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ABSTRACT

This project measured the impact of a short series of Family Math programs in elementary grades on student and parent attitudes toward mathematics, student performance in mathematics, and teacher behavior using control (1993, n=89; 1994, n=234) and experimental (1993, n=101; 1994, n=211) student comparison groups and supplemented by parent and teacher interviews. Only two of the analyses showed statistical significance: (1) Students in the experimental group who had prior Family Math experience showed higher gains on standardized mathematics performance measures than other groups, and (2) Parents who attended Family Math reported increased involvement with their children's schools. Parent interviews indicated strongly favorable attitudes toward Family Math and had high praise for the quality of the program, although parent attitude questionnaires showed no significant gains in either parents' or students' self-confidence. Teacher interviews indicated enthusiastic support for Family Math and substantial modification of teaching methods, as well as improved understandings about mathematics. Appendices include: outlines of the first meeting, student background and attitude questionnaires, parent questionnaires in both English and Spanish, and parent Family Math evaluation forms. (MKR)

AN URBAN FAMILY MATH COLLABORATIVE

Dr. Stan Brodsky, Project D ector
Dr. Marian Fish & Dr. Alan Gross, Evaluators
Josephine Urso, District #15 Site Coordinator

Funded by The Charles A. Dana Foundation

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in collaboration with:
Community School District #15
William P. Casey, Community Superintendent

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TABLE OF CONTENTS

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The project staff gratefully acknowledges the contributions and cooperation of the hundreds of students and their parents and other relatives who participated in this collaborative program in Community School District #15. Those who were part of the Family Math experimental groups not only contributed but also gained from the Family Math experience. We are especially indebted to those who served as control group members since they helped to make this project possible but received no direct benefit from exposure to Family Math.

Almost fifty of the Family Math teachers and staff developers of Community School District #15 gave significant time and creative energy in recruiting the experimental and control group students and adults; dealing with a heavy workload of extracting data from files, transferring information onto forms, and distributing, collecting and collating student and parent questionnaires; planning and preparing materials for each Family Math session; and leading the sessions either after school or in evenings. Our sincere thanks to all of those professionals for their contributions to this study.

Among the most demanding responsibilities in this effort was the work of Josephine Urso, District #15 Mathematics and Testing Coordinator, who supervised the project activities in the District, oriented the Family Math teachers, provided technical assistance and troubleshooting support to the teachers, arranged for and selected the performance instruments in conjunction with Dr. Nick Maruhnich of CTB Macmillan/McGraw-Hill, distributed instruments and forms and gathered completed documents, and supervised the scoring and security of test materials. Ms. Urso carried this enormous workload in addition to her normally heavy District-wide duties with enthusiasm and professional competence.

Our thanks go to Dr. Nick Maruhnich and to CTB Macmillan/McGraw-Hill for permitting this project to benefit from the use of some of their latest mathematical instruments.

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Stanley M. Brodsky, PhD, PE
Project Director
November 1994

AN URBAN FAMILY MATH COLLABORATIVE

FINAL REPORT

Executive Summary

This project measured the impact of a short series of Family Math programs in elementary grades on student and parent attitudes toward mathematics, student performance in mathematics, and teacher behavior using control-experimental comparison groups and supplemented by parent and teacher interviews. Only two of the analyses showed statistical significance. Students in the experimental group who had prior Family Math experience showed higher gains on standardized mathematics performance assessment measures than other groups. Also, parents who attended Family Math reported increased involvement with their childrens' schools. Parent interviews indicated strongly favorable attitudes toward Family Math and had high praise for the quality of the program, although these results were not supported by analysis of the parent attitude questionnaires. Teacher interviews indicated enthusiastic support for Family Math and substantial modification of teaching methods as well as improved understandings about mathematics. In view of the limited extent of the project as well as the offering of three sessions per semester over three semesters and the finding that fewer than one-quarter of the students attended all three sessions in each semester, the positive outcomes in student performance, parent increased involvement in schools, and parent and teacher interview responses are indications that Family Math appears to impact the participants. Further study is recommended. A number of new Family Math teachers and staff developers were also trained and certified during this project and newly developed materials for upper elementary and middle school grades were disseminated for field testing.

Introduction

Family Math is a well-documented program in which parents and their children attend a series of 3 or more 2 hour weekly sessions, usually after school, in evenings or on weekends. The focus of Family Math's hands-on, enjoyable activities is on conceptual development and strategies related to mathematics rather than single answer problems. The program not only aims to shape students' attitudes toward math, related studies, and careers, but also expects to influence parents to reinforce their childrens' interest in math.

This project sought to determine whether attendance at a succession of Family Math programs during the elementary grades would have a measurable impact on student and parent attitudes, student performance in math and teacher behavior. In addition, new Family Math materials for grades 5 through 8 created by Virginia Thompson, Director of Family Math/EQUALS at the Lawrence Hall of Science in Berkeley, California were field tested. During the course of the project a number of new Family Math teachers and staff developers were trained and certified.

Community School District #15 was selected as the operating site for the project because of the cooperation of William P. Casey, the Community Superintendent, the dynamic leadership of Josephine Urso, the District Math Coordinator, and the large number of trained Family Math teachers. District #15 in northwest Brooklyn is part of the New York City Public School System and is described as working class and culturally, linguistically and racially diverse. Josephine Urso,

as Senior Staff Developer, is the only person in New York who is authorized by Virginia Thompson to train and certify new Family Math staff developers.

The Center for Advanced Study in Education (CASE) of the City University of New York (CUNY) Graduate School is the National Family Math Site for New York City. The Site is coordinated by Dr. Stan Brodsky. CASE has facilitated the training of 34 staff developers and more than 450 Family Math teachers. Two highly qualified project evaluators, Drs. Marian C. Fish and Alan Gross, are members of the Graduate Educational Psychology Faculty at the CUNY Graduate School.

Process

Teacher Orientation and Training

An initial orientation meeting with key teachers from District #15 was held on March 17, 1993 to describe the research and project procedures. An agenda for this meeting and an outline of the presentation about the Family Math project are included in Appendix A.

Virginia Thompson and her colleague, Karen Mayfield, scheduled a visit to District #15 on January 28, 1994. In December, an invitation to attend the morning January 28 meeting with Virginia Thompson was sent to all District Math Coordinators in the City, to all Family Math Staff Developers and a selection of others. The purpose of that meeting was to introduce them to the newly developed Family Math activities for 5th through 8th grade which the participants were asked to help to field test. Those districts that were unable to be represented were also sent the new materials for use by their Family Math teachers.

