DOCUMENT RESUME

ED 225 833 SE 040 192

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TITLE Fifth Grade Evaluation: Volume I, Summary. Evaluation Report 7-B-1. Extended Pilot Trial of the Comprehensive School Mathematics Program.
INSTITUTION CEMREL, Inc., St. Louis, Mo.
SPONS AGENCY National Inst: of Education (ED), Washington, DC.
PUB DATE Dec 80
NOTE 28p.; For related documents, see SE 040 181-196 and SE 040 340-348.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Educational Research; *Elementary School Mathematics; *Grade 5; Intermediate Grades; *Mathematics Achievement; Mathematics Curriculum; Mathematics Instruction; *Program Evaluation; Testing
IDENTIFIERS *Comprehensive School Mathematics Program; *Mathematics Education Research

ABSTRACT

The Comprehensive School Mathematics Program (CSMP) is a program of CEMREL, Inc., one of the national educational laboratories, and was funded by the National Institute of Education (NIE). Its major purpose is the development of curriculum materials for grades kindergarten through 6. In the spring of 1980, a series of mathematics tests was administered to fifth-grade classes. Thirty-one CSMP groups and 25 non-CSMP classes were chosen. The main finding is that CSMP classes demonstrated clear superiority over non-CSMP classes in many mathematical thinking areas as assessed by specific tests. Particular examples included calculation in mental arithmetic and estimation, elucidation, and number relationships, as well as in fractions, decimals, and negative numbers. Gains are seen as made without corresponding score decreases in more traditional instruction areas. Teachers' approval of CSMP and reasonably faithful implementation appeared to result in improvement in some areas, with a possible cost in computation that is often made up with teacher supplementation. (MP)

EXTENDED PILOT TRIALS OF THE COMPREHENSIVE SCHOOL MATHEMATICS PROGRAM:

EVALUATION REPORT SERIES

Evaluation Report 7-B-1

Fifth Grade Evaluation: Volume I, Summary

Extended Pilot Trial of the Comprehensive School Mathematics Program

Evaluation Report 7-B-1

Fifth Grade Evaluation: Volume I, Summary

Martin Herbert

December, 1980

Developed by CEMREL, Inc., a private nonprofit corporation supported in part as an educational laboratory by funds from the National Institute of Education, Department of Health, Education, and Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the National Institute of Education, and no official endorsement should be inferred.

Description of Evaluation Report Series

The Comprehensive School Mathematics Program (CSMP) is a program of CEMREL, Inc., one of the national educational laboratories, and is funded by the National Institute of Education. Its major purpose is the development of curriculum materials for grades K-6.

Beginning in September, 1973, CSMP began an extended pilot trial of its Elementary Program. The pilot trial is longitudinal in nature; students who began using CSMP materials in kindergarten or first grade in 1973-74, were able to use them in first and second grades respectively in 1974-75, and so on in subsequent years. Hence the adjective "extended".

The evaluation of the program in this extended pilot trial is intended to be reasonably comprehensive and to supply information desired by a wide variety of audiences. For that reason the reports in this series are reasonably non-technical and do not attempt to widely explore some of the related issues. The list of reports through year six is given on the next page. The following reports are planned for year 7:

7-B-1 - Fifth Grade Evaluation: Volume I, Summary
7-B-2 - Fifth Grade Evaluation: Volume II, Test Data
7-B-3 - Fifth Grade Evaluation: Volume III, Non-Test Data
7-B-4 - Re-evaluation of Second Grade, Revised MANS Tests
7-B-5 - Achievement of Former CSMP Students at Fourth Grade
7-B-6 - Student Achievement, Rapid Implementation Model

