson for typing this report.

James H. Gassman, Supervising Principal
Falconer Central School

Sister Robert Anne, Principal
St. Mary's Elementary School

Ronald E. Hull, Acting Director
Teacher Education Research Center
State University College
Fredonia, New York

DEVELOPING MATHEMATICAL PROCESSES (DMP)

FIELD TEST REPORT, 1973-1974

Dr. William Schall
Associate Professor
Elementary Education Department

and

Dr. Daniel Bauman
Assistant Professor
Teacher Education Research Center

Dr. Madan Mohan
Associate Professor
Teacher Education Research Center

State University College
Fredonia, New York

June, 1975

Preface

Parent Comments

She seems to be doing very well and acts as if she understands and enjoys it very much.

I believe it is a good program, that should be continued as it holds a child's interest.

I am very impressed with the math program in kindergarten. It seems to be preparing them for the future years of math.

She has learned a great deal from it and it is great. A far cry from what we did back when I was a kindergartner.

Sometimes I don't understand it myself. But as long as he understands it, that's all that matters to me.

I don't understand it and I confuse him if I try to help.

At this time it is too early to form an opinion.

When I sat in "L's" class it seemed very hard to understand, but after it was explained, it was very good math.

What math "L" has told me about, she has understood quite well.

It is a cute way to introduce kindergartners to math. It is more of a game than work.

Difficult for us to understand. Presents a problem to tutor him.

From what I know of it, I think it's a good program. It seems to create more interest in the subject for the children.

Purposes of the Study:

The study was designed to: (1) continue the field testing of IMP and extend it to the third grade; (2) implement and refine for the kindergarten through second grades; (3) determine the effectiveness of IMP in terms of pupil, teacher, and parent attitudes toward the program; and (4) determine the extent to which children attained the objectives established by the program.

Secondary purposes were to: (1) continue to support local schools in the investigation and implementation of individualized programs of instruction; (2) enhance local interest in new and innovative programs in elementary school mathematics; and (3) continue a well established program of in-service education for local school personnel.

Development of the Falconer Math Program

In the early 60's, Falconer attempted to make arithmetic "meaningful" for students. To attain this objective, the Falconer math committee members were talking about the "basic principles of mathematics" and were trying to apply them sequentially from the simple processes through the more difficult. When "new math" appeared on the scene, Falconer made a real effort to "get with it" as advantage was taken of the first projects available, which provided an instructor from State University College, Fredonia. Thirty sessions of two hours each were presented to all of the elementary teachers and one high school teacher. The Falconer Board of Education paid these teachers for this in-service work.

The "new math" emphasized many of the basic mathematic properties appropriate for the elementary school student, such as the commutative, associative, and distributive properties. It also introduced extensive use of the mathematical sentence or equation, more precise language, the logic of relating ideas and seeing the patterns of mathematics, and an introductory approach to "set theory."

A transition text, Winston, Moving Ahead in Arithmetic, was selected and initiated in grades 1-6. This text was successfully used for several years.

During the next five years, in-service activity continued with the company's consultant speaking to the faculty periodically. When it became apparent that one text did not meet the needs of all,

selection of dual texts was made---one more difficult; one with lower reading vocabulary requirement.

Some teachers experienced problems with this material. Children were not doing as well as they had previously. The new program seemed to take children into abstractions before they had developed an understanding of the concrete.

In 1969, four local workshops on Values, Individualized Instruction, Research, and a panel on Organization, were presented by State University College, Fredonia.

The year 1970 led to the development of a philosophy of education. Twenty-nine teachers continued to study all areas of Curriculum Development with State University College, Fredonia, assistance. Although science, social studies, and other areas received attention, mathematics continually appeared as a topic in faculty meetings.

During the period of 1969-71, Falconer became interested in Individually Guided Education (IGE) and its various adaptations. Summer courses in 1970 and 1971, with the Teacher Education Research Center, gave leadership training in management systems. Paraprofessionals and staff participated in the Educational Profession Development Act (EPDA) projects of 1970 and 1971. Subsequently, Falconer was selected by the Teacher Education Research Center for a joint project in individualized instruction. From 1970-71 on, unit meetings of teachers became a way of planning learning experiences for the children in each age level.

During the years 1969-70 and 1970-71, Falconer teachers were making a detailed study of all mathematics programs on the market. Sample sets of books were obtained, studied by a mathematics committee,

and routed on to all buildings for further examination. For any series requested by teachers, the salesman or the consultant was invited to speak before the group; however, none of the available series were outstanding in the opinion of the teachers.

The chairman of the elementary mathematics committee, Donald Lazarony, invited the cooperation and advice of the then instructional coordinator of the high school mathematics department, Leland Carlson, who attended most of the committee meetings during the two-year period. Both the elementary chairman and the high school coordinator were enthusiastic in bringing to the attention of the elementary teachers information concerning Developing Mathematical Processes (DMP).

Thus, by the 1970-71 school year, Falconer teachers had reviewed research studies and federal projects and through college mathematics classes at Fredonia, the mathematics chairman learned of DMP. Subsequent to the above activities, a decision was made to apply to the University of Wisconsin Research and Development Center for field testing DMP.

The DMP consultant, Dr. William Schall, from State University College, Fredonia, had numerous in-service days with Falconer teachers, conducted numerous faculty meetings, and trained aides specifically in DMP skills.

In the Summer of 1972, ten classrooms, representing the five elementary buildings in Falconer Central School, and five classrooms from St. Mary's School, Dunkirk, New York, agreed to participate in the large-scale field testing of DMP in grades Kindergarten through Second. The

teachers, teacher aides, and several administrators met in August, 1972, for a two-day training session for DMP at Fredonia State University, conducted by Dr. William E. Schall, DMP State Coordinator.

In September of 1972, Falconer teachers and teachers of St. Mary's School again met together to share ideas. During this time, many bulletins from the University of Wisconsin and State University College, Fredonia, were distributed and studied. A teacher survey was taken. Test results were studied and the first evaluation was made.

DMP was begun in October 1972 in all five Falconer schools. Three schools began K-1-2, and the other two started in Kindergarten. Each year, each school has added a grade. As the materials became commercially available they have been utilized in the appropriate grades.

