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ABSTRACT

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 in mathematics for grades K-6. Beginning in September, 1973, CSMP began an extended pilot trial of its Elementary Program. This report is an attempt to summarize the information collected during the second year, 1974-75. During the second year, 30 school districts were involved in the use of some combination of kindergarten, first, and second grade materials. The report includes data on the school sites, review of formal written reports, and a review of evaluation questions. (RH)

# EXTENDED PILOT TRIALS OF THE COMPREHENSIVE SCHOOL MATHEMATICS PROGRAM:

## EVALUATION REPORT SERIES



# Evaluation Report 2-A-1

# Final Summary Report

# Year 2



# Extended Pilot Trial of the Comprehensive School Mathematics Program

Evaluation Report 2-A-1

FINAL SUMMARY REPORT
Year 2

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November 1, 1975

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## 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 will be able to use them in second and third grades in 1975-76. 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 research issues. The list of reports from the first two years of the extended pilot trial is given on the next page. The most comprehensive of these are the following:

1-A-1: Overview, Design and Instrumentation
1-A-3: Final Summary Report, Year 1
and 2-A-1: Final Summary Report, Year 2

The first of these will be particularly useful to the reader in providing a description of the program, the philosophy and goals of the evaluation and the relationship of individual reports to the evaluation effort as a whole.

Longitudinal Pilot Study of the
Comprehensive School Mathematics Program

Evaluation Report Series

| | |
|---|---|
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Key to Indexing

1-C-2 Observations of CSMP First Grade Classes

"2" refers simply to the number within a given year and type of data

"C" refers to the type of data being reported
- A: Overview, summary and theoretical reports
- B: Student outcomes
- C: Non-test data

"1" refers to the year of the Pilot Study according to the following:

| | Kindergarten | First Grade | Second Grade | Third Grade | . . . |
|---|---|---|---|---|---|
| Year 1 (1973-74) | ▨ | ▨ | | | |
| Year 2 (1974-75) | | ▨ | ▨ | | |
| Year 3 (1975-76) | | | ▨ | ▨ | |

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## Introduction

In the fall of 1973, the Comprehensive School Mathematics Program (CSMP) began a longitudinal pilot study of its Elementary Program. Over 100 teachers began using the program, either in first grade or kindergarten. During the 1974-75 school year, the second year of this pilot study, most of these classes continued into second grade and first grade respectively and many new classes began using CSMP materials.

During the first two years of this Pilot Trial a considerable amount of information was collected about the program, how it was being used and with what results. The list of Evaluation Reports on page iv will give the reader some idea of the variety of evaluation tasks carried out. With the exception of the first and third reports, 1-A-1 and 1-A-3, each report deals with a specific issue or set of data. Report 1-A-1 is intended to be an introduction to the series and describes the program in terms of its content and materials and its history, the general and specific objectives of this summative evaluation, and the setting and design of the Pilot Trial. Report 1-A-3 is a summary of all the reports written on the studies conducted during the first year of the trial, 1973-74.

The present report is an attempt to summarize, in a reasonably non-technical way, the information collected during the second year. While it is not possible, nor necessarily desirable, to suppress the opinions and prejudices of the evaluator, one hopes the reader can easily separate the presentation of data from the authors' interpretation of those data. In any case, if the reader wishes more information about certain of the data reported here or would like to see the actual tests or questionnaires or instruments used, he or she may consult the appropriate report in this Evaluation Report Series.

## Setting: The Second Year

In the first year of the CSMP Extended Pilot Trial, 29 school districts decided to try out the CSMP kindergarten and/or first grade materials. For the second year 24 of the 29 districts continued in the EPT in various ways and six new districts were added.* For the resultant 30 districts the continuation involved the use of some combination of kindergarten, first and second grade materials.

As was the case in the first year, no conditions were placed on the number or location of pilot classes so that participating school systems were free to use the materials in as limited or extensive a way as they wanted and with whatever kinds of classes or teachers they wanted. They were required to pay the cost of producing the necessary instructional materials, to provide or allow for the collection of relevant evaluation data and to provide a coordinator for the program in their district. This coordinator was responsible for overseeing the implementation of the program including the training of pilot teachers (except as noted below) and was generally the liaison person between CSMP and the local district. The coordinator was also required to attend a one-week training workshop in the use of the CSMP curriculum.

### "Local" and "Outer Ring" Sites

The same eight districts as last year were located in the St. Louis area and were designated "local" as opposed to "outer ring." For them the same additional conditions were imposed as last year. First, for each second grade pilot class a suitable comparison class was to be established and accessible for the collection of various data. Second, it was understood that a considerable amount of "evaluating" would be done in these local classes, including interviews, observations, and group and individual testing. Third, all local pilot teachers of "lead" classes (for 1974-75, second grade classes) were trained at one of the series of one-week summer training workshops conducted by CSMP. Any further periodic training sessions to be held during the school year were the responsibility of the local coordinators.

Thus local classes tried out the materials in fairly well-controlled circumstances with standardized training, comparison classes, and considerable observation, while classes at distant sites in the "outer ring" implemented the program in a much less restricted way.

Below is a double table listing the 8 local and 22 outer ring sites along with the numbers of kindergartens, first and second grades involved in the EPT in each site.

*The five districts that dropped out of the EPT had had 10 kindergartens and four first grades. The six new districts had 13 kindergartens, seven first grades and two second grades.