Extended Pilot Trials of the
Comprehensive School Mathematics Program

Evaluation Report Series

Evaluation Report 1-A-1	Overview, Design and Instrumentation
Evaluation Report 1-A-2	External Review of CSMP Materials
Evaluation Report 1-A-3	Final Summary Report Year 1
Evaluation Report 1-B-1	Mid-Year Test Data: CSMP First Grade Content
Evaluation Report 1-B-2	End-of-Year Test Data: CSMP First Grade Content
Evaluation Report 1-B-3	End-of-Year Test Data: Standard First Grade Content
Evaluation Report 1-B-4	End-of-Year Test Data: CSMP Kindergarten Content
Evaluation Report 1-B-5	Test Data on Some General Cognitive Skills
Evaluation Report 1-B-6	Summary Test Data: Detroit Schools
Evaluation Report 1-C-1	Teacher Training Report
Evaluation Report 1-C-2	Observations of CSMP First Grade Classes
Evaluation Report 1-C-3	Mid-Year Data from Teacher Questionnaires
Evaluation Report 1-C-4	End-of-Year Data from Teacher Questionnaires
Evaluation Report 1-C-5	Interviews with CSMP Kindergarten Teachers
Evaluation Report 1-C-6	Analysis of Teacher Logs
Evaluation Report 2-A-1	Final Summary Report Year 2
Evaluation Report 2-B-1	Second Grade Test Data
Evaluation Report 2-B-2	Readministration of First Grade Test Items
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Evaluation Report 2-C-1	Teacher Questionnaire Data
Evaluation Report 2-C-2	Teacher Interviews, Second Grade
Evaluation Report 2-C-3	Teacher Interviews, First Grade
Evaluation Report 3-B-1	Second and Third Grade Test Data Year 3
Evaluation Report 3-C-1	Teacher Questionnaire Data Year 3
Evaluation Report 4-A-1	Final Summary Report Year 4
Evaluation Report 4-B-1	Standardized Test Data, Third Grade
Evaluation Report 4-B-2	Mathematics Applied to Novel Situations (MANS) Test Data
Evaluation Report 4-B-3	Individually Administered Problems, Third Grade
Evaluation Report 4-C-1	Teacher Questionnaire Data, Third Grade
Evaluation Report 5-B-1	Fourth Grade MANS Test Data
Evaluation Report 5-B-2	Individually Administered Problems, Fourth Grade
Evaluation Report 5-C-1	Teacher Questionnaire and Interview Data, Fourth Grade
Evaluation Report 6-B-1	Comparative Test Data: Fourth Grade
Evaluation Report 6-B-2	Preliminary Test Data: Fifth Grade
Evaluation Report 6-C-1	Teacher Questionnaire Data: Grades 3-5

Key to Indexing

Evaluation Reports are labelled m-X-n,

where m is the year of the pilot study, with 1973-74 as Year 1.
X is the type of data being reported where A is for overviews and summaries, B is for student outcomes and C is for other data.
n is the number within a given year and type of data.

Table of Contents

Introduction to Volume I

In the spring of 1980, a series of mathematics tests was administered to 31 fifth grade classes using the Comprehensive School Mathematics Program and to 25 comparison classes using more traditional programs. In addition to the testing, considerable information was collected regarding teacher and student attitudes and implementation of the program.

A summary of all the results is given in this volume which is Volume I (Evaluation Report 7-B-1) of a three-volume set. Volume II (Evaluation Report 7-B-2) describes in detail the tests and results of the testing and Volume III (Evaluation Report 7-B-3) describes attitudinal and implementation data and their relationship to the test data.

Description of Participating Classes

CSMP - 31 classes (out of 44 classes studying CSMP in fifth grade)

- located in 6 school districts; widely varied in geographic location, size and type of community and ability level of students
- 23 of the 31 classes had studied CSMP since first grade, 8 since fourth grade
- overall ability level about the 61st percentile rank in reading comprehension
- about half the teachers received the recommended CSMP training (40 hours), but about a third received less than 10 hours.

non-CSMP - 24 classes

- located in 6 school districts (same as CSMP except two where CSMP was taught in lower grades)
- not randomly selected but as similar as possible to CSMP especially school location and student ability
- overall ability level about the 60th percentile rank in reading comprehension
- all but 2 classes used one of the various, widely used, "traditional" textbooks for mathematics.

A brief description of the sites is given below.

Number of Classes CSMP	Number of Classes non-CSMP	Type of Community	Approximate Socio-Economic Status
6	0	Suburb of small city	Middle
0	5	Small city	Middle/Lower middle
5	3	Inner city of large city	Low
9	6	Inner suburban of large city	Middle/Lower middle
0	3	Medium City	Middle
2	2	Exurban	Middle/Lower middle
6	6	Suburb of large city	Upper Middle
3	0	Suburb of large city	Upper Middle
Total 31	25		

From questionnaire data, further similarities and differences between CSMP and non-CSMP classes are summarized below:

- Average time on math instruction per day: {CSMP = 59 minutes; non-CSMP = 51 minutes}
- Average percent time for teacher-led work: {CSMP = 59%; non-CSMP = 43%}
- Average percent of time supplementing: {CSMP = 25%; non-CSMP = 23%}
- Areas of supplementing:
  - both groups: basic number facts, mental arithmetic drills
  - more by CSMP: multiplication and division algorithm, fractions, decimals
  - more by non-CSMP: money, time, graphs, enrichment
- Median number of years teaching experience: about 10 years for both CSMP and non-CSMP.

Instruments Used

The data summarized in this report are from the following instruments:

- The Reading Comprehension and Computation Subtests of the Comprehensive Test of Basic Skills (CTBS), Level 2, Form s
- The MANS Tests, a series of 27 short tests which attempt to assess some of the underlying processes of CSMP, without using special terminology or problem types. Many of the tests are built around mathematical situations new to both CSMP and non-CSMP students (hence the name "Mathematics Applied to Novel Situations"). They are administered by specially trained testers. Similar tests were grouped into categories which roughly parallel most of the 10 basic skills identified by NCSM and NCTM (National Councils of Supervisors and Teachers of Mathematics).
- A series of student attitude items
- A teacher questionnaire which probed the way the math program was implemented, teacher opinions about teaching math, and evaluations of their math program
- An evaluation by teachers of each of the MANS tests

Comparison of Class Means

For each class, mean scores on each MANS test and on the Reading Comprehension test were calculated. The various tests were grouped into 13 different categories Analysis of Covariance data on these class means are shown in Tables 1-3 for the various categories. In Table 1 are the categories in which CSMP classes did significantly better than non-CSMP classes at the .01 level. Table 2 is for categories where the difference is significant at only the .05 level and Table 3 is for categories with no significant differences. There were no categories (or individual tests) in which non-CSMP classes had significantly lower scores.