Teachers who have been in the program for more than one year have continued their enthusiasm and have completely supported this over any previously known or used program.

The DMP program is one component of IGE. Thus, Falconer has given concerted study to IGE procedures and has implemented an adaptation of IGE planning. However, the beginning classes of DMP appear to be more "graded" than is ideally expected according to the IGE system. Falconer did not utilize the multiunit or continuous progress grouping arrangement during the initial implementation.

The implementation and refinement procedures for the DMP field testing (1973-74) for St. Mary's School, Dunkirk, were conducted in a similar manner. Dr. Schall visited the school and worked with the teachers and children a minimum of once per month. During the 1973-74 school year, two third grade classrooms at St. Mary's were added to the DMP field test.

Mrs. Margaret Smith, a teacher at St. Mary's, completed her Master's project at Fredonia State University using the 1973-74 data collected from the third grade classrooms at St. Mary's.

In May of 1973, five Falconer teachers, accompanied by Dr. Schall, attended the New York State Math Conference where they presented the DMP program. During this period of time, three teachers also assisted Dr. Schall in presenting the program to the Rochester, New York, teachers. Another group spoke to the Cassadaga Valley Central Schools, Sinclairville, New York, and seven teachers gave small group presentations to the Western New York Tri-County Math Conference. In April of 1974, five teachers and the math chairman attended the New York State Math Conference in Rochester with Dr. Schall.

In the Fall of 1973, Falconer teachers, with Dr. Schall, the Fredonia DMP consultant, demonstrated DMP materials and program to a five-school in-service day session sponsored by Falconer, Panama, Sherman, Chautauqua and Frewsburg Central Schools. Dr. Lloyd Joyal, from the University of Wisconsin, was the principal speaker for the day. He demonstrated for teachers many mathematical games for use in their program. Six Falconer teachers gave presentations at this session.

Visitors to the Falconer DMP classes have come from not only local area schools, but also from Pompton Lakes, New Jersey; Niagara Falls, Hamburg, Olean, and Elmira, New York.

Dr. Schall, the Fredonia DMP consultant, has worked with the teachers in their building during bi-monthly visits over the past two years. He has held after-school in-service sessions with the teachers in each building, as well as meeting with all of the teachers involved.

He has given specialized training to the aides working in the program, and he has spoken at several faculty meetings. Slides showing children's DMP activities have been developed into a slide presentation and a video cassette.

During the 1972-73 and 1973-74 school years, DMP was a component of the Title I Falconer School Project.

Overview of Developing Mathematical Processes (DMP)

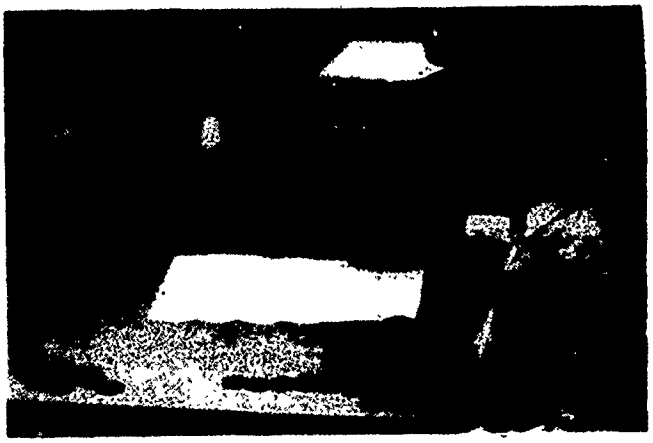
During the 1972-73 school year approximately 60 schools participated in the large-scale field testing of DMP Levels 1-4. The schools involved were located in 17 states and in a variety of settings -- urban, suburban and non-urban. There were both public and private schools; about one third of the schools were multiunit schools. The size of the schools varied greatly as did the number of DMP teachers in a school.

Level 5 of the program was scheduled for testing in 1973-74, and the remaining levels in 1974-75 and 1975-76. After the field tests are completed, DMP materials will be commercially available from Rand McNally and Company. Levels 1 to 3 were made available commercially in late 1974.

The following quotations explain the activity approach used in the DMP program. They discuss the main characteristics of the program and the principles on which these characteristics are based. The three major characteristics of DMP are (Harvey, et al., 1970):

> The major innovation that is used in the DMP program is the inclusion of geometric ideas at all levels of instruction. The geometry is not the formal geometry studied in tenth grade; rather it is an informal, intuitive look at size, shape, and incidence relationships of two- and three-dimensional objects. A serious attempt is made in the instructional materials to integrate geometry with the study of arithmetic.
>
> The integration is possible because of a second characteristic of DMP: arithmetic is developed from a measurement approach. In a measurement approach, the children themselves generate the numbers they work with. The attributes of length, weight, numerousness, volume, area, time, and money

"Togetherness...."



Validating a "joining" sentence.

Using Links

> are explored in depth, and the children measure objects, sets of objects, distances, and events so that these entities can be compared and described. The numerical measures are then processed by the children. Because some of these entities are characterized by direction as well as size, the study of positive and negative integers is begun rather early, at approximately third-grade level. Because children are constantly generating numerical data, it is considered appropriate to study certain elementary notions of probability and statistics so that data can be organized and analyzed.
>
> A third characteristic of DMP is that the instructional materials are intended for use in a framework of individually guided education (IGE). IGE emphasizes assessment and evaluation of each child's progress and needs. A child's instructional program is designed around a variety of learning situations. For example, materials can be used for independent study, or they can be used with small groups so that the children learn from each other and from the materials.

These characteristics of DMP program are derived from the following principles (Harvey, et al., 1972):

> The main characteristics of DMP's activity approach are based on sound psychological principles that research has shown are important to learning math. These characteristics include having children work individually or in small groups, as well as in large groups, while the teacher acts as a resource person, not a lecturer. And in an activity approach the children use physical materials (Unifix cubes, Lots-a-Links, games, etc.) to help make abstract mathematical ideas more concrete. Also, children work together, discussing the problems they are solving and justifying their answers. Finally, the overall objectives and activities for classroom work are selected by the teacher, but informal activities which result from the interests of the students are pursued by the class when appropriate.
>
> By now it should be clear that an activity approach to math is rather different from that usually found in traditional classrooms. It should be clear, too, that activity-centered math is not turning children loose to riot; nor is it hit-or-miss random learning, with a haphazardly conducted instructional program. In fact, just the opposite is true. DMP's activities are organized and sequenced with great care, so that skills needed at a certain point have already been mastered in prior activities.