On the afternoon of January 28, 1994 a meeting of District #15 Family Math teachers with Virginia Thompson and Karen Mayfield was held. Twenty three Family Math teachers from the district attended. The project procedures were reviewed and the new Family Math materials were disseminated. Several other Family Math teachers from participating schools who could not attend, were briefed individually by Josephine Urso.

Another feature of this project was the preparation of additional teachers of Family Math both in District #15 and other districts across the City as well as a small group of Family Math staff developers to continue the expansion of the Family Math teaching corps. Workshops were scheduled for July 19 & 20, 1994 for new teacher preparation, which required 12 hours, and for July 18, 19 & 20, 1994 for preparing a group of experienced Family Math teachers to become staff developers, which required 18 hours. A total of 9 new Family Math teachers were trained for District #15, 28 were trained for other New York City Public Schools entities, and one from out of New York City was trained; a total of 38 new Family Math teachers. In addition, 4 new Family Math staff developers were qualified.

Current Project

This Family Math program was conducted over an 18 month period, covering three academic semesters. The initial period was the Spring 1993 semester for which data are indicated as 1993. The second period, consisting of two semesters which comprise a full academic year, Fall 1993 and

Spring 1994, is represented by data identified as 1994. During the Spring 1993 period, families with fourth, fifth and sixth grade students from 10 elementary schools were offered three consecutive Family Math sessions. The 1994 cohort was drawn from 11 elementary and 1 middle school and included a small number of seventh graders. The same families who attended Family Math as part of the 1993 groups were encouraged to attend the Family Math sessions in 1994. In addition, new families were invited to participate in the 1994 groups at all grade levels.

Evaluation Plan

Four evaluation instruments were devised by the evaluators, tested and suitably modified. These instruments were a *Student Background Questionnaire* to be completed by the teacher, a 10-item *Student Attitude Questionnaire*, a *Parent Questionnaire* in both English and Spanish, and a *Parent Family Math Evaluation Form.* The *Student Attitude* and the *Parent Questionnaires* were pre and post measures. The first three instruments were expected to be completed for both the Family Math (experimental) group and the control group. Both parent forms and the *Student Attitude Questionnaire* were organized in checklist formats. Copies of these forms appear in Appendix B.

Student conceptual math ability was assessed using materials prepared and validated by CTB Macmillan/McGraw-Hill through the cooperation of Dr. Nick Maruhnich. Copies of these instruments are not included because the condition under which they were made available to this project required that they be secure and confidential. These materials were designed to reflect the latest National Council of Teachers of Mathematics standards for both content and process outcomes which are the areas that Family Math would most likely influence including concept and strategy development and problem-solving approaches. The assessment consisted of open-ended, constructed response tasks.

In addition to the measures noted above, student performance on norm-referenced standardized achievement tests used by the New York City Public Schools was included. An SPSS computer program was designed and modified by Dr. Alan Gross to analyze the available data.

The evaluators also prepared a semi-structured format for interviewing a sample of the Family Math teachers and a second such format for interviews with a sample of parents who attended Family Math sessions with their children. These interviews were carried out during the Spring 1994 semester.

One major question addressed by this evaluation was whether students who participated in Family Math showed higher gains on mathematics performance measures (i.e. standardized test scores and performance assessment measures) than comparable students who did not participate in the program. Additional questions addressed include:

a) did student participants show more favorable attitudes toward mathematics than students who did not participate?

b) did parent participants show more favorable attitudes toward mathematics than parents who did not participate?

c) did participation in the program have an impact on family involvement with the school?

d) how did parents and students evaluate the Family Math sessions?

e) in what ways did teaching Family Math affect teacher behavior?

Evaluation Methodology

The major question of program impact on standardized test scores and mathematical performance assessment measures was assessed using a control/experimental group design. The experimental group consisted of those students and parents who participated in the Family Math program. Within each school, a control group was randomly selected from school records. In 1993, there were 101 students (and 101 parents) in the experimental group and 89 students in the control group. In 1994, there were 211 students in the experimental group and 234 students in the control group. Initial differences between groups were statistically adjusted using analysis of covariance to compare post-score differences between control and experimental groups. In analyzing program effects, the experimental group was broken down into two groups, those having had prior Family Math experience and those who did not. Thus, all statistical comparisons involved three groups,; the control group, and the two experimental groups. It should be noted that permission of the New York City Board of Education was required to obtain the test score data for all students. *Student Background Questionnaires* and attendance sheets were filled out for each student by the Family Math teachers.

To analyze student attitudes, the *Student Attitude Questionnaire* was developed. Modeled after standard measures (e.g. the Dutton Scale), it was composed of 10 items that asked students to describe their attitudes about math by responding "never", "some of the time", "most of the time", or "always" to each item (e.g. "I enjoy doing math"). The student attitude data was analyzed using the same control/experimental group design described above. Both control and experimental students completed attitude questionnaires, pre- and post-participation.

To analyze parent attitudes, the *Parent Questionnaire* was developed. The original questionnaire consisted of 25 items that assessed three areas: parent self-confidence with respect to math, parents' perception of their child's self-confidence with respect to math, and family involvement with school activities. Due to concern about its length, this questionnaire was shortened to 16 items for the 1994 groups. Parents were asked to respond "strongly disagree", "mildly disagree", "mildly agree", and "strongly agree" to each item (e.g. "Math is one of my favorite subjects"). The parent data was analyzed using the same control/experimental groups described above. Both control and experimental parents completed questionnaires pre- and post-participation. Copies of the three questionnaires noted above and the evaluation form mentioned in the following paragraph are shown in Appendix B.

The *Parent Family Math Evaluation Form* was administered to parents at the end of each Family Math series asking them to rate the "overall quality of the sessions" and the "everyday usefulness of the sessions", what they had accomplished, whether they would "like to attend more Family Math classes next year" and whether they would "recommend Family Math to a friend". In addition, 10 parents who participated in the Family Math workshops during the Fall 1993 semester were interviewed in the Spring 1994 to assess parent reactions to Family Math and to determine in what ways Family Math affected parent or child attitudes or behavior.