Table 1

| "Local" School Districts | Number of Classes | | |
|---|---|---|---|
| | Kindergarten | First Grade | Second Grade |
| Affton, MO | 1 | 0 | 0 |
| Ferguson-Florissant, MO | 6 | 7 | 2 |
| Francis Howell, MO | 0 | 5 | 5 |
| Herrin, IL | 1 | 1 | 0 |
| Ladue, MO | 6 | 6 | 0 |
| Normandy, MO | 6 | 12 | 4 |
| Saint Louis, MO | 13 | 11 | 3 |
| Sesser, IL | 3 | 3 | 3 |

| "Outer Ring" School Districts | Number of Classes | | |
|---|---|---|---|
| | Kindergarten | First Grade | Second Grade |
| Austin, TX | 3 | 3 | 4 |
| Autrain Township, MI | 1 | 0 | 0 |
| Bethlehem, PA | 15 | 8 | 2 |
| Clarksville Academy, TN | 0 | 1 | 0 |
| Clarksville/Montgomery Co., TN | 5 | 8 | 1 |
| Detroit, MI: Region 4 | 10 | 12 | 0 |
| Region 5 | 9 | 11 | 6 |
| Elizabethtown, KY | 1 | 2 | 1 |
| Ennis, TX | 8 | 0 | 0 |
| Fort Campbell, KY | 1 | 2 | 1 |
| Gulliver Academy, FL | 1 | 1 | 0 |
| Houston Co., TN | 3 | 2 | 0 |
| Lincoln Co., TN | 2 | 2 | 0 |
| Marquette Diocese, MI | | | 1 |
| Nashville, TN | 1 | 1 | 1 |
| New Hartford, NY | 2 | 2 | 1 |
| North Allegheny, PA | 18 | 0 | 0 |
| Philadelphia, PA | 0 | 8 | 4 |
| Polk Co., GA* | 7 | 29 | 25 |
| Portland, ME | 15 | 14 | 0 |
| Shippensburg, PA | 1 | 1 | 1 |
| Tenn. Tech. Univ. Exp. Sch., TN | 1 | 1 | 1 |
| Walker Co., GA | 0 | 3 | 2 |

*Polk Co., GA, also had 16 third grades (using second grade materials).

## Coordinators and Teacher Training

As was the case in the first year, the people who became CSMP coordinators could be put into one of four categories according to their position within the school district. Some were regular teachers who filled the double role of pilot teacher and coordinator. Some coordinators were elementary school principals. Some coordinators were primarily college based personnel who worked with a school district on a somewhat ad hoc basis in implementing this pilot trial. The largest group of coordinators were district supervisory officials, usually with a title such as curriculum coordinator or curriculum consultant. Thus there was considerable variation in the role the coordinator ordinarily played in the school system, in the authority over pilot teachers which that role provided and in the mathematics background of coordinators.

As noted previously, all coordinators, as well as all second grade pilot teachers in the St. Louis area, attended a one-week training workshop in the summer. The workshop time was about equally divided between the development of mathematical content and the methods used to teach the content, including the use of various instructional materials. The presentation was in lecture format for the most part with some question-and-answer sessions. Experienced teachers were available to help answer questions and specially prepared films were also used. A more complete description of the CSMP workshops (for kindergarten and first grade teachers) is given in another evaluation Report.*

Upon their return to their local district, outer ring coordinators were responsible for the training of their own pilot teachers. In addition, all the coordinators served as liaison between CSMP and the local school system and collected any required evaluation data from the local system.

## The "Local" Setting and the Emphasis of the Evaluation Effort

There were many new kindergarten, first, and second grade classes started nationwide in 1974-75, but the major evaluation emphasis was on the local second grade classes of students who would be completing their second year of the CSMP curriculum. After the first year of the Extended Pilot Study, school districts made the decision of whether or not to continue using CSMP in second grade with the original class of first graders. Of the 8 original local districts, one continued with kindergarten classes only, two districts continued with kindergarten and first grades only, and one had adopted the program district-wide making it difficult to locate comparison classes.

With the exception of the teacher questionnaire, the data summarized here comes exclusively from these local districts: the questionnaire being sent to teachers both within and outside the local area. With the exception of the two sets of data collected on first grade students and teachers (from the same districts described above), the data reported herewith is on the second grade teachers and students described in Table 2 below.

*Evaluation Report 1-C-1: Teacher Training Report

Table 2

Description of Local
Second Grade CSMP and Non-CSMP Classes, 1974-75

| District Number | Number of Pairs of 2nd Grade Classes | Mean Number of Students per CSMP Class (non-CSMP Class)* | Predominant Racial Makeup | | | Estimated Socio-Economic Status | | | | | Type of Community |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Black | White | Mixed | Low | Low-Middle | Middle | High Middle | High | |
| 1 | 2 | 21(20) | | ✓ | | | | ✓ | | | Suburban |
| 2 | 5 | 22(24) | | ✓ | | | ✓ | ✓ | | | Rural/Suburban |
| 3 | 3 | 25(25) | | | ✓ | | ✓ | | ✓ | | Suburban |
| 4 | 3 | 27(28) | ✓ | | | ✓ | ✓ | | | | Urban |

*Based on numbers present when covariate test was administered.

## Review of Formal Written Reports

### Second Grade Test Data*

Thirteen second grade classes in four districts in the local area studied the CSMP curriculum during the 1974-75 school year. A wide range of abilities and socio-economic status was represented by these classes (see Tables 2 and 3). For each CSMP class there was a comparison class, in the same school where possible and in an adjacent school where the CSMP class was the only second grade class. These classes were usually the same groups of students who were tested the year before in first grade in the CSMP - Non-CSMP comparisons described in a previous report.**

The design was essentially the same as for the previous year. The comparison classes established the previous year were, with two exceptions, continued virtually intact as second grade comparison classes. In those two cases, new comparison classes were established. The Kuhlmann-Anderson Test, a test of mental ability, was administered to all classes in the fall, and these scores were used as covariates for adjusting scores on the basis of differing entering ability. This test will be referred to subsequently as the "pretest", though not in the sense of a pre-post test designed to measure change. As will be seen later such adjustments were very small because of the excellent matches between the CSMP classes and their paired comparison classes. Table 3 summarizes the situation below.