Table 1

Categories with Large CSMP-Advantage

Category	ns/tn[1]	Adjusted Means[2]		p-value
		CSMP	non-CSMP	
Mental Arithmetic Open number sentences to be done mentally, i.e., without "scratch" work. The answer box could appear on either side of the equals sign. Many of the items required more than merely calculation skills.	4/4	19.7	15.9	.01
Decimals Simple word problems, relative size, and linear measurements.	2/2	11.1	8.5	.01
Number Relations Solution and application of mathematical patterns and relationships involving the concept of number machines.	2/2	12.2	10.2	.01
Elucidation Find as many solutions as possible to given problems.	1/1	16.2	13.2	.01
Estimating Intervals Determine which of several given intervals contains the answer to a computation problem. Short time limits were strictly enforced.	2/3	15.6	14.5	.01

1. ns/nt = number of scales in category which produced a significant difference ($p < .05$) divided by the total number of scales in category.

2. Adjusted from Analysis of Covariance procedure on class means with reading comprehension as covariate (df=1,48). Since differences in class means in reading were small, such adjustments usually amounted to no more than 0.1 on individual tests.

Table 2

Categories with Moderate CSMP Advantage

Category	ns/tn[1]	Adjusted Means[2]		p-value
		CSMP	non-CSMP	
Fractions Seven tests covering various aspects of fractions including representations, measurement, open sentences, word problems, relative size, and equivalent fractions.	2/7	33.0	31.1	.03
Probability Estimate frequencies of various outcomes and select best random devices for a given outcome.	1/2	17.2	15.8	.02
Negative Numbers Solve problems in a game in which hits and misses correspond to gains and losses of a certain number of points.	1/1	6.4	5.8	.05
Word Problems Two and three stage word problems with low verbal and computation load.	0/1	6.6	6.1	.03

Table 3

Categories with No Significant Differences

Category	ns/tn[1]	Adjusted Means[2]		p-value
		CSMP	non-CSMP	
Computation 48 multiple-choice items, 12 for each operation. Roughly half the items involved whole number algorithms, a quarter of them involved fractions, and a quarter decimals. CTBS Computation test.	0/4	34.9	34.3	.42
Most Reasonable Answer For a given computation problem, determine which of 3 answers (all of which are wrong) is most reasonable. Short time limits were strictly enforced.	0/4	12.9	12.9	.82
Measurement Estimation Estimate the answer to a visually presented problem in area, volume, height, etc.. A range of answers was accepted.	0/1	2.1	2.1	.81
Organizing Data Given a graph in which weight is plotted against age, determine age per given weights and vice versa, including interpolation.	0/1	6.5	6.5	.81

1. ns/nt = number of scales in category which produced a significant difference ($p < .05$) divided by the total number of scales in category.

2. Adjusted from Analysis of Covariance procedure on class means with reading comprehension as covariate (df=1,48). Since differences in class means in reading were small, such adjustments usually amounted to no more than 0.1 on individual tests.

Graphs of Class Means

The mean score across all categories was calculated for each class and these are plotted against class reading scores in Figure 1. (The different symbols in the key for Figure 1 represent different districts. The line drawn on the graph is the regression line of Total MANS score on Reading Comprehension score.)