Finally, a sample of 10 Family Math teachers were interviewed to assess the impact of the program on their attitudes concerning mathematics education and instructional practices.

Results

Background Data

The background data for the 1993 and 1994 cohorts are presented in Table 1 separately for the control and combined experimental groups. The results in Table 1 can be summarized as follows:

a) In both cohorts, students were primarily in grades 4 through 6.

b) For both cohorts there were slightly more female than male students in both the control and experimental groups.

c) The range for the percentage of Limited English Proficiency (LEP) students was from 6.5% for the 1994 control group to 16.8% for the 1993 experimental group.

d) The majority of the students participated in the free lunch program.

e) In both cohorts, the students in the combined experimental groups had attended Family Math sessions prior to the current study more often than those students in the control group.

f) Most students did not attend all three Family Math sessions offered in either cohort. In 1993, 61% of the students attended two or more sessions. In 1994, the percentage was 64%.

g) The percentage of parents attending decreased between session 1 and session 3.

Attitude Data

Table 2 summarizes the responses to the *Parent Family Math Evaluation Form* which provides parent ratings of the Family Math program as described above. Average parent ratings of the overall quality of the sessions, presentation of materials and the everyday usefulness of the sessions were consistently in the "Excellent" category. On a scale of 1 ("Excellent") to 5 ("Poor") the average ratings ranged from 1.3 to 1.5. More than two-thirds of the parents reported having accomplished the following goals:

a) helping their child with math
b) providing math materials at home
c) knowing more about math
d) learning how math is taught in school.

Over 90 % of the parents stated that they would like to attend more Family Math classes next year and would like to recommend the program to a friend.

The Family Math Parent Interview data strongly supported these positive ratings. As discussed in a subsequent section, parent enthusiasm for Family Math was evident through their desire to share it with others and to expand the program hours.

Comparisons of the Control and Two Experimental Groups

In Table 3 the effect of participating in Family Math was analyzed using a series of analyses of covariance. Three different groups were contrasted: a control group (C), an experimental group of students who had had no prior Family Math experience (NPFM) and an experimental group of students who had prior Family Math experience (PFM). These groups were compared on the following set of post-scores:

a) score on a mathematics performance assessment measure (MATH), an instrument which measures conceptual math ability, that was prepared and validated by CTB Macmillan/McGraw-Hill (in collaboration with the Maryland State Department of Education,

b) the national percentile ranking (NP) on the California Achievement Test, a standardized achievement test administered annually by the New York City Board of Education,

c) the *Student Attitude Questionnaire,* comprised of 10 items which measure student attitudes toward math,

d) a measure of parent self-confidence with respect to math; this score was the average of specific items on the *Parent Questionnaire* and is denoted as PAR1,

e) a measure of parents' perception of their child's self-confidence with respect to math; this score was the average of specific items on the *Parent Questionnaire* and is denoted as PAR2, and

f) a measure of parent involvement with school activities; this score was the average of specific items on the *Parent Questionnaire* and is denoted as PAR3.

In comparing the postscores of the three groups, the corresponding prescores served as the covariates except for the post NP measure, where pre-math was the covariate.

In Table 3 the adjusted mean scores are reported for each of the three groups for each of the postscore measures for the 1993 and 1994 cohorts. Two significant results were obtained. First, in Spring 1994 the PFM (prior Family Math) group scores significantly higher on the NP (standardized test measure) than the other two groups. The average percentile score for the PFM group was approximately 11 points higher than the NPFM experimental group. Second, in 1994 both experimental groups scored higher on the PAR3 measure (parent involvement with school activities) than the control group. Whereas the mean ratings for the two experimental groups were 2.8 and 2.9, the mean rating for the control group was 2.3. No other results were statistically significant.

Finally, the Family Math Teacher Interview data, which is reported in detail below, revealed that teachers were very enthusiastic about Family Math and that leading Family Math workshops broadened their own ideas about teaching math. They observed increasing self-confidence on the part of students and parents with regard to math.

Teacher Interviews

Purpose. A series of interviews with teachers who have led Family Math workshops during the Spring or Fall 1993 were conducted during late February and early March 1994. The purpose of these interviews was to assess teacher reactions to Family Math and to determine in what ways teaching Family Math affects teacher attitudes and behavior.

Background. In Spring 1994 this Family Math project was running in 12 of the schools in grades 4, 5, 6 and 7. Ten teachers from District #15 were interviewed, eight at their work sites, and two on the telephone, using a semi-structured interview format. Seven teachers were female and three were male. The teachers were from six different schools, either pre-K to 6th grade or kindergarten to 6th grade; one teacher worked at the district office. This is an experienced group of professionals as all but one teacher had been teaching for 12 or more years. The teachers varied in the number of times they had led Family Math workshops. About half were fairly new leaders with between one and five workshops completed, while the other half had led the workshops between 10 and 16 times. Most had either co-lead the Family Math workshops or had worked with an assistant.

Family Math workshops were generally held right after school, from about 3:15 to 5:15, although two teachers held them in the evening from about 6:00 to 8:00.

Analysis of Interview Data. ***Why did you decide to get involved in Family Math?*** In general, the teachers involved in Family Math described themselves as enjoying math; they wanted to pursue further activities related to math. Some were asked by their principals or other administrators to participate; others had tried writing curriculum or booklets and wanted a change; all were curious about the program. Josephine Urso, the District Math Coordinator, generated enthusiasm about the program as well. The philosophy of the program, joining parent and child and getting parents more involved in schools, appealed to a number of them. One teacher, an exception, said she had "math anxiety" and wanted to participate to help overcome her fears.

Has Family Math changed your attitude toward math or your method or style of teaching math in the classroom? Teacher attitudes toward math continue to be very positive after participation in Family Math. Teachers reported that it "validated my feelings toward math," "gave me a better understanding of math," and "made me think differently about how to teach math." About half of the teachers said they changed their own classroom practices by "doing a lot more hands on activities," "greater emphasis on talking through math problems," "more development of concepts," and "more manipulative activities." The others said it reinforced what they were already doing; one teacher said it promoted interests in different areas for her including math through literature.