Table 3

Local Second Grade Classes
in Extended Pilot Study, 1974-75

| District Number | Class Pair Number | CSMP Class | | Comparison Class | | Class Pairs Located in Same School? |
|---|---|---|---|---|---|---|
| | | Mean Pretest Score | Number of Students | Mean Pretest Raw Score | Number of Students | |
| 1 | 1 | 51.5 | 17 | 49.6 | 17 | Yes |
| | 2 | 52.4 | 24 | 51.7 | 23 | Yes |
| 2 | 3* | 62.3 | 25 | 59.6 | 25 | Yes |
| | 4* | 42.5 | 21 | 49.7 | 19 | Yes |
| | 5* | 52.4 | 23 | 49.1 | 20 | Yes |
| | 6* | 56.5 | 22 | 55.2 | 25 | Yes |
| | 7 | 58.9 | 15 | 58.2 | 28 | No |
| 3 | 8 | 54.2 | 25 | 53.5 | 24 | Yes |
| | 9 | 54.3 | 28 | 49.4 | 25 | Yes |
| | 10 | 52.5 | 23 | 49.7 | 27 | Yes |
| 4 | 11 | 36.1 | 27 | 31.9 | 28 | No |
| | 12 | 42.3 | 27 | 45.0 | 26 | No |
| | 13 | 45.0 | 25 | 50.4 | 30 | No |
| | Mean | 50.8 | 23.2 | 50.2 | 24.4 | |

*Class pair 3 and class pair 4 were located in the same school. So were class pairs 5 and 6.

*For a complete report on this data, see 2-B-1, Second Grade Test Data

**Evaluation Report 1-A-3: Final Summary Report Year 1

Two kinds of tests, a standardized test and a series of comparison tests, were administered to CSMP and Non-CSMP classes according to a testing plan which ensured that representative pairs of classes would take each test. In the case of the standardized test all 13 pairs of classes were used. The standardized test used was the Mathematics Test, with two subtests, of the Comprehensive Test of Basic Skills. Four Comparison Tests with varying numbers of subtests were developed: two tests were group-administered to the whole class and two administered to about seven representative students of each selected class. These comparison tasks were essentially problems posed in situations which were novel to both CSMP and Non-CSMP students. They were intended to be situations in which the techniques and ways of thinking about mathematics which are stressed in the CSMP curriculum might be used with more success than would normally be the case.

Table 4 summarizes the results of these tests. Mean scores across classes are given for the CSMP and for the Non-CSMP classes, and those tests on which the differences were significant at the .05 level are indicated. A two-way Analysis of Covariance was used, with classes as the unit of anlaysis, and the resulting F-test had between 1 and 4, and 1 and 11 degrees of freedom.

Table 4

Summary Data for Tests
Administered to CSMP and Non-CSMP Classes

| Test | Number of Pairs of Classes | Mean for CSMP Classes | Mean for Non-CSMP Classes | Significant at .05 level |
|---|---|---|---|---|
| Comparison Test I | | | | |
| a) Word Problems | | 4.79 | 4.06 | |
| b) Number Puzzles | | 2.66 | 2.51 | |
| c) Estimation: Calculation | 6 | 5.18 | 5.03 | |
| d) Estimation: Largest Number | | 5.26 | 4.44 | ✓ |
| e) Showing Fractions | | 1.15 | 0.92 | |
| Total | | 19.06 | 17.01 | |
| Comparison Test II | | | | |
| a) Equations: Construction | | 2.72 | 2.03 | ✓ |
| b) Equations: Fluency | 7 | 13.63 | 11.19 | ✓ |
| c) Combinatorics | | 16.94 | 17.08 | |
| d) Regrouping | | 6.34 | 6.55 | |
| Total | | 39.62 | 38.86 | ✓ |
| Comparison Test III | | | | |
| a) Classification | 12 | 17.98 | 17.23 | |
| b) Binary Relations | | 8.05 | 8.12 | |
| Total | | 26.03 | 25.36 | |
| Comparison Test IV | | | | |
| a) Number Patterns | 11 | 10.11 | 9.28 | ✓ |
| b) Functions | | 6.48 | 5.75 | |
| c) Probability | | 4.59 | 3.99 | ✓ |
| Total | | 21.18 | 19.01 | ✓ |
| Comprehensive Test of Basic Skills | | | | |
| a) Computation | 13 | 21.63 | 20.28 | ✓ |
| b) Concepts and Applications | | 18.96 | 18.12 | ✓ |
| Total | | 40.61 | 38.47 | ✓ |

All differences which were significant were in favor of CSMP. These included both the Computation and Concepts parts of the standardized test and several of the various Comparison Tests. With the exception of Comparison Test IVc), Probability, the four subtests on which CSMP classes did significantly better than Non-CSMP classes were what might be called "directly numerical" situations; numbers (or numerals) themselves were the stimuli. Other subtests in which the given stimuli were situations in which numbers (or more widely, mathematical thinking) were to be applied (Ia, Ie, IIc, IId, IIIa, IIIb) did not produce significant differences.

These results are very encouraging. CSMP students did better on both parts of the standardized test and on several novel tasks of a numerical nature. It is also important to note that the results were consistent across school districts and, perhaps more importantly, across ability levels. It is not the case that differences were due to gains by high ability students; low ability students also did better. In addition, students who transferred into CSMP at the beginning of second grade appeared to do as well as students who were in CSMP from first grade except on Comparison Test I where they had slightly lower scores.

In the authors' opinion there are two explanations worth considering other than the obvious one that the CSMP curriculum is responsible for these differences. The first explanation is that teachers were not randomly assigned to CSMP and Non-CSMP classes (indeed this is virtually impossible to accomplish in the pilot stages of any program implementation). It is therefore possible that CSMP teachers may be, as a group, more capable of producing student achievement. This is a plausible explanation and cannot be entirely refuted. However, in discussions with principals who had both a CSMP and a Non-CSMP teacher in their school, there was no support for such differences; indeed in one case the same teacher taught both classes and in another the principal thought the Non-CSMP teacher was a better teacher. It is also true that this selection factor would be stronger in the first year of this study when the very first teachers to use CSMP are chosen. The next year, the second grade teachers more or less inherit the program and the classes.