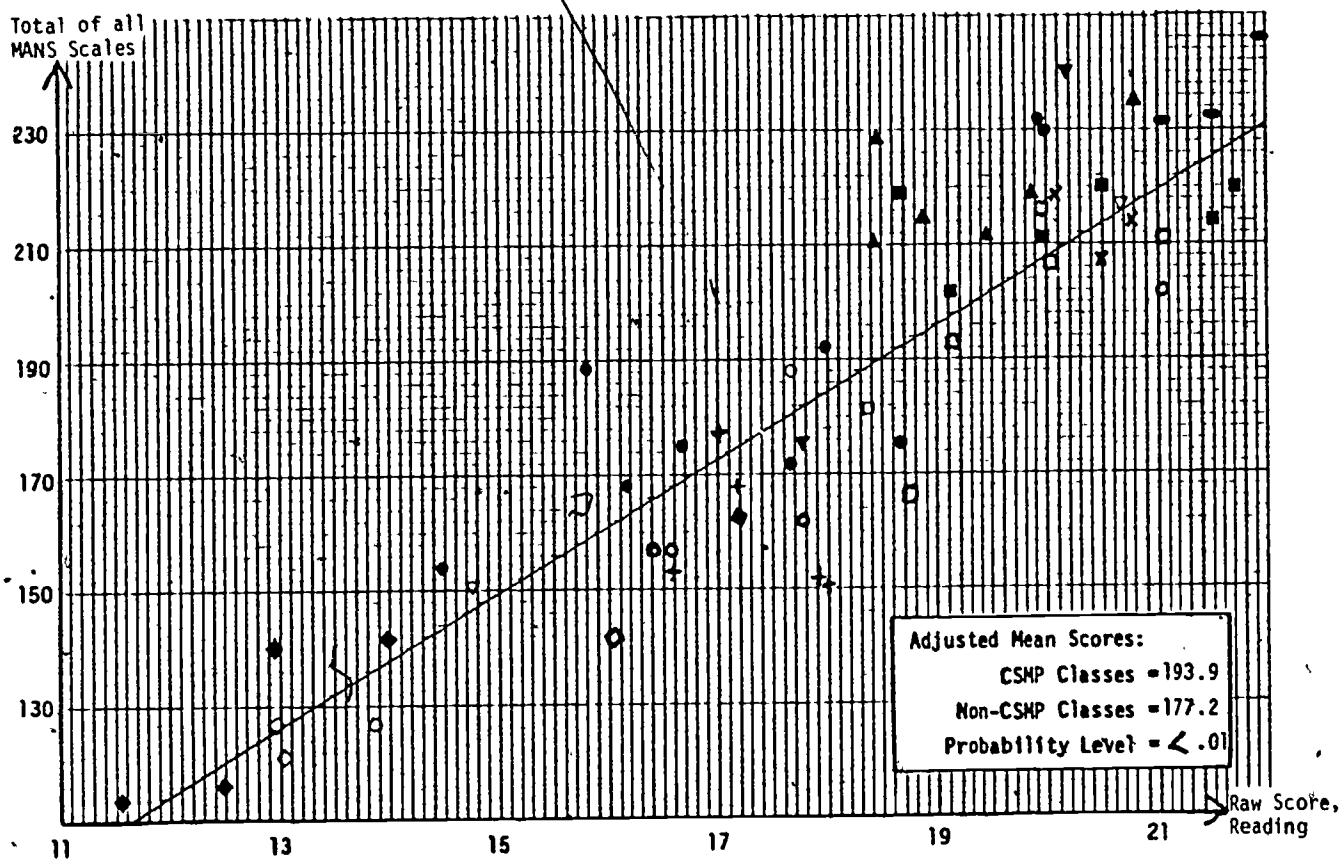

Fig. 1, Graph of Class Means - Total MANS versus Reading Comprehension

CSMP Classes: ■ ● ▼ ◆ ▲

Non-CSMR Classes: □ + ×

It can be seen from the graph that the CSMP advantage was greatest for classes with high reading ability, i.e., reading score above 18 (see also page 9).

Comparison of District/School Level Data

A much more conservative analysis than using class means was also done, first considering as units of analysis the 12 CSMP and 12 non-CSMP schools and then the 6 CSMP and 6 non-CSMP districts.

A separate analysis of school mean scores generated results almost identical to the analysis of class means, both on total MANS score and on the individual MANS categories.

A separate analysis of district mean scores generated almost identical results on the total MANS score (see Figure 2) and on most of the individual categories.