What concerns have arisen in implementing the Family Math program? Concerns raised fall into two categories: preparation time and workshop issues. Preparation time. Substantial preparation was required in order to be sure that the workshop ran smoothly according to most of the teachers. Gathering materials, planning activities and developing new activities for participants who had attended prior workshops were time consuming. Most of the teachers prepared during school time when they had "prep" periods or during lunch. Several teachers reported that the preparation time was reduced as they gave more workshops because they had their materials ready; however, two teachers who have led numerous workshops and do not want to repeat activities, are using their time to search for new ones to maintain interest. One teacher said "the workshop is the easy part." All of the teachers were very frustrated by the additional paperwork they were required to complete because of the grant evaluation. They said that this takes up time and energy that would best be used for the workshop. Also, they are concerned that this "turns off" participants. Workshop issues. The main issue that arose regarding the workshop was regulating the flow of people. In several schools the turnout was so high that the teacher felt "pulled all over" as she tried to help everyone at once. Other teachers were disappointed when only half of those expected showed up. Some teachers saw a drop off in numbers over the three sessions; others did not. It seems that the inability to predict the number of participants is somewhat disconcerting. A few issues arose during the workshop. For example, some parents brought younger siblings who were occasionally distracting or disruptive. Another teacher mentioned that in her sessions the parents got "chatty" (with each other) and the children wanted their attention back. One teacher was initially anxious about having parents and colleagues present, but once she got used to it, she enjoyed it immensely.

How did you handle non-English speaking participants? Several teachers had participants whose primary language was not English. Written materials were available in Spanish, and one teacher made duplicate sets for all sessions. She also asked a bilingual parent to assist her. Another teacher who was bilingual chose not to give out the Spanish materials and switched to Spanish when it was

necessary. She found that even non-English speaking parents had little difficulty understanding because of the "hands on" nature of the workshop and the modeling by the leader. For example, there was no translator for some Chinese participants, and they followed along without a problem.

What kinds of assistance have you received when you needed help? In general, the workshops went smoothly and the teachers enjoyed doing them. They were always able to rely on Josephine Urso for assistance; in particular, when they gave their first workshop, she offered materials and came to the workshops to help or sent someone else. As they became more experienced, the teachers began to rely more on each other for sharing ideas and experiences.

What changes did you make while teaching Family Math? Most of the teachers reported closely following the activities in the book. Some of the more experienced Family Math teachers developed some of their own activities, and some teachers reported occasionally changing the materials. Variations on activities to simplify concepts also occurred.

How would you change Family Math to work better? As might be expected, either eliminating the paperwork (particularly from the grant evaluation) or having someone assist with the clerical tasks was an oft-repeated suggestion. Also, providing a pool of materials, already prepared, and more new activities was a frequent response. One teacher suggested getting paraprofessionals who work in the classrooms with Family Math teachers involved in the project so that they could prepare materials together and benefit from the exposure to the program. One teacher would like to provide a book or some other relevant reward to students who attend all three sessions. She saw this as a way of reinforcing students, but also of conveying the concept of math through literature. Another teacher suggested having more than three workshop sessions each semester. She felt that the participants wanted to continue coming and that there was too much time in between the fall and spring sessions. Finally, one teacher would have liked some more training about how to go over answers. He suggested that new Family Math leaders serve as "apprentices" or assistants to more experienced leaders; he also suggested having a training video or slides to "walk through" the sessions. Interestingly, he was originally a science teacher while all of the others were math teachers.

What observations have you made about the impact of the Family Math program on the parents? The teachers were delighted with the response of the parents. First their attitudes toward math seemed to become more positive. Some parents were initially afraid of math; this changed to "I can do that." Teachers felt that parents became more confident and even competitive. Second, the parents enjoyed themselves. "They had fun and verbalized it, laughing and chatting." Parents met other parents and became friendly. Third, they saw parents working with their children in a cooperative way, talking through problems. "Seeing parents and children working together for two hours without arguing is great." They are hopeful that this improves the parent-child relationship. A few teachers mentioned that parents became friendlier with the teacher and more active in the school as well.

What observations have you made about the impact of the Family Math program on the students? The consensus was that the appeal of math was increased for students who attended Family Math. This was said in many different ways: "They enjoy math a lot more," "I have to throw them out at the end of the session or they won't leave," and "They get excited when the Family Math letters are going out." Some brought older brothers and sisters to the sessions. Others discussed Family Math

in the classroom. Teachers reported that the students became more confident and relaxed; they observed that students tended to think through problems more often. It was noted that the students in Family Math for this grant were in grades 4, 5 and 6 rather than the primary grades. This is often a "tougher" audience to please, but it appears as though there was great motivation.

Summary. The teacher response to Family Math was very enthusiastic. They expanded their own ideas about teaching math, conscientiously gathered and prepared materials, and modified existing activities where appropriate. They were supported and encouraged by both Josephine Urso and their colleagues. They were rewarded by seeing parents and students who enjoyed the sessions enormously and whose attitudes toward math became more positive. They saw increasing self-confidence on the part of parents and students with regard to math, and they delighted in the cooperation between parent and child as they worked together.

Parent Interviews

Purpose. A small group of parents who participated in the Family Math workshops during the Fall 1993 were interviewed in the Spring 1994. The purpose of the interviews was to assess parent reactions to Family Math and to determine in what ways Family Math affected parent or child attitudes or behavior.

Background. Ten participants, 8 mothers, 1 grandmother and 1 father who attended Family Math in the fall were interviewed by telephone for this evaluation. Four of the parents had attended one Family Math workshop (Fall 1993), while the others had attended 2, 3, 4 or 6 times in prior years (often with their older children). Parents interviewed were from four different schools in the district. Four of the parents did not speak English as a first language. Five of the parents worked full-time. Several participated in other school activities, but most did not.

While all the parents who attended Family Math had a child in either 5th or 6th grade, over half of the parents brought siblings to the workshops as well. The siblings ranged from 3 to 15 years old. Also, in this group there were two couples who attended with their children.

Analysis of Interview Data. ***Why did you decide to attend Family Math?*** Several reasons for participation were mentioned. First, parents said that they thought it would be enjoyable to go to Family Math and that, in particular, it was fun to do things with their children; they stressed over and over the importance of the "family" aspect. The father, who often worked the night shift, said he went because "I hardly have time to do things with my daughter." A second reason was that the child asked or encouraged the parent to attend. One mother was reluctant to go, but her daughter signed them up. Third, several parents mentioned that they thought it would benefit their children because "math is Jane's weakest area," or, "if I go, my grandson will be more interested in math."