The other explanation may be that CSMP classes spend more time in math instruction than do Non-CSMP classes. Based on interview data*, the mean number of minutes per day on math instruction in the 13 CSMP classes was 50, which is slightly higher than usual. However, there was no relationship between number of minutes and achievement either with or without adjusting for differences in entering ability. This information is not available for Non-CSMP classes though it is known that, in at least some classes, school scheduling dictated that the same time be spent for all math instructions.

Thus, while these two alternatives cannot be ruled out, there are good reasons for discounting them as explanations for higher achievement by CSMP students. The so-called "novelty effect" is also discounted for two reasons. First, as described in the report dealing with student interviews**, students were usually not aware that their math program was particularly different from what other students used. Second, data collected over the past two years from first grade students indicates that, as judged by student performance, teachers do as well if not better in their second year of teaching CSMP as they did the first year (a fuller discussion is given on p. 9).

*Evaluation Report 2-C-2: Teacher Interviews, Second Grade
**Evaluation Report 2-B-3: Student Interviews

One is led to believe from what is presented above that CSMP students did significantly better than Non-CSMP students on several measures and that this can be attributed to the CSMP program and not to other factors. The reader should bear in mind that these results can not necessarily be generalized to school systems or classes or teachers beyond those participating in this study (ie. "local classes"). That is one of the penalties for non-random (in this case voluntary) sampling of school districts, and within districts, teachers.

A series of tests dealing with the unique aspects of CSMP, content not already covered in one of the above tests, was also administered to CSMP classes. The results are more difficult to interpret because of the lack of standards, either through what "usually happens" (control groups) or what "should happen" (a priori standards of achievement laid down by the program). Thus the interpretation of the data here is the authors' own subjective evaluation of what one should expect second grade CSMP students to be able to do. However, this evaluation is based on knowledge of curriculum, the contents of the various lessons and relative emphasis of topics; and on discussions with teachers, observations of classes and interviews with students.

Rather than reviewing and commenting on the results of each subtest*, this discussion will center on general topics.

a) Multiplication. The level of achievement with simple, whole-number, single-digit, multiplication is quite satisfactory, as indicated also by the standardized test data. It is also very satisfactory in two areas not typically given much consideration in second grade. A surprising number of students were able to double or triple relatively large numbers; nearly half the students could calculate "2x37". And in calculating fractional parts of a whole number, specifically 1/nth of a number, students also did very well; about half the students could calculate "$\frac{1}{2}$x48" and "$\frac{1}{4}$x20."

b) Integers. Negative integers are not studied in other second grade curricula. Hence there is no basis of comparison and it may safely be said that whatever progress CSMP students make is a "gain" over Non-CSMP students. The level of success is judged to be adequate; 60% of the students could select the one true number sentence of four very similar and possibly confusing sentences involving negative integers, though only about half the students could compute "4+7" and "5+4." However, the improvement from first grade is rather disappointing. There was only a moderate increase from last year in the percentage correct on those items repeated from last year's test.

c) Arrow Diagrams. The method of looking at percent correct is not entirely satisfactory for this topic. Generally these percentages are satisfactory. On the one hand there are surprisingly high percentages of students getting difficult items correct; for example the "Detective Story" and other items whose format was completely new to students. On the other hand there were many subtests on which up to 20% of the students had virtually no success.

d) Minicomputer. Again there are a very wide range of scores; many could do virtually everything asked and many others could do

> virtually nothing. Over 30% of the students made at most one error on this rather comprehensive individually administered test and these students generally worked very rapidly. On the other hand when considering low ability students (the bottom 20% of the CSMP students as measured by the pretest), only two of these 11 students could consistently read and write numbers on the Minicomputer, let alone even set up the Minicomputer for subtraction, multiplication or taking one-half of a number.

Students who transferred into a second grade CSMP class during the first two months of school do not, as a group, perform as well on these tests of CSMP content as students who were in the program from the beginning. Thus while new students do not appear to be penalized as far as the standard skills and concepts, they do not, during the course of the year, "catch up" with the other students in acquiring those concepts specific to CSMP. This is not a surprising result.

In summary then, CSMP classes did better than Non-CSMP classes on both standardized measures and some "content-free" comparison tasks, and this is true for both high and low ability students and for both original and transfer students. Although overall performance was generally adequate and at times praiseworthy for unique CSMP content, on those subtests involving arrow diagrams and the Minicomputer a considerable number of students had little or no success, and students who transferred into CSMP classes near the beginning of the year were not able to catch up with their classmates on CSMP concepts.

Readministration of First Grade Test Items*

The major purpose of this study was to compare the performance of two groups of first grade CSMP students; the teachers of the first group were new to CSMP and the teachers of the second group were these same teachers one year later. A lower performance the second year would support the contention that results** obtained in the first year of the pilot study, 1973-74, were at least partly due to the enthusiasm of the teachers for a novel math program. A higher performance would support the view that teachers the second time around more than made up for any loss of enthusiasm because they were more familiar with the program.

The classes used to investigate this issue were those of teachers 1-12 in the chart below, ie., all local teachers who began using CSMP in 1973-74 and continued using it in 1974-75.

*For a complete report on this data, see 2-B-2: Readministration of First Grade Content

**Evaluation Report 1-B-2: End-of-Year Test Data: CSMP First Grade Content and Evaluation Report 1-B-3: End-of-Year Test Data: Standard First Grade Content

| Teacher | 1973-74 | 1974-75 |
|---|---|---|
| #1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | taught CSMP for the first time | taught CSMP for the second time |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 1* | | |
| 2* | comparison teachers for teachers 1-5 above | taught CSMP for the first time |
| 3* | | |
| 4* | | |
| 5* | | |

The classes of teachere 1* - 5* in the above chart provide information regard- two other issues. One addresses the possibility that CSMP teachers in the first year of the pilot study were systematically better than teachers who served as comparison teachers. The performance of the students of teachers 1-5 in their first year of teaching CSMP, 1973-74, is compared with performance of the students of teachers 1* - 5* in <u>their</u> first year of teaching CSMP, 1974-75.