In the DMP program children are allowed to work at their own pace until they have mastered a particular topic. If a child seems to be lagging behind, the teacher and the child may retrace some steps in the program and plan a little differently for the child. In DMP the sequence of mathematical skills is important, but the needs of the learner are more important. The sequence for each child is paced for him; the child is not paced for the sequence.

In many DMP classrooms not all children are on page 37 at the same time, nor will children necessarily be using their workbooks every day. Further, children will, usually, not be sitting quietly in neat rows of desks. Often children will be found buzzing around all over the room working with many kinds of materials. An activity approach to mathematics requires that learners be active participators in the learning process. This is the heart of the DMP program.

The following paragraph from the Assessment and Managing Instruction (Harvey, et al., 1972) summarizes DMP's relation to the IGE Model:

> DMP is a complete mathematics program that is designed to help the teacher provide individually guided education for each child. DMP is built on a foundation of carefully specified and hierarchically sequenced behavioral objectives. The children's level of mastery of each objective can be determined by using the DMP assessment instruments which help the teacher decide how to group the students so that each child is working on a set of objectives that are appropriate for him. For each set of objectives there are various instructional activities which teachers can use. In these activities children may work in large groups, in small groups, in pairs, or individually. Activities may involve physical objects, pictures, games, or stories in presenting mathematical concepts. The variety of activities in DMP enables the teacher to design an instructional program that best meets the needs of the students.

In summary, then, DMP is a research-based, elementary mathematics program currently under development by the Mathematics Project of the Wisconsin Research and Development Center. DMP provides a complete mathematics program for the elementary school, including not only the usual topics in arithmetic, but also an informal, intuitive introduction to major ideas of geometry, probability, and statistics. This program is based on the principle that children learn best in an active environment where they can seek out answers and strategies to problems of personal interest. This active environment stems from the development of arithmetic through a measurement approach with the children themselves generating and working with the numbers and their relationships.

DMP is different for four reasons. First, it has been developed from a child's perspective--not from the perspective of an adult. Young children are naturally active and curious. They want to find out about the things around them and within their own world. But they do not want to be told about those things; they want to interact with the objects of their world through their senses. The DMP program gives children an opportunity to learn about their world while actively investigating and studying the mathematical aspects of their environment. One should not consider mathematics as something that happens only in a mathematics classroom. Rather, one should seek ways in which one can help children relate mathematics to such aspects of a school program as science, social studies, art, and communication skills.

Second, the DMP program is a carefully designed approach to mathematics learning. At the heart of the design is a set of interrelated behavioral objectives. Each explicitly stated objective defines a learning goal, and earlier objectives lay the groundwork for those that follow. Each topic in DMP teaches toward a specific set of these objectives, and the activities are designed to help the child master the objectives. Mastery of successive behavioral objectives marks the child's progress through the DMP program. His success will depend in part on the teacher's knowledge of the relationships among these objectives and on the teacher's ability to assess the child's progress with them. The teacher materials accompanying this program are designed to help the teacher do this.

Third, the program includes a wide variety of instructional activities that teach toward the objectives. Each activity has been carefully considered, tried out in a variety of schools, and revised one or more times. The activities ask the children to use the problem-solving processes of mathematics. By engaging in such activities, the child is encouraged to explore the mathematical properties of his world and to talk about and record this information. In so doing, he is developing a natural language and symbolism that has meaning to him.

Fourth, DMP has been designed for Individually Guided Education (IGE). Since not all children are interested in the same aspects of their environment, nor do they learn in the same ways or at the same rates, the DMP program is designed for use in an individually guided educational setting. While most of the activities are designed for

use with small or large groups of children, some are designed for use by a child or a pair of children. This gives a child the chance to interact with ideas embodied in physical, pictorial, or symbolic representations on his own, in the company of a classmate, or within a small group. He can investigate ideas in depth or he can go on to a new idea as he wishes. This also means that the teacher can guide him toward the type of activity that is best suited for him in terms of his development, learning style, and temperament. Extensive assessment materials are provided to assist the teacher in making these decisions.

Data Collection

The Falconer teachers expressed a desire to have an active role in the evaluation of the math program in the second year of DMP. To implement this role, the math committee, with participation by other teachers, gathered a list of questions at a meeting March 11, 1974. The list was divided according to source of information: records, teachers, pupils, and parents; and put into questionnaire format. The pupil section posed a problem in that for prereaders, the response format should not require reading. The "happy face, sad face" form in Appendix B was used and was well accepted by the pupils.

All three questionnaires were distributed in May and collected over a period of two weeks. The teacher questionnaire was distributed and discussed in a faculty meeting and then returned the following week. The pupil questionnaire was read in class while pupils responded on the answer form. Some of the younger pupils asked to add

whiskers and/or color the faces and were permitted to do so. The parent questionnaires were sent home with students and returned the same way. DMP or non-DMP classification was determined by the class in which they were attending. Some parents had children in both programs.

Central records data in both Falconer and St. Mary's were collected during the summer from class record sheets of the standardized testing program. Falconer used the Stanford Achievement Test, and St. Mary's used the SRA Assessment Series. The DMP class record sheets were recorded as they were passed from one teacher to the next over the summer. These records represent the basic information used by the teacher in selecting a starting point for the following year and are offered as a statement of where the students were at the end of the year.

All three questionnaires were transferred to optical scan sheets and processed through the item analysis program FORTAP (Baker, 1968) as modified (Bauman, 1970) for use on the CDC 6400 computer. Cross tabulations by program and grade level were processed by the computer program NUCROSS (Janda, 1963) as modified (Bauman, 1972) for the system at Fredonia.

Results

The teachers are clearly supportive as evidenced in the tabulation of the teacher questionnaire data (Appendix A) and in comments (Appendix B) in the several response sections. The Hoyt reliability for the questionnaire was .83. The 1974 results are in general agreement with the 1973 results to the extent that similarity exists in the questions asked.