Did your participation meet your expectations? Without exception, all of the parents felt that the Family Math workshops had met their expectations. Comments included "I had fun," "I learned a lot," and "met my expectations and more."

Has your attitude toward math changed in any way? All but two of the parents answered "yes" to this question. About half indicated that they had learned math differently or were "scared" of math before going to Family Math. One woman said, "when I was young, I didn't like math so

much in my country, and I was confused. Now, I'm studying too...math is fun and interesting." Another said, "It helped me to realize that math could be fun." Of the two parents who did not report a change in attitude, one always liked math (and still does), and the other always disliked math, found it hard (and still does).

Has your relationship with your child (with regard to math) changed in any way? All but one participant reported changes in the child-parent relationship with regard to math. In general, they agreed that it was now more enjoyable to do math together and that the children were less hesitant to ask for help. Over half of those interviewed mentioned that they tried to incorporate math activities more often into daily activities, for example, when cooking and shopping. One mother said, "It brought us closer together, even if only for math." The father who reported no change indicated that his wife was the one who spent time on math with his daughter because of his evening work hours.

What observations have your made about your child and math? The parents report that the children were much more enthusiastic about math after participating in the Family Math workshops. They described their children as enjoying math more and finding math more interesting. One mother found that "the pressure is off, and my daughter is more relaxed about math." Several parents said their children liked to explain their math homework to them.

Has your participation in (other) school activities changed in any way? In general, there was no reported change in parents' school-related activities. About half of the parents are already active in the school either as volunteers or on the PTA or, in 2 cases, as teachers. They remain active and Family Math is just one of many activities they attend. For the other five parents, Family Math is the only school activity in which they have participated. They were clear that it was the "family" aspect that made Family Math different from other school activities and that appealed to them.

Has your relationship with your child's teacher changed in any way? Once again about half of the parents did report changes in relationships with the teachers as a result of attending Family Math. Most of the comments reflected greater confidence in approaching teachers and the school in general. One parent commented that she is more likely to call the teacher's hot line or send a note if she doesn't understand something, whereas before "I would have been embarrassed." Another parent felt that she got to know more teachers in the school which made her more comfortable when she was in the school. She said, "It's nice to have a chance to interact with other teachers outside of the regular school day." A third parent said that her son was having problems with math, and the teacher recommended that they go to Family Math. She feels that the teacher knows she is doing "everything I can" and it "clinches our relationship."

How would you change Family Math to make it work better? The major complaint from three parents was that there should be longer Family Math workshops and more Family Math workshops. One parent said, "Just when I get into it, it's time to go." Several parents thought it should be more than three sessions. Several other parents said that they wished more parents would go, particularly those who were not involved in other activities in the school. They seemed to enjoy it so much that they wanted to share this pleasurable experience with others.

<u>Other Observations</u>. Parents with limited English were asked how this affected their participation in the Family Math workshops. They were unanimous in saying that a bilingual leader or other

person fluent in their language was not necessary for them to enjoy and participate in the workshop. While several admitted that initially their reluctance to participate was primarily due to their limited English, they were clear that once they attended it was not an obstacle. They reported that the teachers were very friendly and made them feel welcome.

Probably the most revealing information is that virtually all of the people interviewed said that they will be attending Family Math again in Spring 1994, and that they are looking forward to it.

Summary. The response of this diverse group of parents to Family Math was very positive. The appeal of Family Math stemmed from the joint parent-child approach; parents felt comfortable bringing siblings as well so that they could all "have fun together." Motivation for attending was to learn more math and to develop an interest in math for their children. Changes in math-related interactions at home as well as in the children's attitudes toward math (improved) were reported. While participation in other school activities did not change, greater confidence in relating to teachers and other school personnel were reported. Parent enthusiasm is evident through their continued participation in Family Math, their desire to expand the program hours and number of sessions and their wish to "share" it with more parents.

Impact

Discussion

The most important result of this evaluation is the finding that the students in the Spring 1994 who had prior attendance in Family Math workshops scored higher (national percentile) than those who had more limited or no Family Math experience. This suggests that more sessions of Family Math may lead to improved mathematics performance. It is unclear whether the additional math experiences directly affect performance or whether parent participation mediates student performance. Students may simply score higher because they have had more instruction, or they may score higher because parents now spend more time helping them with their homework or some combination of factors. Since students were not randomly assigned to groups, it is also possible that self-selection of the most highly motivated parents into the prior experience group provides the basis for these findings. A follow-up study where students are randomly assigned to groups will further clarify this issue. Further, the significant finding with regard to greater parent-school involvement suggests that participation in Family Math may result in greater school involvement which has been shown to be related to improved student performance.

It is necessary to be cautious, however, with results based on so few sessions. As was discussed above, few of the families attended all three Family Math sessions each term. In fact, fewer than one quarter of the students attended all three sessions. This would severely limit the potential impact of the intervention and makes the two significant results more striking. The other nonsignificant results as well as the interview data suggest that three sessions is not enough to expect change and an expanded or ongoing program might be more effective.

Attitude changes of parents on the questionnaires with regard to their own and their perception of their child's self-confidence with respect to mathematics were not significant. Yet, the 10 parents interviewed clearly expressed that both their attitudes and their behaviors had changed. This inconsistency is hard to explain and may reflect the impreciseness of the attitude measures.

It is clear from both the interview data and the parent evaluations that the quality of the sessions was outstanding and that the parents were vary satisfied and enthusiastic about the Family Math program and eager to continue their participation.

In view of the several positive indications in this study, further research on the impact of Family Math should focus on extending the longitudinal nature of the experimental experience to encompass three or more years of Family Math attendance in successive semesters as well as random assignment into groups . In addition, the number of sessions in each semester should be increased to 5 or 6 and incentive techniques devised to greatly improve the regularity of attendance. Another variation which might prove interesting, would be the introduction of Family Science into the sequence, particularly at the upper elementary and middle school grades to further augment interest in mathematics, science, engineering and technology. Family Science is a program, similar to Family Math, which uses hands-on science activities.