The other issue is a partial replication of the CSMP - Non-CSMP comparisons made originally in 1973-74. To do this, the performance of the students of teachers 1* - 5* in 1973-74 (using a traditional math text) is compared with the performance of the students of these same teachers one year later (using the CSMP program).

In all these comparisons an assumption has been made that the general ability level of students within any of the participating schools has not changed from 1973-74 to 1974-75.

Items were selected from a battery of tests administered the previous year to CSMP and comparison classes. Sixteen subtests were developed covering 11 content topics. This set of subtests was divided into three parts. Within each of the 17 classes one part was administered to a random half of the students and the third part was administered to all students. The administration of the testing was carried out by two specially trained testers.

A univariate analysis of variance was used on the class means of each subtest. A comparison was made between student performance with inexperienced teachers and with the same teachers after one year's experience with CSMP and revealed the following:

a) Classes with an experienced CSMP teacher scored significantly higher ($p<.05$) on Subtest 16: Larger Numbers.
b) Classes with an experienced CSMP teacher scored higher (marginally significant with $p<.06$) on Subtest 11: Relations - +3 spiral.
c) There were no differences approaching significance on the other 14 subtests.

A review was made of the 11 items answered correctly by at least 10 percent more students with experienced CSMP teachers than students with inexperienced CSMP teachers. These items generally dealt with one of three content areas:

a) Addition of integers
b) Estimation of sums of two two-digit numbers
c) Arrow diagrams

One item was answered correctly by at least 10 percent more students with an inexperienced CSMP teacher than students with an experienced CSMP teacher, namely a subtraction problem, 3-0=__.

A comparison of five CSMP classes in 1974-75 versus five Non-CSMP classes in 1973-74 with the same teachers revealed the CSMP classes scores significantly higher ($p<.05$) on Subtest 16: Larger Numbers.

A comparison of five CSMP classes in 1973-74 (taught by an original group of CSMP teachers) with five CSMP classes in 1974-75 (taught by the five teachers who served as comparison teachers in 1973-74) indicated the comparison teachers did at least as well when teaching CSMP for the first time as did the original group of teachers.

In conclusion, it appears that CSMP teachers do just as well the second time around and that any loss due to the novelty effect of the program is more than balanced by the gain in experience. This is in agreement with statements made by these same teachers in a series of interviews conducted at the end of the school year (see Evaluation Report 2-C-3). In addition, the data tends to corroborate the findings from the first year of the pilot study and to cast some doubt on the possibility that in some cases CSMP students did better because they had better teachers. While the results are not strong enough (small numbers of teachers, no covariate scores such as pretest ability scores) to support a definite conclusion, they tend to give additional credence to the first year results.

Student Interviews*

During the second half of the 1974-75 school year a series of 4 interviews was conducted with 18 students in 9 second grade classes. The students were selected to provide a total group which was representative of the entire group of local second grade CSMP students.

*See 2-B-3, Student Interviews, for a complete report.

The first two interviews were designed to survey students' knowledge and skills in CSMP mathematics. The third interview was a rather individualized follow-up and extension of Interviews 1 and 2 and included questions dealing with elementary concepts, repetition of certain kinds of items and a series of problem situations dealing with applications of certain CSMP concepts. The fourth interview was of a summative and attitudinal nature.

The complete set of interviews and student responses are given in the relevant Evaluation Report. The enormous amount of information from these interviews cannot readily be summarized and the reader is urged to read the actual interviews and form his own opinion of what conclusions to draw from them.

Teacher Questionnaire Data*

Near the end of the 1974-75 school year a rather extensive questionnaire was sent to all local and outer ring teachers. Slightly different forms of the questionnaire were prepared, depending on whether the teacher was teaching the kindergarten, first or second grade portion of the program. Some of the kindergarten and first grade teachers were using the program for the second year and, where feasible, the analyses of responses in this report were done separately for these "experienced" teachers. The questionnaire was sent to approximately 360 teachers. About 50% of the questionnaires were returned.

In this summary of the data collected, not every single item will be attended to. What will be summarized are what the authors consider the key questions. Special emphasis will be placed on areas in which significant dissatisfaction was expressed.

Students' attitudes towards CSMP were very favorable. The clearest, most unequivocal responses were given in answer to questions concerning student attitude. On two items comparing students' attitudes towards CSMP with their attitudes towards a traditional math program (a free response item and a multiple choice response) there was very strong agreement that students enjoyed CSMP and were enthused about it and much preferred it to a traditional program. In the overall evaluation of CSMP, a free response item, more teachers wrote about the healthy attitudes of their students than about anything else.

Teachers felt that students' achievement was higher with CSMP than compared to previous years with other math programs. Fifty percent of the teachers thought achievement was "far more" and another 37% thought it "a little more" than the previous program, while only 4% thought it either "a little less" or "far less." Two and a half times as many responses were listed for "areas in which students have accomplished more" than for "areas in which students have accomplished less." Half of the responses listed under "more accomplished" dealt with basic skills, especially computation, and over a quarter had to do with general abilities such as problem solving, critical thinking, relationship, etc. These responses coincide fairly well with test data gathered during the past two years.**

*For the complete report, see 2-C-1, Teacher Questionnaire Data

**Evaluation Report 1-A-3: Final Summary Report Year 1 and Evaluation Report 2-B-1: Second Grade Test Data

There were signs that the program appeared to be being implemented fairly well. For example:

a) Most teachers thought that the spiral approach was more effective than the mastery approach.
b) Second-year teachers generally felt their classes went more smoothly this year.
c) Most teachers said that preparation time for CSMP was about the same, or would be after a year's experience, as for other math programs.
d) As one might expect, the content given the heaviest emphasis by teachers had to do with basic computational skills and the least emphasis was given to ideas such as probability and combinatorics topics which appear infrequently in CSMP and virtually never in other programs.