Most responses to Section A on materials are positive, strongly agree or mildly agree, so it would seem that with some exceptions the teachers are finding the materials adequate and appropriate. The negative reactions are to specific mechanical difficulties that can be corrected as supplies are ordered or as will be corrected (as a result of the field testing) in the commercial edition.

Items 2, 5, 7b, and 9 of the 1972 survey revealed some problems with materials but responses were generally positive.

2. Do you spend more or less time preparing mathematics lessons this year with the DMP Program than you did last year with your former program? If you are spending more time in preparation this year, explain why you think you do this. Do you spend more time because you choose to, or do you find more preparation time is necessary with the DMP Program?

5. Do you find space or the physical limitations of your room a problem with the DMP Program?

7b. Does the materials kit contain items which you find are not used? List these items.

9. Does the manipulative materials kit contain enough materials for your classroom use? What do you need more of, if anything? How many students do you have in your class?

Several specific difficulties have been solved over the year and indeed were solved by May, 1973, when all responses were positive to question 7.

> 7. The curriculum package, Teacher's Guide, pupil texts, physical manipulative aids, and assessment materials are based on sound learning and teaching principles.

Section B deals with specific aspects of the Teacher's Guide. There is some disagreement over what format would be most appropriate and this is probably reflected in the mild disagreement over whether the Guide makes lesson planning less time consuming. Responses to questions regarding the Guide indicate that lesson planning was less time consuming. The questions analyzing the Guide are a result of the means used to draft the questionnaire and should reflect all concerns of the users - the teachers. The commercial developer is considering these reactions and the next edition of the Guide should reflect solutions.

Assessment Procedures (Section C) present no substantial problems. The negative responses indicate the need for aides. These questions reflect the situation in Falconer schools where close contact between teachers and the individual attention given students may make assistance and formal tests less necessary than in a larger system. In the May, 1973, survey, all responses to the general question on assessment and evaluation (item 6) were positive.

> 6. The assessment and evaluation of each child's progress and needs is made possible through the use of the curriculum package.

The activity approach (Section D) responses were all positive. The teachers clearly endorsed the teaching strategy of activity involvement and felt that the Teacher's Guide explains the activities adequately. These findings are consistent with the previous year's findings (Item 3).

> 3. Each student's contribution in generating numbers helps the child in his learning.

The measurement approach (Section E) and inclusion of geometry (Section F) were accepted with almost all responses in agreement with their use. In the previous evaluation (Item 2) acceptance was also indicated by judging it educationally sound.

> 2. The inclusion of geometric ideas in the DMP is an educationally sound innovation.

In both evaluations, sequence was rated highly. That the program is definitely sequenced is indicated in the first survey (Item 1) and specific aspects of the sequencing continuity and flexibility needs were served as indicated in the second survey (Section G).

> 1. The DMP is a carefully sequenced mathematics instruction program.

In Use of Aides (Section H), over half of the teachers strongly agreed that scheduling of aides has allowed for flexibility and efficiency. Since some classrooms did not have aides, those teachers did not report that aides had helped in their classroom.

Among those teachers in their second year of DMP teaching, there was agreement that the second year went better than the first year. Most teachers checked "strongly agree" with the statements that preparations and presentations were easier and less time consuming the second year. Teacher use of aides was seen by most teachers

as more efficient the second year.

The question on standardized tests (item 38) reflects teacher impressions and should be considered with Table 1 which summarizes results for the standardized test in use throughout the school system.

38. On standardized tests, given children who have received instruction in DMP, the scores were substantially equal to scores attained by other groups in previous years.

Most teachers omitted the question or checked "don't know", as the spring testing scores were not available at the time the teachers completed the questionnaire. A teacher judgment then had to be a projection or, for second year DMP teachers, a subjective impression of scores for their own class the previous year. The actual results were higher than predicted but not high enough to reach statistical significance. Most teachers expected scores to be higher, however, two thought they would be lower. The data confirm those expectations. Since the tests used were designed to assess traditional math programs, the findings of no loss should be interpreted as very positive. A new program with different objectives from the previous program would be expected to result in some loss in achievement if previous objectives were used as criteria for success.

The method used for predicting posttest scores was suggested by the New York State Education Department (The State of New York, 1972) for all project evaluations. The procedure has been used for several years in Title I. The procedure is titled, "Model V Historical Regression Analysis" in New York publications and has been referred to as the Rhode Island Model in previous publications.

How long is your chain?

"Shaping up"

That teachers are confident that the more general goal of understanding mathematical concepts and principles has been met was indicated in the positive responses to Item 13 of the 1973 questionnaire. Results on mastery tests of DMP objectives support this confidence.

13. You feel that the effect of DMP on your pupil's understandings of mathematical concepts/principles has been.

Input from all DMP teachers had been solicited in order that the data collected should meet the needs of the Falconer math committee. The overwhelming agreement in response to Section K attests to success in reflecting the data requests of those teachers. The comments in each section support this conclusion since nearly all comments were further specifics on items to point out exceptions or reasons.

Table I

Stanford Achievement Test Results

Test	N	Grade-Equivalent Means			t
		Pretest	Predicted*	Posttest	
Second Grade Total Math	53	2.08	2.56	2.92	0.64
Third Grade Concepts	60	3.14	4.19	4.94	0.65
Third Grade Computation	60	2.11	3.53	3.85	0.38

*Using the New York State Education Department Model V Historical Regression Analysis Procedure.

Pupil Questionnaire

The DMP pupils responded positively to all items on the pupil questionnaire (Appendix B). Over three-fourths of the pupils answered "yes" to the five general questions about math. More than four-fifths answered "yes" (positively) to the questions specific to DMP with the exception of number 13, "Are you able to partition sets of objects?" Items 11, 12, and 13 were omitted from the questions asked the classes for whom the questions were inappropriate, and so the number of omits equals one-third of the pupils. The table by grade level indicates that most of the kindergarten classes omitted the three items. The Hoyt reliability was .79 when all thirteen items were included.

11.* Are you able to join and separate unifix cubes to validate adding and subtracting?