Additional Outcomes

There are now 69 qualified Family Math teachers including 5 staff developers in District #15 as of the end of this project. Of these, 47 directly participated in one or more phases of the project. In addition, 7 other District #15 teachers met with Virginia Thompson and Karen Mayfield on January 28, 1994. Also, 78 teachers from 24 of the 31 CSD's, other than #15, plus another 7 entities either participated in the meeting with Virginia Thompson, received her new materials, or were newly qualified as teachers or trainers in Family Math. Thus, a total of 132 professionals were in some way directly affected by this project. We have seen from the teacher interviews that many will use elements of the Family Math materials to change what they do in their regular math classes and that the enthusiasm that Family Math generates among participants is also found among the teaching faculty. Since most elementary school teachers will work with 30 or more students each year and some work with many more as math specialists, or in middle schools where a math teacher may see several classes a day due to departmentalized scheduling, the impact will be felt by large numbers of students through these teachers. Furthermore, because of the normal flow of students through the grades, the effect is continuous on new groups each year. By having created four new staff developers, additional teachers of Family Math will be qualified as these staff developers train others to teach Family Math.

As parents increasingly take a serious interest in their children's growth in math and other critical subjects, it is likely that families will be better informed about their educational choices and the connection between careers and academics. Furthermore, as parents and children have fun working cooperatively in Family Math activities, intrafamily relationships can be expected to grow in positive ways. With more than 200 children in the experimental group, they probably represent more than 170 families who have been directly exposed to Family Math in this project. Moreover, there will be expanding opportunities for family participation in Family Math now that all 21 elementary schools in District #15 have one or more qualified Family Math teachers. This is a goal which is most desirable to ensure access to this experience by all families who wish to participate but has not been achieved elsewhere in the City.

TABLE 1. BACKGROUND DATA FOR CONTROL & EXPERIMENTAL GROUPS 1993 & 1994 COHORTS

	1993		1994	
	(N = 89)	(N = 101)	(N = 234)	(N = 211)
VARIABLE	CONTROL	EXPER.	CONTROL	EXPER.
GRADE				
4	33.0 %	39.2 %	36.8 %	40.3 %
5	50.5 %	43.1 %	38.5 %	40.8 %
6	16.5 %	17.6 %	22.6 %	16.6 %
7			2.1 %	2.4 %
GENDER				
MALE	43.8 %	44.6 %	48.7 %	45.9 %
FEMALE	56.2 %	55.4 %	51.3 %	54.1 %
LEP[1]	9.0 %	16.8 %	6.5 %	7.1 %
FREE LUNCH	72.5 %	68.1 %	62.7 %	51.3 %
PRIOR EXP[2]	15.4 %	48.0 %	7.3 %	29.6 %
NSESSIONS[3]				
0	100.0 %		100.0 %	4.3 %
1		38.9 %		31.1 %
2		36.8 %		25.8 %
3		24.2 %		32.5 %
>3				6.3 %
ATTENDANCE BY AT LEAST ONE PARENT				
SESSION 1		87.5 %		86.3 %
SESSION 2		62.5 %		65.7 %
SESSION 3		32.3 %		49.0 %

[1]LEP = Limited English Proficient
[2]PRIOR EXP = Any Prior Experience Attending Family. Math Programs
[3]NSESSIONS = Number of Sessions Attended This Semester

TABLE 2. PARENT EVALUATIONS OF FAMILY MATH TRAINING

QUESTION		1993	1994
AVERAGE RATING[1] OF OVERALL QUALITY OF THE SESSIONS		1.4 (N = 66)	1.3 (N = 55)
AVERAGE RATING OF PRESENTATION OF MATERIALS		1.4 (N = 66)	1.3 (N = 55)
AVERAGE RATING OF EVERYDAY USEFULNESS OF SESSIONS		1.4 (N = 65)	1.5 (N = 55)
I'M ABLE TO HELP MY CHILD WITH MATH.	% YES	83.3 (N = 66)	68.5 (N = 55)
I HAVE MATH MATERIALS TO USE WITH MY CHILD AT HOME	% YES	72.7 (N = 66)	74.1 (N = 54)
I KNOW MORE ABOUT MATH	% YES	72.7 (N = 66)	75.9 (N = 54)
I'VE LEARNED HOW MATH IS TAUGHT IN SCHOOL	% YES	80.3 (N = 66)	75.9 (N = 54)
WOULD YOU LIKE TO ATTEND MORE FAMILY MATH CLASSES NEXT YEAR?	% YES	91.0 (N = 67)	96.3 (N = 54
WOULD YOU RECOMMEND FAMILY MATH TO A FRIEND?	% YES	94.0 (N = 67)	96.4 (N = 55)

[1] Ratings were on a 1-5 Scale where 1 = EXCELLENT and 5 = POOR.

TABLE 3. ANALYSIS OF COVARIANCE COMPARING THE POST SCORES OF THE CONTROL & EXPERIMENTAL GROUPS

1993 COHORT -- ADJUSTED POST SCORE MEANS

GROUP	MATH	NP	STUATT	PAR1	PAR2	PAR3
CONTROL	20.4 (N = 89)	65.7 (N = 78)	2.8 (N = 88)	3.0 (N = 39)	3.0 (N = 39)	2.9 (N = 39)
EXPERIMENTAL (No Prior Family Math Experience)	20.1 (N = 50)	66.8 (N = 42)	2.9 (N = 47)	3.2 (N = 20)	3.2 (N = 20)	3.0 (N = 20)
EXPERIMENTAL (Prior Family Math Experience)	20.7 (N = 45)	73.0 (N = 41)	3.0 (N = 44)	2.8 (N = 23)	3.1 (N = 23)	2.9 (N = 22)
STATIST SIGNIF	NS	NS	NS	NS	NS	NS

1994 COHORT -- ADJUSTED POST SCORE MEANS

GROUP	MATH	NP	STUATT	PAR1	PAR2	PAR3
CONTROL	10.7 (N = 190)	69.5 (N = 223)	3.0 (N = 170)	3.1 (N = 75)	3.2 (N = 75)	2.3 (N = 74)
EXPERIMENTAL (No Prior Family Math Experience)	10.5 (N = 104)	66.6 (N = 114)	2.9 (N = 80)	3.0 (N = 41)	3.2 (N = 41)	2.8 (N - 41)
EXPERIMENTAL (Prior Family Math Experience)	11.6 (N = 55)	77.9 (N = 51)	3.1 (N = 42)	3.1 (N = 31)	3.3 (N = 31)	2.9 (N = 31)
STATIST SIGNIF	NS	SIG	NS	NS	NS	SIG