However, there were indications of things happening which were not intended. For example.

a) Three quarters of the teachers supplemented the program with Non-CSMP material such as commercial worksheets. In half of the cases this was done on a regular and frequent basis.
b) Significant numbers of teachers (one-third of the first grade teachers) taught math for over one hour per day, rather longer than usual.
c) Forty percent of the teachers received less than 10 hours of teacher training, or less than half the recommended time.
d) Almost a quarter of the teachers rate the ease of managing CSMP materials as either "poor" or "unsatisfactory" and over half thought that a better bookkeeping system was needed for monitoring student progress.
e) Many second and third grade teachers did not make sufficient progress during the year to complete even the minimum recommended portion of the curriculum. It should be noted, however, that teachers with a year's experience in CSMP did tend to make much better progress than teachers new to CSMP.

In the authors' opinion, the two most serious criticisms had to do with the (possibly related) issues of the efficacy of the Minicomputer and the appropriateness of the program for low ability students. In a free-response item dealing with the Minicomputer, 37% of the first and second grade teachers did not think it was a good device for teaching low ability students; about the same number thought it was a good device for them. Forty-one percent of the teachers thought CSMP less appropriate for low ability students than their previous math program; 46% thought it more appropriate.

The responses to these two questions, reflected fairly well in the summary evaluations given by each teacher, were rather different than, say, the responses to the question regarding the management of materials. In the latter case the responses were also balanced but this was because many neutral and few extreme responses were given. For the two questions described above, there were many responses at either end of the scale. Teachers felt rather strongly about the issues and happened to be rather equally divided one way or the other. Without

considering the reasons for their opinions, and noting that equal numbers of teachers felt just the opposite, it is true that over a third of the teachers thought the Minicomputer in particular, and the program as a whole, were not particularly appropriate for low ability students. Most of these same teachers nevertheless were, on the whole, impressed by CSMP students' achievement and attitudes.

Teacher Interviews: Second Grade*

The interviews were conducted with the 17 local second grade teachers at the end of the 1974-75 school year. These were teachers of classes which began using CSMP materials in first grade the previous year. The students had then completed two years of the CSMP program.

Thr purpose of the interviews was to probe teacher opinion concerning the second grade CSMP program in a somewhat informal, open-ended manner. It was felt that through this personalized approach, information might be gained that would not have been gotten in the more formal questionnaires and logs which are given to all the teachers using CSMP.

The interview was based on a set of questions designed to elicit a range of teacher opinions about the program including general impressions, program comparisons, best and worst aspects, time in class, lesson sequence, management of materials, student attitudes, new students, slow students, teacher preparation, parent reactions, first and second grade comparisons, and other comments. In some of the questions the teachers were asked to compare CSMP to other programs in terms of certain aspects. In other questions they were asked to make non-comparative qualitative judgements about CSMP.

Usually the interviews took place while the students were involved in part of the end-of-year testing program. The interviews took from 20-30 minutes to administer and were usually conducted in private with only the interviewer and the teacher present. One interviewer conducted all the interviews. All the interviews were tape recorded. Transcripts of the recordings are included in the Appendix of Report 2-C-2.

Using the transcript of the interviews, an attempt was made to summarize the responses across teachers. Because of the open-endedness of the questions (and the extent of the responses), this proved to be a somewhat difficult task. Nevertheless, a number of conclusions may be drawn.

1. The teachers were favorably impressed with the overall program and many specific aspects of it. Many indicated their opinion of the program had become more favorable as the year progressed, although some teachers still expressed concern about the program meeting the needs of the low ability student.

2. The teachers felt the overall CSMP program was superior to other programs which they had taught, especially in regard to content, student attitude, and learning.

*For the complete report, see 2-C-2, Teacher Interviews: Second Grade.

3. The Minicomputer and the variety of higher level concepts were viewed as being the best aspects of the program while the difficulties encountered by the low ability student were mentioned as the worst aspect.

4. The teachers felt CSMP does not involve appreciably more class time than other programs and the suggested times for the lessons in the teacher's guide were reasonable.

5. Generally the teachers followed the teacher's guide but did make slight adjustments in the lesson sequence and used supplementary materials especially for basic addition and subtraction facts.

6. The teachers found the materials easy to manage and felt the workbooks, worksheets and class activities supplied enough information to decide which students needed individual help. Also about half of the teachers indicated a need for testing materials or suggestions for topic emphasis.

7. All the teachers felt the students enjoyed CSMP more than other math programs with many teachers feeling the average and above average students liked the program the most and the low ability students liked the program the least.

8. Many teachers felt the students who entered the program in the middle of the year or later experienced the most difficulties, and more attention should be paid to problem of new students in the teacher's guide.

9. There was little consensus of opinion concerning the appropriateness of the program or the spiral approach for the slower students.

10. Parent reactions, though not extensive in most cases, were almost always positive.

11. All teachers indicated some special training was necessary to teach the program.

These conclusions leave one with an overwhelming impression that the teachers have a very high regard for the program. The only problems mentioned with any consistency were the difficulties experienced by the slower students, and the need for more emphasis on the basic addition and subtraction facts.

Teacher Interviews: First Grade*

The interviews were conducted with 13 local first grade teachers at the end of the school year. These teachers all taught first grade CSMP during the previous year, 1973-74; at which time they were the lead group of first grade teachers. Thus this was their second year in teaching the first grade CSMP curriculum.