12.* Are you able to validate number sentences?

13.* Are you able to partition sets of objects?

* Questions relating directly to DMP

Items that reflect achievement of skills would be expected to vary with grade level as upper grades would have had more skill training. Responses to Items 12 and 13 clearly reflect differences by grade level as shown in the report by grade level in Appendix B.

Differences by grade level on other items are not so striking and may reflect response set or other factors more than a difference in DMP program from year to year. Statistical significance can be misleading since there is no way to partition variance due to grade level differences in the DMP program from variance due to maturation and other causes. Clearly, responses at each grade level were

positive and satisfaction in the student acceptance of DMP should be the primary observation from these results.

The results from the Pupil Questionnaire by Program (Appendix B) are positive for both DMP and non-DMP. Falconer students seem to be happy and confident in math. Comparisons in items 6-13 are not possible since different questions were used in the non-DMP classes.

Parent Questionnaire

Assessing awareness of the program was the primary intent of the Parent Questionnaire. Introducing a new program requires education of parents and the tables in Appendix C clearly reflect success in parents' knowledge of the math program. None of the DMP parents reported their child in the Winston Series and 81% correctly identified DMP. Visiting the classroom, Item 5, is apparently the least popular means of learning about the program. News releases and meetings reached appreciable numbers and paralleled the time commitment required.

5. Have you visited your child's classroom this year at a time when his math class was in progress?

Interaction between parent and child about the math program can be influenced by many factors. Questions 2, 6, and 9 combine assessment of parental information with assessment of parental role.

2. Does your child bring home math papers to show you?

6. Have you made it a practice to help your child with his math assignments?

9. Does your child discuss his math activities with you?

Should parents make it a practice to help their children with math assignments? The 65% that didn't may have felt it inappropriate or may have felt inadequate. The 35% who did assist were probably familiar with the program.

Parents' observations of pupil attitude was overwhelmingly positive, and this assessment was based on extensive information as indicated by the other items. A well-informed group of parents tended to judge their children's attitude toward the DMP math program to be favorable.

Appendix C contains a summary of the parents' comments since there were so many. The volume of responses indicated the parents' willingness to make their views known. The individual comments were the source of information most useful to the school in responding to their constituency. The call for more information was clear and is likely to be a continuing demand.

School people tend to become less concerned with informing the community after a program becomes familiar to staff. Each year of the program, more parents who may be new to the school and to the program are added. The comparison of parents' responses by grade level in Appendix C becomes a comparison by year of introduction. The upper grades were introduced when the program was new and they have also had an additional year of experience.

CONCLUSIONS

The teachers would like to continue with the program. The "hands on" approach to the teaching of mathematics (through the use of manipulative materials) and concept development is strongly endorsed. There are, of course, further changes to be made in the program and in logistics and support that would help ease implementation and refinement for the next year.

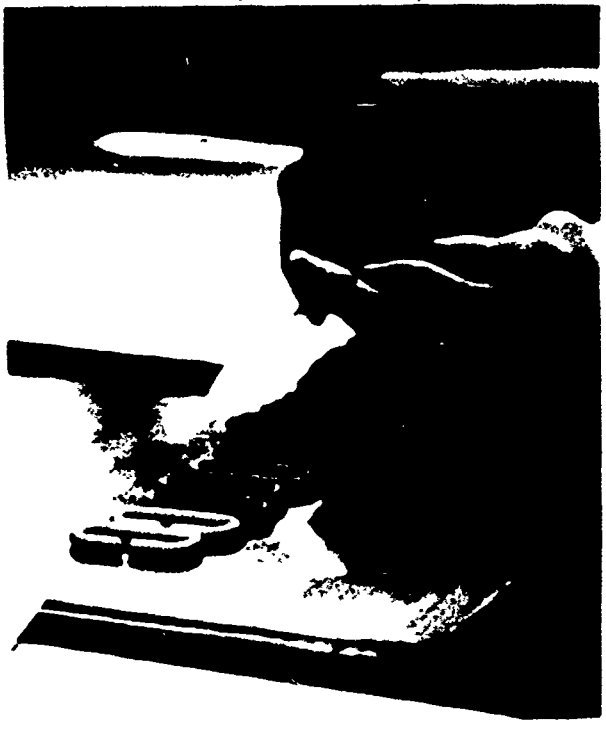
The students were generally successful on traditional measures and on DMP objectives in mastering mathematics. A positive attitude toward math by students is the assessment of self-report, of parents, and of teachers.

The parents were informed about and were supportive of the program. A variety of means were used to obtain interaction with child, program and school and the results were positive.

How
many?

Does
that
check?

How many links to a desk?



APPENDIX A Falconer Central School
Spring 1974

Results for 18 DMP Teachers, All Levels Combined

D. M. P. QUESTIONNAIRE

D.M.P. Teachers: This questionaire, which is based on questions raised earlier this school year by your attempts to ascertain your attitudes and reactions to D.M.P. after having completed your first or second year in the program. Space is provided for welcomed comments after each section.

All results reported as numbers.

Please mark your answers according to the following scale:

1. Strongly agree
2. Mildly agree
3. No specific preference or don't know
4. Mildly disagree
5. Strongly disagree

A. Materials:

	Omits	1	2	3	4	5
1. The materials are easily accessible.	-	2	13	1	2	-
2. The materials are appropriate to meet the lesson objective.	-	11	7	-	-	-
3. The materials are adequate for the various activities.	-	7	7	1	3	-
4. Activity cards should be covered with a protective coating.	-	13	5	-	-	-
5. The format and size of the workbooks are appropriate and practical.	-	8	5	2	3	-
6. It would be desirable to have the workbook pages (at the K-1 level particularly) torn out and grouped by lessons.	-	13	1	4	-	-
7. The containers are adequate particularly for capacity comparisons.	1	4	3	2	3	5