TABLE 3. (CONTINUED)

MATH = Post performance-based assessment mathematics score
NP = Percentile score on standardized mathematics examination
STUATT = Average score on the 10 item Student Attitude Questionnaire
(1 = Most negative attitude, 4 = Most positive attitude)
PAR1 = Average score on items 1-7 of the Parent Questionnaire
(1 = Most negative attitude, 4 = Most positive attitude)
PAR2 = Average score on items 8-11 of the Parent Questionnaire
(1 = Most negative attitude, 4 = Most positive attitude)
PAR3 = Average score on items 12-16 of the Parent Questionnaire
(1 = Most negative attitude, 4 = Most positive attitude)

APPENDIX A

Agenda and Presentation Outline for March 17, 1993 Meeting

OFFICE OF THE COMMUNITY SUPERINTENDENT
COMMUNITY SCHOOL DISTRICT 15
360 SMITH STREET
BROOKLYN, NEW YORK 11231

William P. Casey
Community Superintendent

Loyda R. Alfalla
Deputy Superintendent

March 8, 1993

CASE/District 15

Family Math Meeting

March 17, 1993

A G E N D A

- Welcome and Introductions

- Overview of CASE/CUNY/District 15
  Mathematics Project:
  Dr. S. Brodsky, CASE/CUNY

- Specific Administration Matters:
  - Portfolios:
    Pre-test
    Attitude Survey
    Spring '93 Test Score
  - Materials
  - Payroll Issues

- Questions, Comments and Concerns

OUTLINE OF CSD#15--CASE/CUNY GRAD SCHOOL FAMILY MATH PROJECT
FUNDED BY A GRANT FROM THE CHARLES A. DANA FOUNDATION

Formal Title -- An Urban FAMILY MATH Collaborative

Project Directors -- Josephine Urso for CSD #15
Dr. Stan Brodsky for CASE/CUNY Grad School
Evaluators -- Dr. Marian Fish, CUNY Graduate Ed Psych Faculty
Dr. Alan Gross, CUNY Graduate Ed Psych Faculty

Significance:

We expect this project to be the definitive study of the effectiveness of Family Math and that it will be a national model. Results will be reported at national meetings and in the professional literature.

Major Hypothesis:

Participation in Family Math programs in successive semesters will have a positive impact on family attitudes, certain student abilities and math-related student choices in middle schools.

Additional Purposes:

To field-test and evaluate newly developed Family Math materials for middle school grades. These materials are being developed by FAMILY MATH/EQUALS at the Lawrence Hall of Science at the University of California, Berkeley.

To prepare more persons to teach Family Math programs in CSD #15 and elsewhere in NYC. Dates for a training session will be announced -- probably scheduled for July 1993.

Recruitment:

We want as many families as possible (in the grades to be designated) to make a commitment to attend all sessions (3) of a Family Math program in this semester (Spring '93) at their home school AND attend all sessions of Family Math programs in Fall '93 (3 sessions) and Spring '94 (3 sessions) given in the school that the children are attending at the time of the programs. We know that some will make the commitment but might miss some sessions and they will still be part of the study -- but we want as many full attenders as possible to really help the study to show what Family Math can do. Shoot for 20 or more families with both grades represented. Set up portfolio for each FM & non-FM student in the study.

Documents For The Study:

Just before this semester's program --

* Student Pre-Test for all Family Math students.
* Student Attitude Questionnaire Form 1 to all Family Math students AND at least as many non-Family Math students from the same grades and classes.
* Parent Attitude Questionnaire to all Family Math parents AND to the parents of the non-Family Math students included above.
* Student Background Questionnaire to be completed by the Family Math teachers for all Family Math students and non-Family Math students included above.

After the semester's program --

* Student Post-Test for all Family Math students.
* Student Attitude Questionnaire Form 2 as above for all FM and non-FM students.
* Repeat Parent Attitude Questionnaire for all FM parents as above.
* Parent Family Math Evaluation Form to all Family Math parents who attended.

APPENDIX B

Evaluation Forms

- **Student Background Questionnaire**
- **Student Attitude Questionnaire**
- **Parent Questionnaire (English Version)**
- **Parent Questionnaire (Spanish Version)**
- **Parent Family Math Evaluation Form**

Semester:_____
Term -- Year

STUDENT BACKGROUND QUESTIONNAIRE

1. Student Name:_____

2. OSIS Number:_____ 3. Date of Birth:_____ - _____ - _____
Mo. - Day - Year

4. Class:_____ 5. School:_____

6. Gender (M = Male, F = Female):_____

7. Is this student designated as Limited English Proficient? (Y = Yes, N = No): _____

8. Does this student receive Free or Reduced Price Lunch? (Y = Yes, N = No): _____

9. Has this student attended any previous Family Math program? (Y = Yes, N = No, U = Unknown): _____

10. Is this student enrolled in a Family Math program this semester? (Y = Yes, N = No): _____

11. At the end of this semester, please record the number of Family Math sessions the student attended: _____

12. For each session attended, please record which parent(s) or other adult attended with the student.

	Mother	Father	Both	Other Person
Session 1	_____	_____	_____	_____
Session 2	_____	_____	_____	_____
Session 3	_____	_____	_____	_____

13. Pre-Test Score on Mathematics Performance Test: _____

14. Post-Test Score on Mathematics Performance Test: _____

15. CAT - 5 National Percentile Score: _____

16. Next Semester's School:_____

17. Next Semester's Grade:_____

Many thanks for all your efforts in support of this project. Your contribution is important and is much appreciated.

STUDENT ATTITUDE QUESTIONNAIRE

Student Name_____

STUDENT OSIS # _____ Date of Administration_____

TELL US WHAT YOU THINK BY PUTTING A CIRCLE AROUND THE NUMBER WHICH BEST DESCRIBES YOURSELF. REMEMBER, THERE ARE NO WRONG OR RIGHT ANSWERS. WE JUST WANT TO KNOW WHAT YOU THINK.