*For the complete report, see 2-C-3, Teacher Interviews: First Grade

Presumably any "novelty effect" would have worn off and teachers would be confident enough of their knowledge of the program to have adapted it in whatever way they wanted.

The interview was based on a series of questions relating to various aspects of the program: including background information, change from last year, new students, low ability students, Minicomputer and arrow diagrams, student attitudes, the spiral approach and an overall evaluation. The complete set of questions was not necessarily asked of each teacher; in some cases the teacher's response to a previous question provided the desired information and in other cases the interviewer simply missed the question. Occasionally a teacher raised new issues which were pursued in follow-up questions.

The interviews required from 20 to 30 minutes and were usually conducted at lunch or recess or after school when the children were not present. All the interviews were tape recorded and transcripts of the recordings are given in the Appendix of Report 2-C-3. The summary that follows below is the author's own version of the salient points.

Five teachers will not be teaching CSMP next year. This may have caused them to respond or to teach the program in a different way than would be the case if they knew their students would be continuing into second grade in CSMP.

There was generally what might be called a "return to normality". Teachers were neither wildly enthusiastic nor extremely negative in their appraisals of various aspects of the program. They seemed to have roughly the same number of students (fairly typical class sizes), with approximately the same ability level and covered about the same number of lessons, as in the previous year. The program went more smoothly for teachers, there seemed to be fewer problems in managing the materials (or else teachers got used to existing problems) and the amount of preparation was reduced to nearer what teachers would normally spend. Teachers adapted the program in various ways; in dealing with low ability students, in omitting certain lessons, in supplementing with Non-CSMP worksheets, in working with new students and in repeating or lengthening the instruction time for certain lessons. All these things indicate that the teachers were getting used to the program and had indeed incorporated it into their teaching so that CSMP was no longer "the new math program" but was becoming, in a sense, just plain "math".

It is worth noting, however, that many teachers were still spending more time in teaching CSMP than they would have spent with their previous math program. Whether this is good or bad is problematical. Some teachers indicated the program was rich with many varied things to do and they and their students enjoyed math time; thus it was <u>desirable</u> to spend more time. Others noted that there were so many lessons which required extra time and review, that in order to complete a reasonable portion of the curriculum it was <u>necessary</u> for them to spend longer each day.

Without doubt the teachers, with one exception, liked the program and liked teaching it. Many of the responses, both positive and negative, were somewhat tempered and every teacher pointed out some facets of the program they disliked. Clearly these teachers with two years experience with CSMP did not usually see the program as superlative in every way, but just as clearly they <u>did</u> like it.

The most positive aspect of CSMP was the enthusiasm that students had for the program. This was attributed to the wide variety of lessons and materials and to the fact that students did not have to spend long periods of time on the same topic or skill development.

The questions which drew the longest responses and the most disagreement were those regarding the appropriateness of the program for low ability students and the value of the Minicomputer as a teaching device. These two questions were strongly related of course, since there was fairly strong agreement that for average, and especially high ability students, the program as a whole and the Minicomputer in particular were very effective and the teachers themselves liked the Minicomputer. The students learned more and were presented with a greater challenge than would normally be the case. But teachers did not agree on the efficacy of the program for low ability students. Some thought the Minicomputer and arrow diagrams too abstract, particularly near the beginning of the year when students did not have a fully developed concept of numbers and all the teachers indicated that these students did not get as much out of the program as they would have liked. Many noted that these students could not work on their own with many activities. One may take it that these teachers feel that CSMP does not adequately meet the needs of low ability students. However, in the view of most, neither do other math programs. Teachers were divided on whether or not these children would be better off in a traditional program; it seemed to be a difficult decision either way. Similarly, whether or not these students got enough out of the Minicomputer to justify the time and effort was a difficult decision. Typically teachers seemed to feel that kids liked it, that slow children had many difficulties with it but that they got something worthwhile out of it.

Certain individual interviews highlighted certain issues or raised new ones. For example:

a) The need for a screening test at the beginning of the year to identify students ill prepared to begin CSMP.
b) The difficulties in dealing with large numbers of students who transfer into the class during the school year without the CSMP background and language.
c) The difficulty in teaching CSMP without assistance after a year of frequent help from aides, senior students, etc.
d) A description of the basic thinking skills enhanced by CSMP.
e) A well articulated criticism of various aspects of the program (the only interview that was on the whole negative towards CSMP).

## Review of Evaluation Questions

At the outset of this long-term evaluation effort (called the Extended Pilot Trial (EPT) of the CSMP elementary school math program), a set of rather specific questions were posed (page 33, Report 1-A-1, Overview, Design and Instrumentation). At the time, these questions served the purpose of giving the reader a better idea of exactly what would be the foci of this summative evaluation.

Now, in this final section of the summary report for the second year of the EPT, it would seem appropriate to again raise those same questions. This may accomplish three purposes. (1) Check to see if the actual evaluation effort is being focused on the issues deemed important at the outset. (2) See if there are now answers (or partial answers) to the questions. (3) Examine the necessity for revisions of, or additions to, the initial questions.

The initial questions fell into three categories of issues: the intrinsic merit of the CSMP program, the practicality of its adoption by regular school systems, and the cognitive outcomes of the program on children studying it.

### Intrinsic Merit

During the first two years of the EPT, there have been two expert, external reviews of the CSMP program. The first of these took place during Year 1 of the pilot study and constitutes Evaluation Report 1-A-2. Five mathematics educators, selected from a list provided by the Mathematical Association of America, independently reviewed available CSMP curricular materials. The second review consisted of site visit of CSMP conducted by a three person team selected by the National Institute for Education. In the Appendix is given that section of the resulting report which deals with the CSMP materials.

Regarding the soundness of the mathematical content, there has been universally high praise in both reviews. Regarding the relevance of the program, reviewers differed greatly in their apparent definitions of relevance and one hesitates to make a general summary of the reactions. Nevertheless, the program has been generally commended for its innovations in the area of presenting the basics and for its vigorous inclusion of topics either not presented in elementary programs or presented very poorly or in a minor way.