Comments: _____

7a. Have been able to store materials adequately.	3	2	4	-	4	5

B. [illegible] Guide:

	OMITS	1	2	3	4	5
8. The guide and plans are easy to follow.	-	14	4	-	-	-
9. Lessons can be adopted to particular learning and/or teaching style.	-	14	3	-	-	-
10. The guide is accurate.	1	9	6	-	2	-
11. The guide gives enough pertinent information to plan lessons effectively.	-	10	8	-	-	-
12. The guide makes lesson planning less time consuming.	-	9	4	-	4	-
13. It would be desirable to have each unit bound separately.	-	7	1	4	2	4
14. The guide would be more practical in a loose [illegible] notebook so pages could be removed separately.	-	9	1	3	3	2

Comments: _____

C. [illegible] Procedures:

		1	2	3	4	5
15. The assessment tests basically cover the material being taught.	-	9	6	-	3	-
16. The assessment tests are desirable in evaluating the progress of each child.	-	11	6	1	-	-
17. The assessment procedures are relatively convenient.	-	8	9	1	-	-
18. An aide is necessary to help with the assessment procedures..	-	5	4	3	4	2
19. The children's attitudes toward DMP are favorable.	-	12	6	-	-	-
20. The beginning level pre-assessment inventories are desirable to determine pupil strengths and weaknesses.	-	4	6	1	4	3

C.

Comments: _____

_____

_____

D. Activity Approach:

	OMITS	1	2	3	4	5
21. Pupil involvement in lesson activities is an effective way for him to understand the math concept being presented.	-	15	3	-	-	-
22. Activity involvement helps attain the teacher's task of obtaining the lesson objective.	-	11	7	-	-	-
23. Lesson activities are explained in the teacher's guide so that the teacher understands them and the reason for using them.	-	14	4	-	-	-

Comments: _____

_____

_____

E. Measurement Approach:

		1	2	3	4	5
24. The measurement approach (comparing lengths weighing, finding volume, etc.) allows the children to effectively learn the lesson presented.	-	12	6	-	-	-
25. The measurement approach provides a more meaningful way for a child to understand concepts. (He learns the concept easier)	-	12	4	2	-	-

Comments: _____

_____

_____

F. Inclusion of Geometry:

	OMITS	1	2	3	4	5
26. The geometry units are understandable to the children for the age and ability involved.	-	12	5	-	1	-
27. The use of geometric solids increases the child's vocabulary and increases his awareness of geometric likeness and differences.	2	12	4	-	-	-
28. The geometry units have relevence and provide adequate exposure to the children of this level.	1	10	4	3	-	-

Comments: _____

_____

_____

G. Sequence of Units:

	1	2	3	4	5
29. The suggested sequence of topics allows for continuity of objectives.	-	11	5	2	-	-
30. The sequence of units allows for flexibility during the year.	-	15	3	-	-	-

Comments: _____

_____

_____

H. Use of Aides:

	1	2	3	4	5
31. The scheduling of aides has allowed for flexibilty and efficiency.	1	9	2	4	-	2
32. A classroom aide is helpful and beneficial to the DMP program.	-	11	2	3	1	1

Comments: _____

_____

_____

I. First-Second Year Comparison:

(Questions 33-37 to be answered only by teachers in their second year of DMP teaching.)

	OMITS	1	2	3	4	5
* 33. Lesson preparations of D.M.P. were easier during the second year of D.M.P.	8	7	2	1	-	-
* 34. Lesson preparations of D.M.P. were less time consuming during the second year of D.M.P.	8	7	2	1	-	-
* 35. Lesson presentations were easier during the second year of D.M.P.	8	7	-	2	1	-
* 36. Lesson presentations were less time consuming during the second year of D.M.P.	8	5	1	3	-	-
* 37. Their use of aides became more efficent during the second year of the program. *(as compared to the first year)	9	5	1	3	-	-

Comments: _____

_____

_____

J. Program Comparison:

		1	2	3	4	5
38. On standardized tests, given children who have received instruction in DMP, the scores were substantially equal to scores attained by other groups in previous years.	8	1	3	4	2	-

Comments: _____

_____

_____

K. Questionnaire Evaluation:

		1	2	3	4	5
39. This questionnaire adequately reflects the the questions/problems/concerns of DMP teachers as suggested by those teachers at the math committee meeting on March 11, 1974 (at North Side School)	3	10	3	2	-	-

Comments: _____

_____

Summary of Additional Comments Section of Teacher Questionnaire

Teacher Reaction to Questionnaire
(Additional Comments) Summary.

A. DMP Materials

Two teachers found difficulty using some containers.

B. DMP Teacher's Guide

Teachers found the guides to be very helpful. Although they were complex, the guides did help reduce planning time.

C. Assessment Procedures

There was no appreciable adverse feeling against the procedures although four teachers felt an aide would be beneficial.

D. Activity Approach

Only one teacher felt the activity approach was not suitable saying it was too complicated.

E. Activity Approach

One teacher stated that she felt not all children learn more easily by this approach.

F. Inclusion of Geometry

One teacher commented that she felt the geometry emphasis was very good.

G. Sequence of Units

One teacher requested that unit order be changed to take into consideration the immaturity of children in the Fall.

H. Use of Aides

Ten teachers commented that they either had no aide or had found an aide helpful.

Comments were isolated except for those listed under Use of Aides. Aide availability should be reviewed by the appropriate parties.

APPENDIX B

Pupil Primary Math Questionnaire

Results for 348 DMP Pupils, All Levels Combined.

DIRECTIONS: Teacher reads questions below to her class as a whole, or if more desirable, in a small group. Children respond on answer paper as follows:

(Smiling Face) Yes

(Sad Face) No

	Percent of Those Responding		
	Yes	No	Omit
1. Do you like math class?	83	17	5
2. Do you think you are doing good work in math class?	89	11	7
3. Do you like to do your math workbook pages?	80	20	7
4. Is math easy for you to learn?	76	24	6
5. Do you like working together with other children in math class?	90	10	8
6* Do you like to move around the room to different learning stations in math?	83	17	14
7* Do you like to compare and order with materials such as logalinks and unifix cubes?	87	17	8
8* Are you able to order objects from shortest to longest?	92	8	13
9* Are you able to equalize two objects so they are the same size?	96	4	12
10* Are you able to describe and classify shapes and faces of geometric pieces?	92	8	14
11* Are you able to join and separate unifix cubes to validate adding and subtracting?	89	11	118
12* Are you able to validate number sentences?	87	13	119
13* Are you able to partition sets of objects?	58	42	118

*Questions relating directly to DMP (SPECIFIC ACTIVITIES)

Pupil Primary Math Questionnaire

	Yes	No		Yes	No
1.			6.		
2.			7.		
3.			8.		
4.			9.		
5.			10.		