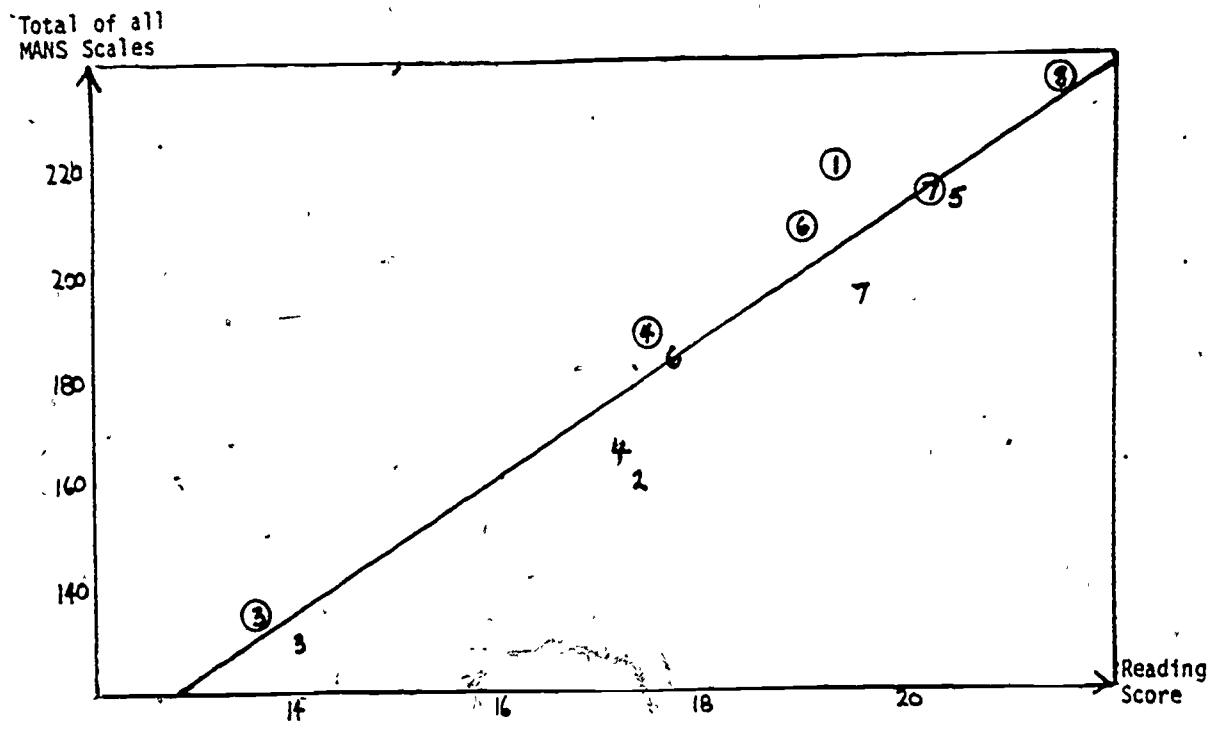

Fig. 2, Graph of District Means

Circled numeral = CSMP District
Plain numeral = non-CSMP District

Comparison by Student Reading Level

The mean score on the MANS scales was calculated for all students in approximately the lowest quarter of reading scores. This was done separately for CSMP and non-CSMP students. The same calculations were performed for students in each of the other 3 quarters of reading ability. Figure 3 shows these mean scores on the total of all the MANS scales.

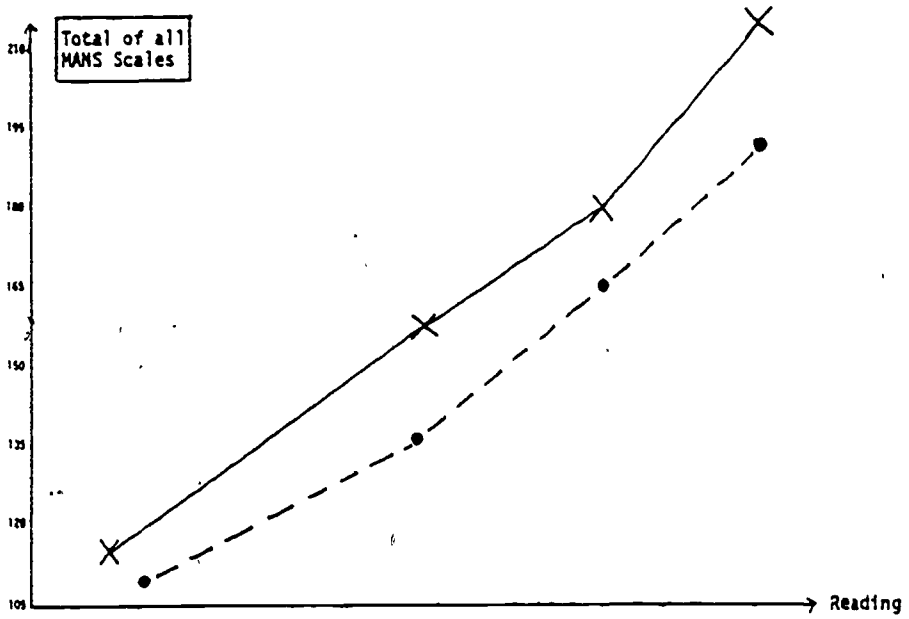

Fig. 3, Total MANS Scores by Reading Groups
X = CSMP students, ● = non-CSMP students

Figure 3 shows fairly consistent results in favor of CSMP except for a slight narrowing of the gap for the lowest level of readers. When graphs were drawn for the various category scores, it was found in most cases that the lines were parallel (quite consistent results).

For 4 categories however, there were virtually no differences between CSMP and non-CSMP students in the lowest reading group, but clear differences in the other reading group. There categories were: probability, word problems, mental arithmetic and estimation.

Comparison of Mean Scores for New Students

It is to be expected that students who transfer into CSMP (or into any program for that matter) will be at somewhat of a disadvantage, at least while they "catch-up" with the rest of the class. The disadvantage may be greater for CSMP students where there is a greater backlog of specialized content to catch up on.

Separate mean scores were calculated for "new" students (who moved or were transferred to a participating school during the previous summer) and "late" students (who moved to a participating school after the first month of school). On the average there was about one student per class in each category. When reading scores were taken into account, it was found that:

- Both "new" and "late" CSMP students did at least as well as "regular" CSMP students of similar reading ability. The same result occurred for non-CSMP students.