	NEVER	SOME OF THE TIME	MOST OF THE TIME	ALWAYS
1. I enjoy doing math.	1	2	3	4
2. A math test would scare me.	1	2	3	4
3. I learn math easily.	1	2	3	4
4. I do well in math.	1	2	3	4
5. Math is a difficult subject for me to learn	1	2	3	4
6. I like math puzzles or games that use math.	1	2	3	4
7. I use math quite a lot.	1	2	3	4
8. I like doing math homework.	1	2	3	4
9. I have more trouble with math than with other subjects.	1	2	3	4
10. I talk about math with my mother or father.	1	2	3	4

Form 1

PARENT QUESTIONNAIRE

Your Child's Name:_____ Child's OSIS No.:_____

Your Child's Grade:_____ Date This Form Completed:___-___-___
mo.-day -yr

Here are some things that some people might say about math, or about learning math. We would like to know your reactions to them. Please indicate how you feel about these statements by circling SD if you STRONGLY DISAGREE, or D if you MILDLY DISAGREE, or A if you MILDLY AGREE, or SA if you STRONGLY AGREE. Remember, there are no right or wrong answers. We want to know what you think.

	STRONGLY DISAGREE	MILDLY DISAGREE	MILDLY AGREE	STRONGLY AGREE
1. I enjoy doing math.	SD	D	A	SA
2. A math test would scare me.	SD	D	A	SA
3. I learn math easily.	SD	D	A	SA
4. Math is a difficult subject to learn.	SD	D	A	SA
5. Math is one of my favorite subjects.	SD	D	A	SA
6. I like math puzzles or games that use math.	SD	D	A	SA
7. I use math quite a lot from day to day.	SD	D	A	SA
8. My child seems to like math a lot.	SD	D	A	SA
9. I regularly supervise my child's math homework.	SD	D	A	SA
10. I point out to my child how math is used in our day-to-day life.	SD	D	A	SA
11. My child is doing well in math in school.	SD	D	A	SA

The following are some different statements about parent/school relationships. Please indicate how you feel about these statements by circling SD if you STRONGLY DISAGREE, or D if you MILDLY DISAGREE, or A if you MILDLY AGREE, or SA if you STRONGLY AGREE. Remember, there are no right or wrong answers. We want to know what you think.

12. My child's school actively encourages parents to be involved.	SD	D	A	SA
13. I generally don't talk with my child's teacher unless there is a problem.	SD	D	A	SA
14. I regularly attend school events.	SD	D	A	SA
15. I regularly volunteer at my child's school.	SD	D	A	SA
16. I help in planning activities at my child's school.	SD	D	A	SA

THANK YOU FOR YOUR COOPERATION IN COMPLETING THIS QUESTIONNAIRE.

CUESTIONARIO PARA PADRES Y MADRES

Nombre de su hija/o:_____ Número de OSIS:_____

Grado de su hija/o:_____ Fecha:___-___-___
mes-día-año

Estas son algunas de las cosas que la gente dice acerca de matemáticas o del aprendizaje de matemáticas. Nos gustaría saber qué piensa de estas opiniones. Por favor indique si está de acuerdo con estas opiniones. Ponga un círculo alrededor de CD si usted está COMPLETAMENTE EN DESACUERDO, o un círculo alrededor de D si usted está MÁS O MENOS EN DESACUERDO, o A si está MÁS O MENOS ACUERDO, o CA si está COMPLETAMENTE DE ACUERDO. Recuerde, no hay respuestas correctas o incorrectas. Sólo queremos saber lo que usted piensa.

	COMPLETAMENTE EN DESACUERDO	MÁS O MENOS EN DESACUERDO	MÁS O MENOS DE ACUERDO	COMPLETAMENTE DE ACUERDO
1. Disfruto estudiando matemáticas.	CD	D	A	CA
2. Un exámen de matemáticas me asusta.	CD	D	A	CA
3. Aprendo matemáticas fácilmente.	CD	D	A	CA
4. Matemáticas es una materia difícil de aprender.	CD	D	A	CA
5. Matemáticas es una de mis materias preferidas.	CD	D	A	CA
6. Me gustan los rompecabezas de matemáticas o los juegos que usan matemáticas.	CD	D	A	CA
7. Uso matemáticas bastante cada día.	CD	D	A	CA
8. Al parecer a mi hija/o le gustan mucho las matemáticas.	CD	D	A	CA
9. Superviso regularmente la tarea de matemáticas de mi hija/o.	CD	D	A	CA
10. Le indico a mi hija/o como se usan las matemáticas en la vida diaria.	CD	D	A	CA
11. A mi hija/o le va bién en matemáticas en la escuela.	CD	D	A	CA

Las siguientes son algunas de las opiniones sobre las relaciones entre los padres de familia y la escuela. Po favor indique si está de acuerdo con estas opiniones. Ponga un círculo alrededor de CD si usted está COMPLETAMENTE EN DESACUERDO, o un círculo alrededor de D si usted está MÁS O MENOS EN DESACUERDO, o A si está MÁS O MENOS ACUERDO, o CA si está COMPLETAMENTE DE ACUERDO. Recuerde, no hay respuestas correctas o incorrectas. Sólo queremos saber lo que usted piensa.

12. La escuela de mi hija/o anima activamente la participación de los padres.	CD	D	A	CA
13. Generalmente no hablo con el maestro o la maestra de mi hija/o a menos que haya un problema.	CD	D	A	CA
14. Regularmente voy a eventos escolares.	CD	D	A	CA
15. Soy voluntaria/o regularmente en la escuela de mi hija/o.	CD	D	A	CA
16. Ayudo a planear actividades en la escuela de mi hija/o.	CD	D	A	CA

GRACIAS POR SU COOPERACIÓN

PARENT FAMILY MATH EVALUATION FORM

Today's Date:_____

1. Student's Name:_____ Student's OSIS No.: _____

2. Please rate the Family Math Sessions on each of the following areas. Circle the number which shows your answer.

	Excellent				Poor
(a) Overall Quality of the Sessions	1	2	3	4	5
(b) Presentation of Materials	1	2	3	4	5
(c) Everyday Usefulness of Sessions	1	2	3	4	5

3. After going to the Family Math sessions, I feel that I have accomplished the following: **Check all items that apply to you.**

_____ I'm able to help my child with math.

_____ I have math materials to use with my child at home.

_____ I know more about math.

_____ I've learned how math is taught in school.

	(Circle Your Answer)		
4. Would you like to attend more Family Math classes next year?	Yes	No	Not Sure
5. Would you recommend Family Math to a friend?	Yes	No	Not Sure

Thank you for your participation and cooperation.