Pupil Questionnaire, DMP Pupils Only, by Grade Level

Item	Grade Level	Number Responding	Percent of Number Responding	
			No	Yes
1	K	126	24	76
	1	112	13	87
	2	42	7	93
	3	63	14	86
2	K	128	13	87
	1	111	12	88
	2	42	14	86
	3	60	8	92
3	K	126	25	75
	1	111	22	78
	2	43	12	88
	3	61	15	85
4	K	126	24	76
	1	112	22	78
	2	43	30	70
	3	61	15	85
5	K	128	16	84
	1	111	12	88
	2	41	5	95
	3	60	3	97
6	K	120	27	73
	1	112	21	79
	2	42	5	95
	3	60	8	92
7	K	122	17	83
	1	112	16	84
	2	43	14	86
	3	63	21	79
8	K	120	11	89
	1	111	11	89
	2	42	5	95
	3	62	-	100
9	K	120	6	94
	1	112	9	91
	2	43	2	98
	3	62	3	97

Item	Grade Level	Number Responding	Percent of Number Responding	
			No	Yes
10	K	120	7	93
	1	112	8	92
	2	41	10	90
	3	61	8	92
11	K	22	18	82
	1	106	18	82
	2	41	10	90
	3	61	5	95
12	K	22	50	50
	1	105	15	85
	2	40	10	90
	3	62	5	95
13	K	22	59	41
	1	106	44	56
	2	40	85	15
	3	62	5	95

Pupil Questionnaire by Program

Item Number	Group	Number Responding	Percent of Number Responding	
			No	Yes
1	DMP	343	17	83
	Non-DMP	112	13	87
	Total	455	16	84
2	DMP	341	12	88
	Non-DMP	112	24	76
	Total	453	15	85
3	DMP	341	20	80
	Non-DMP	112	17	83
	Total	453	20	80
4	DMP	342	22	78
	Non-DMP	111	25	75
	Total	453	23	77
5	DMP	340	11	89
	Non-DMP	112	18	82
	Total	452	13	87

APPENDIX C

- - - - - - Falconer Central School - - - - - -

RESULTS FOR 225 DMP PARENTS, ALL LEVELS COMBINED

Parent Questionnaire

Primary Math Program

Dear Parents:

In an attempt to survey the opinions of adults and children about your child's math program in the primary grades, we are asking you to respond to the short questionnaire below. Thank you.

Omits are reported as numbers, responses as percents of those responding.

The Elementary Math Committee

1. What math program is your child in?

   81 Developing Mathematical Processes (DMP) — 0 Winston Series — 19 Don't Know

   OMITS 2

2. Does your child bring home math papers to show you?

   35 Sometimes — 61 Frequently — 3 Seldom — 1 Never

   OMITS -

3. Have you during the last school year discusses your child's math program with his teacher?

   OMITS 4 — 47 Yes — 53 No

4. Have you attended an open house school or P.T.A. meeting in which primary math was discussed?

   OMITS 3 — 36 Yes — 64 No

5. Have you visited your child's classroom this year at a time when his math class was in progress?

   OMITS 3 — 15 Yes — 85 No

6. Have you made it a practice to help your child with his math assignments?

   OMITS 18 — 35 Yes — 65 No

7. Have you, earlier this year, read any newsletter, or the article in the Post Journal magazine section about primary math?

   OMITS 4 — 58 Yes — 42 No

8. What would you judge your child's attitude towards his math class to be?

   91 Favorable — 8 Non-committal — 1 Unfavorable

   OMITS 7

9. Does your child discuss his math activities with you?

   37 Frequently — 50 Sometimes — 9 Seldom — 4 Never

   OMITS 4

10. What impression, if any, do you have of your child's math program?_____

_____

_____

Your child is in grade _____. Your child's teacher is_____.

K-39% *1-28%* *2-18%* *3-15%*

_____

Parent Questionnaire, DMP Only, by GRADE

Item Number	Grade Level	Number Responding	Percents DMP	Winston	Don't Know
1	K	86	77	0	23
	1	63	81	0	19
	2	40	80	0	20
	3	34	91	0	9

			NEVER	SELDOM	SOMETIMES	FREQUENTLY
2	K	86	2	1	29	67
	1	63	0	3	40	57
	2	40	0	5	23	73
	3	36	3	3	56	39

			PERCENTS NO	YES
3	K	84	37	63
	1	63	73	27
	2	40	50	50
	3	34	62	38

			PERCENTS NO	YES
4	K	84	71	29
	1	63	65	35
	2	40	63	38
	3	35	46	54

			PERCENTS NO	YES
5	K	83	82	18
	1	63	86	14
	2	40	85	15
	3	36	89	11

Parent Questionnaire, DMP Only, By Grade

Item Number	Grade Level	Number Responding	PERCENTS NO	PERCENTS YES
6	K	74	72	28
	1	58	69	31
	2	39	59	41
	3	36	53	47