- CSMP students did better than non-CSMP students (for both "new " students and "late students), and the difference was consistent with the main results, the CSMP students' performance being relatively best in Mental Arithmetic, Decimals and Elucidation.

Teacher Attitudes

The teachers of all of the classes participating in the testing also completed questionnaires, and the results are described in this section.

Teacher Evaluation of CSMP

Teachers were asked to give an overall evaluation of CSMP in a free-response, paragraph form. About a third of the responses were categorized as enthusiastically positive and another half the responses were also positive but contained reservations about the program, (usually concerning insufficient emphasis on computation and the appropriateness for low ability students). Only 14% of the responses judged CSMP as "adequate" and 5% "poor". (About 60% of the non-CSMP teachers judged their program as adequate or poor.)

Teachers were also asked to compare CSMP with the previous math curriculum they had taught, using several 5-point items. Responses are given below: in parenthesis are given mean scores on the same items for non-CSMP teachers on items for which there were noteworthy differences.

Very favorable responses (mean scores $\geq$ 3.9) were given for:

overall quality,
student interest and involvement (versus 3.4 for non-CSMP teachers),
students' achievement in math concepts (versus 3.4),
students' ability to do logical reasoning (versus 2.9), and
appropriateness for high ability students.

Neutral responses (mean score around 3.0) were given for:

students' facility in solving word problems, and
students' achievement in computation skills (versus 3.5).

Unfavorable responses (mean score = 2.4) were given for:

appropriateness for low ability students (versus 2.8).

These responses are similar to previous CSMP teachers' responses in grades 3 and 4, with responses in grades K-2 tending to be more positive toward CSMP than in grades 3-5.

These responses are also consistent with responses to other questionnaire items answered by these fifth grade teachers, namely:

- On an open-ended question, the most frequently named "best aspects" of CSMP were concerned with the promotion of reasoning and creative thinking skills, appropriateness for high ability students, student interest, and allowance for different ability levels (each named by at least 25% of the teachers).

- The most frequently named worst aspects concerned problems with low ability students.

- On a checklist of items for which their entering fifth graders had been inadequately prepared, basic number facts and operations and familiarity with fractions and with decimals were each checked by 40%-60% of the teachers. On a similar checklist concerning inadequate coverage during 5th grade, operations with fractions was checked by 57% of the teachers and basic number facts, operations with decimals and word problems were each checked by at least 25% of the teachers.

- On a series of items about the spiral approach, CSMP teachers overall gave favorable responses, but a significant minority of the teachers (25%-35%) expressed strong disagreement with certain apsects of it and would prefer a somewhat looser version of this approach.

Comparison of CSMP and non-CSMP Teachers' Attitudes

The previous section described things teachers liked and disliked about the program, ignoring for the moment the responses of non-CSMP teachers to the same questions. This section summarizes differences between the two groups of teachers' responses, regardless of whether the response was positive or negative in an absolute sense. (For example, 43% of the CSMP teachers checked "word problems" as an area not adequately covered, making it noteworthy in the last section, but since a similarly high number of non-CSMP teachers (48%) also checked word problems, it will not appear in this section.)

CSMP teachers, in comparison with non-CSMP teachers:

a) Were more likely to describe their math class as:

fun atmosphere (versus business-like)
oriented towards creative activities (versus solving specific problems)
a harder subject to teach (versus easier)
oriented towards general progress (versus basic skills)
following lesson plans in great detail (versus only as a general guide)

b) Were more likely to think low ability students benefit from:

small group instruction (versus individual)
touching lightly on a topic several times (versus staying for mastery)

c) In comparison to their previous math program, were more likely to judge their present program as superior in:

student interest and involvement
students' achievement in mathematical concepts
students' ability to do logical reasoning
appropriateness for high ability students

and inferior in:

achievement in computation programs.

d) As best aspects of their program, were more likely to name:

promotes reasoning skills/creative thinking
allows for different ability levels
variety of content and spiral approach

and less likely to name:

attractive format
good coverage of the basics
good review and supplementary materials

e) As worst aspects of their program, were more likely to name:

not appropriate for low ability students

and less likely to name:

not challenging enough/boring
no schedule for presenting concepts

f) As content deficiencies, were more likely to identify:

computation - basic facts, algorithms, fraction and decimal operations

and less likely to identify:

mental arithmetic.

Teacher Ratings of MANS Scales

All teachers were asked to rate the importance of the goals represented by each of the various MANS Tests. Table 4 shows the mean rating across CSMP and non-CSMP teachers, for the various tests in each category. The Categories are listed in order of perceived importance.