			PERCENTS NO	PERCENTS YES
7	K	83	41	59
	1	63	41	59
	2	40	50	50
	3	35	40	60

			UNFAVORABLE	NON COMMITAL	FAVORABLE
8	K	83	-	7	93
	1	63	-	11	89
	2	40	-	8	93
	3	35	9	6	86

			NEVER	SELDOM	SOMETIMES	FREQUENTLY
9	K	84	1	11	44	44
	1	63	3	11	49	37
	2	40	10	8	53	40
	3	36	3	3	64	31

Question 10 Comments Summary From DMP Parents

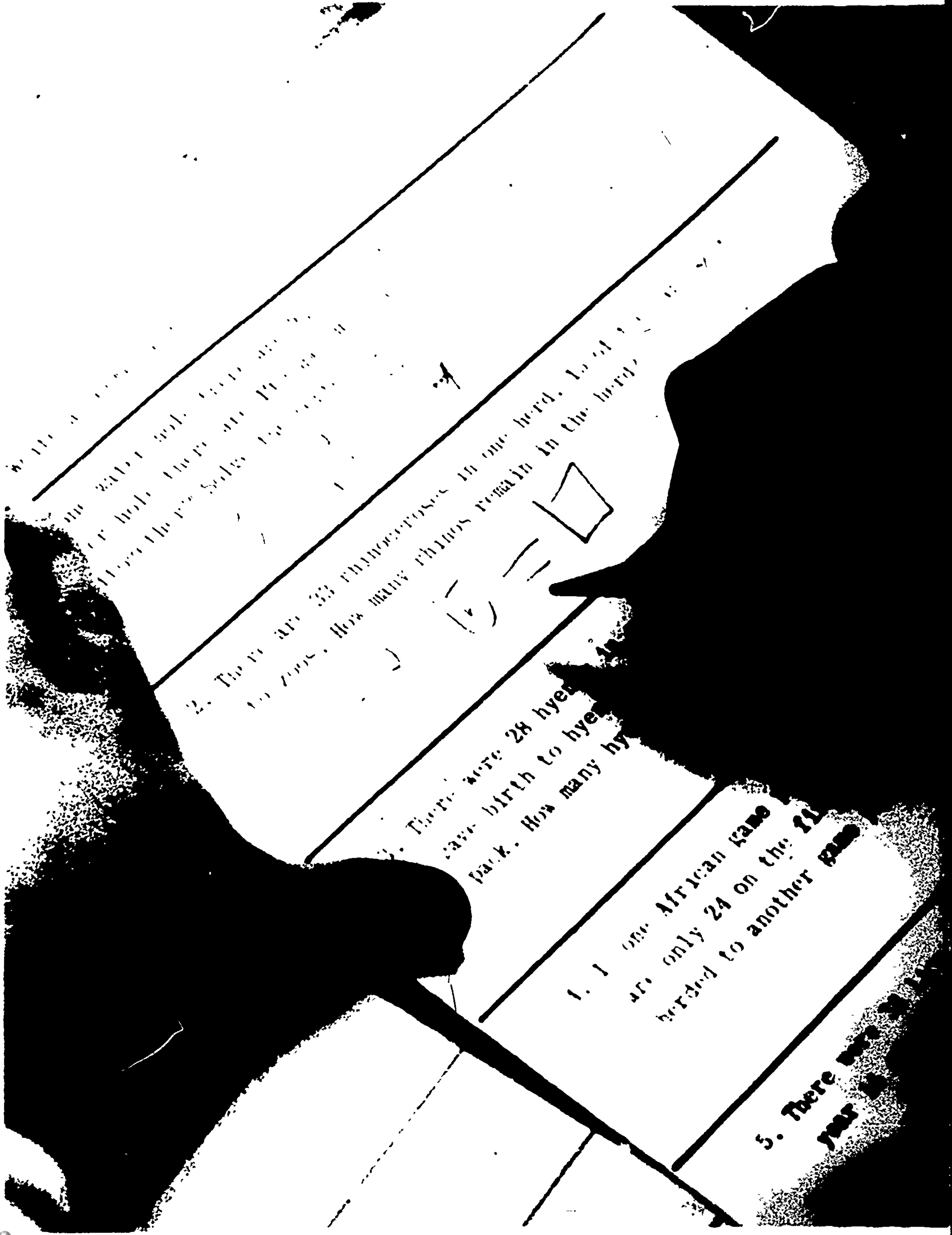
Ninety-one of one hundred thirty-one responses showed a favorable reaction to their child being involved in the DMP program. Twenty-three responses were non-commital saying they did not know enough about the program or were waiting to react to future developments. Seventeen responses were negative stating in most instances that the program was not understood by the parent. Seven parents stated the material was inappropriate and four stated their desire to return to the old math.

The response to DMP math by parents is largely favorable and in many cases, enthusiastic. Unfavorable responses reflected parents' feelings that they were not informed adequately of the program's structure and goals. An information program to parents would be desirable.

Question 10 Comments Summary From Non-DMP Parents

Thirty-nine of eighty-four responses showed a favorable reaction to their child's being involved in the DMP Program. Forty-four responses were non-commital saying they knew little of the situation, or no comment was listed. One comment was unfavorable by referring to the complexity of the program.

As little information on the Non-DMP (regular textbook methods) program has been published or sent to parents in the last few years, the response seems to indicate an acceptance of the status/quo as indicated by the large number of non-commital responses. The text-book format of the program would be quite familiar to parents, albeit the curriculum material has changed, thus allowing them to identify more easily with it than with a departure to a different format.


How many rhinos remain in the herd
There were 28 hye
birth to hye
How many hy
One African game
only 24 on the
to another game
5. There

Bibliography

Baker, Frank B., Fortap, a Fortran Test Analysis Package. Madison, Wisconsin: Laboratory of Experimental Design. The University of Wisconsin, 1968.

Bauman, Daniel J., Fortap on the CDC 6400. Fredonia, New York: Teacher Education Research Center. The State University of New York, 1970.

Bauman, Daniel J., The Cross-Tabulation Program NYFTAB. Fredonia, New York: Teacher Education Research Center. The State University of New York, 1972.

Harvey, John G., Moser, James M., and Romberg, Thomas A. Developing Mathematical Processes Sampler, Level Two. Madison, Wisconsin: Wisconsin Research and Development Center for Cognitive Learning. The University of Wisconsin, 1970, pp. 1 and 2.

Harvey, John G., Moser, James M., and Romberg, Thomas A. An Activity Approach to Math. Madison, Wisconsin: Wisconsin Research and Development Center for Cognitive Learning. The University of Wisconsin, 1972, p. 1.

Hoyt, Cyril J. "Test Reliability Estimated by Analysis of Variance." Psychometrika, 1941, 6, 153-160.

Janda, Kenneth A., Data Processing Applications to Political Research. Evanston, Illinois: Northwestern University Press, 1965.

_____, District Evaluator's Handbook of Selected Evaluation Procedures for Categorically Aided Programs Serving Disadvantaged Learners. Albany, New York: The State Education Department, 1972.

MTA