Table 4

Mean Rating of Importnace
by MANS Category

Category of MANS Tests	Mean Rating Across Teachers	
	CSMP	non-CSMP
CTBS Computation	4.9	4.8
Word Problems	4.4	4.65
Mental Arithmetic	4.4	4.3
Fractions	4.3	4.3
Decimals	4.35	4.25
Organizing Data	4.2	4.3
Estimation	4.1	3.85
Elucidation	3.7	3.5
Number Relations	3.5	3.25
Probability	3.15	3.1

The rank order of importance was almost identical for the two groups of teachers, though CSMP teachers gave higher absolute ratings for Estimation, Elucidation, and Number Relations; non-CSMP teachers rated Word Problems higher. It was also true that the 5 categories in which the CSMP teachers' rating was at least 0.1 higher than the non-CSMP teachers were the same 5 categories in which CSMP classes had significantly higher scores at the .01 level.

Furthermore, when CSMP teachers were asked to judge whether or not CSMP students would do better on a given scale then they would have in an ordinary textbook program, their "predictions" agreed rather well with the actual test data. The 7 categories with average rating scores above 3.0 (which corresponded to "about the same") were the same categories as those in which CSMP classes did significantly better at the .05 level. The exceptions to this prediction accuracy were the Computation and Word Problem categories, these were rated as the 2 most important categories and also as the 2 in which CSMP students would do least well; in fact CSMP students did as well as non-CSMP students in Computation and significantly better in Word Problems.

Student Attitudes

A series of attitude scales was administered to students during the MANS testing. Mean scores were derived for each class, and an Analysis of Covariance procedure (with Reading Comprehension as covariate) was used with the results shown in Table 5.

Table 5

Adjusted Mean Scores, Attitude Scales

Attitude Scales	Attitude Scale Means Across Classes		*=significant at .05 level
	CSMP	non-CSMP	
A1: Like math versus other subjects	10.5	11.4	*
A2: Self concept in mathematics	10.6	10.5	
A3: Value of spiral approach	4.6	4.4	
A4: Value of estimation	4.2	4.0	
A5: Math is closed	7.4	7.4	
A6: Math is mainly calculation	5.4	5.2	
A7: Math is open	5.7	5.3	*

CSMP classes had significantly higher scores on A7: Math is open

(e.g., Being good at pretending helps people in math.

Always True | Usually True | Not Usually True | Never True)

CSMP classes had significantly lower scores on A1: Math versus other subjects, which was calculated by taking the difference between how well they liked math versus how well they liked other subjects on items like the following:

(What do you think about these subjects in school?

e.g., Science

Like | In between | Do not like)

For CSMP students, 51% "Liked" mathematics versus an average of 58% who like the other 5 subject areas. For non-CSMP students, 58% liked math and 51% liked the other subjects.

In comparing some of the responses with responses from fourth graders in 1979 (many of whom also participated in the present study), it was true for both CSMP and non-CSMP students that in 5th grade they had more homework and more tests, and were more likely to think math boring and less likely to think it fun.

Achievement Versus Other Data

Correlational relationships between the various MANS scores and other data (implementation variables, teacher and student attitudes, and teacher evaluation of MANS) were studied. Given the relatively small number of classes and the relatively large number of variables, it is rather difficult to state with confidence exactly what factors lead to improvement in various areas of mathematics achievement. The following summary represents those relationships which are the most consistent among the many variables. (In order to remove the effects of class ability level from these analyses, partial correlations were used.)

Teacher Attitudes

For CSMP Classes:

1. Approval of CSMP tends to be related to higher scores on most MANS tests but lower scores on computationally oriented tests. That is, the correlations between teacher attitude scores (such as overall evaluation of CSMP, agreement with various aspects of the CSMP philosophy, etc.) and mean class scores on CSMP-oriented tests (dealing with decimals and probability, for example) are almost always positive. But correlations between these teacher attitude scores and mean class scores on the computationally oriented tests (CTBS Computation, Fractions, Mental Arithmetic) are almost always negative.

2. There is a set of what might be called "implementation factors" which is also related to higher scores on CSMP-oriented tests and lower scores on computationally-oriented tests. This set of factors is the following:

   - students report more games and less homework for math,
   - teacher has more CSMP training
   - teacher supplements less
   - class made more progress in schedule

3. Each of these implementation factors is positively related to approval of CSMP.

Thus there is some reason to believe that teachers who are in agreement with the CSMP philosophy will tend to implement the program in a reasonably faithful manner, resulting in higher scores in those areas which CSMP emphasizes and lower scores on computation tests.

For non-CSMP Classes:

1. Approval of the math program was positively related to math achievement of the class (with no distinction between computation versus other tests) but the relationships were weak and seldom reached significance.

2. There is a set of implementation factors which is related to higher scores on the MANS tests but is unrelated to computation scores. This set of factors is the following:

   - students report fewer games and less individual help
   - teacher supplements less
   - math period is shorter

3. Frequency of testing is positively related to computation scores but is unrelated to other MANS test scores. (Frequency of testing was not an important factor for CSMP classes.)

The finding in item 2 is rather difficult to explain. It may be that for non-CSMP teachers, supplementing, with the use of games and necessitating longer math periods, takes time away from activities which would develop MANS skills. Indeed, non-CSMP teachers' supplementation covers a very wide range of activities, whereas for CSMP teachers it nearly always means computation practice.

Student Attitudes

The correlations between class mean scores on:

a) Student attitude scales, A1: Like math versus other subjects
and A2: Self concept in math,

and b) Reading Comprehension, Computation, and Total MANS scores are shown below in Table 6.

Table 6

Correlations between Class Mean Scores:
Student Attitudes versus Test Scores

	Reading	Computation	Total MANS
A1: Math versus other subjects			
CSMP Classes	.03	.24	.07
non-CSMP Classes	-.15	-.17	-.05
A2: Self concept in math			
CSMP Classes	-.30	-.05	-.34
non-CSMP Classes	-.26	-.25	-.25

For both CSMP and non-CSMP classes, liking math versus other subjects is virtually unrelated to reading and total MANS scores, and self concept is negatively related to reading and total MANS scores. CSMP and non-CSMP classes differ however in the relationship of these attitude scores to computation. For example, liking math is positively related to computation scores for CSMP, negatively related for non-CSMP.

It was also true that CSMP classes tended to like math more when:

- the teacher approved of the curriculum
- fewer tests and games were reported by the students
- supplementing occurred more often

For non-CSMP classes, these same factors were associated with liking math less!

Ability Level of Class

There were two variables whose correlation with class ability level (as measured by mean reading score) were very different for CSMP and for non-CSMP classes.

a) Correlation with the degree to which the teachers thought that their present math program was inappropriate for low ability students: CSMP = -.10, non-CSMP = -.51. Thus for non-CSMP teachers, this opinion of inappropriateness was most often held by teachers of lower ability classes; for CSMP teachers holding this opinion was virtually unrelated to ability level of teacher's class.

b) Correlation with the degree to which the teacher's description of math class corresponded to what might be called a CSMP style (oriented to general progress, lessons proceed briskly, content is challenging, there is a fun atmosphere, there are creative activities): CSMP = +.46, non-CSMP = -.21. Thus for CSMP, this kind of math class occurred more often with higher ability classes; for non-CSMP it occurred (slightly) more often with lower ability classes.

Summary

The main finding in this study is that CSMP classes, as they have in comparative studies at lower grade levels, demonstrate a clear superiority over non-CSMP classes in many of the areas of mathematical thinking assessed by the MANS tests. In particular, this was true about: aspects of computation other than the calculation of exact answers using the classic algorithms (e.g., Mental Arithmetic and Estimation); the production of multiple answers to problems (Elucidation); and discovering and using mathematical patterns and functional relationships (Number Relationships). In addition, they had significantly higher scores in the three areas which receive increasing emphasis in the upper elementary grades, namely: fractions, decimals, and negative numbers. These gains were made without any corresponding decrease in scores on the more traditional areas of instruction: word problems (which actually showed a slight CSMP advantage) and computation.

Item analysis data and different methods of analysis (using class, school and district means) confirmed these general results, though for some tests the advantage for CSMP students was smaller or non-existent for students at the lowest reading level. (It should also be noted that there was a disproportionately high number of above average classes among the 56 participating classes.)

Teacher reaction to CSMP was favorable, and it was more favorable than was the reaction of non-CSMP teachers to their particular program, which in most cases was one of the widely used, traditionally-oriented textbooks. Clearly CSMP teachers had to "work" harder than non-CSMP teachers; aside from some kind of training program (often less than recommended), they usually spent more time in math class and spent a greater proportion of that time working with the whole group.

Considerable supplementing of the CSMP curriculum occurred; an average of 25% of math time was spent on activities not in the "official" curriculum. This percent was about the same as for non-CSMP teachers, but for those teachers supplementing activities were quite varied (some computation practice, graphs, enrichment, etc.) whereas for CSMP it was almost always computation practice.

Two related criticisms of the curriculum by CSMP teachers stood out above all others. First, many teachers consider the program inappropriate in some ways for low ability students. Second, most teachers think that CSMP does not provide enough practice in computation skills, which no doubt accounts for the great amount of computational practice they add to the curriculum. This in turn may result in longer lessons and the deletion of certain lessons (probability, geometry) from the schedule because of time constraints.

From correlational data, teachers' approval of CSMP (using many different criteria) was associated with more "game" playing in class, less homework, more teacher training and less supplementing. This is not a surprising result; these characteristics may be thought of as indicating a more faithful version of CSMP in the classroom. Furthermore, these same characteristics are associated with higher scores in CSMP-oriented tests and lower scores in computationally-oriented tests.

Thus it may be that approval of CSMP, and reasonably faithful implementation of it, do indeed result in improved performance in certain areas of mathematics but at a possible cost in computation skills, which deficit is made up by teacher supplementation. But then, computational efficiency is relatively easy to accomplish, compared to improving student abilities in say, mental arithmetic, estimation, or elucidation, which are surely concomitants of good problem sovving skills.