On the issue of overall soundness of the program, reviewers had mixed and tentative reactions. The reactions were mixed in that not all reviewers reacted positively to each of the major pedagogical techniques of the program. The reactions were tentative in that many of the reviewers expressed the pragmatic desire to withhold judgment on the innovative pedagogy until its effectiveness could be determined. However, the overall judgment on this issue was also positive.

### Practicality

There have been two approaches to obtaining information as to the practicality of the adoption of the CSMP program by regular school systems. The first, has been to compile figures on the extent of use of the program; presumably, analyzed closely, these figures will at least point to gross problem areas in the dissemination process, if any such arise. The other approach has been to try to

identify the specific requirements for the adoptability of the program and take measures of to what extent the CSMP experience in the pilot trial sites has met those requirements.

Since the is only two years old, the evaluation effort has so far concentrated on the second approach, leaving a careful analysis of usage figures until later in the EPT when a sufficient amount of such data is available.

Using the second approach, one can review the data collected by turning to each of the initial evaluation questions which address the issue of "Practicality."

What is the cost, to the adopting school systems of buying materials initially and maintaining materials for continued use, especially in comparison with present materials costs for elementary school math instruction? During the fall of 1974, a rather extensive analysis was made comparing costs for CSMP materials (K-2) with those of 13 commercial publishers (see pp. 21-24 of Report 1-A-3). It was found that although the CSMP costs were not way out of line and actually less costly than some of the commercial materials, they certainly were higher than average. Although these relatively high costs are a very real concern, there are many factors involved between the present state of the materials and the final product and it is difficult to estimate what the eventual price might be. As of yet, no data has been collected on the extent to which cost has figured into the decisions of school systems to (a) try out the program (b) expand or contract its use, or (c) discontinue using CSMP materials. Clearly such data should be collected, where possible.

What are the personnel requirements for a school system in using the program? These requirements are three-fold: a local coordinator, teacher training, and the possible availability of teachers with more specialized training in grades 3-6. Although a local coordinator is required by CSMP in its contract with the school system and is probably quite essential to the smooth adoption of the program in a system, it has not been necessary for school districts to hire a special coordinator just for CSMP. The role of coordinator has perhaps best been played by district supervisory personnel, though classroom teachers, principals, and local university professors (people with a very wide variety of math backgrounds, power within the school systems, etc.) have been at times successful also. This is not to say that anyone can play the coordinator role successfully, but rather that individuals with the formal qualifications required would seem to be present in most systems.

As for teacher training requirements (up to one week, depending on grade level), these do not appear to be excessive and there seem to be enough successful variations on their fulfillment, that most any smaller school system can handle it. Larger systems seem to have more difficulty fulfilling this requirement. Finally, as to the question of the necessity of available teachers with more specialized training for grades 3 to 6, there is really no evidence at all: either as to the eventual necessity for such teachers or for the capability of school systems to avail themselves of such teachers.

Although further elaboration on this question of personnel requirements is available (Report 1-A-3, pp. 2,3), suffice it to summarize here that, for the CSMP program as it exists through Year 2 of the EPT, the personnel requirements do not seem to be out of line with what most (but not all) school systems can provide.

How successful are teachers in coping with the program and implementing it in a manner reasonably faithful to the intentions of CSMP? Here and for the next two questions the reader may wish to consult rather detailed answers to this compound question in the reports on teacher logs, questionnaires, interviews and observations (those numbered n-C-n) or the summaries of same in Report 1-A-3 and the previous section of this report. Very briefly, the vast majority of the teachers who have taught CSMP seem to be able to cope with it and do so in a manner reasonably faithful to the original intentions.

It is important to note that the usual pattern of implementation thus far is with teachers who, by and large volunteer to teach the program. Whether teachers who are more or less forced to teach CSMP (as could be the case with a system-wide adoption) will cope as well and implement the program as faithfully remains to be seen. Clearly this question is one which can't be given an adequate answer until there has been more experience with school systems who have adopted the program system-wide.

Do users like the program in comparison to other math programs they have used? If one defines "users" to mean "teachers", a great deal of evidence has been gathered, and the answer is clearly positive. Again it should be pointed out that relatively few teachers have taught CSMP who were completely uninvolved with the decision to use it. And again, this question must be left open until there has been more experience with system-wide adoption.

If one defines "users" to mean "students", a great deal of secondary evidence has been gathered. Teachers almost universally report that the vast majority of their students really like the program. Since students at this age are almost never included in the decision to use a particular curriculum, one can assume that these teacher reports are on non-voluntary students. Rather limited attempts to assess student attitudes more directly have not shed much light on this issue.

Can students transfer into and out of the program at any point in the curriculum without creating serious difficulties for the student or his new teacher? The question of students transferring into CSMP has been investigated rather thoroughly both in the evidence gathered from the teachers (the n-C-n reports) and in the analysis of student outcomes, (see 2-B-1, pp. 56,57). It is clear that transferring into the CSMP program can cause problems, but these seem generally not to be of great concern to teachers or school systems.

No direct evidence is available on students transferring out of the CSMP program, but since the scores of CSMP students on basic skills and concepts are, if anything, higher than Non-CSMP students, one would not expect such students to have difficulty with more traditional math programs.

It may be that the problem of students transferring into CSMP will become more serious as students have a greater backlog of catching up to do. Or it may be less serious because students are older and can more quickly assimilate the new information. Hence this question needs much more time to be investigated. It should be pointed out here that we have been speaking of individual transferring students. There also exists the situation in which an entire class enters the program at other than first grade. In the future it should be possible to give evidence on this question, whether the transfers be individuals or class groups.

The above questions speak to the issue of whether or not (some number of) "typical" classrooms in a school system can use the CSMP program. These questions may be thought of as parts of a larger question.

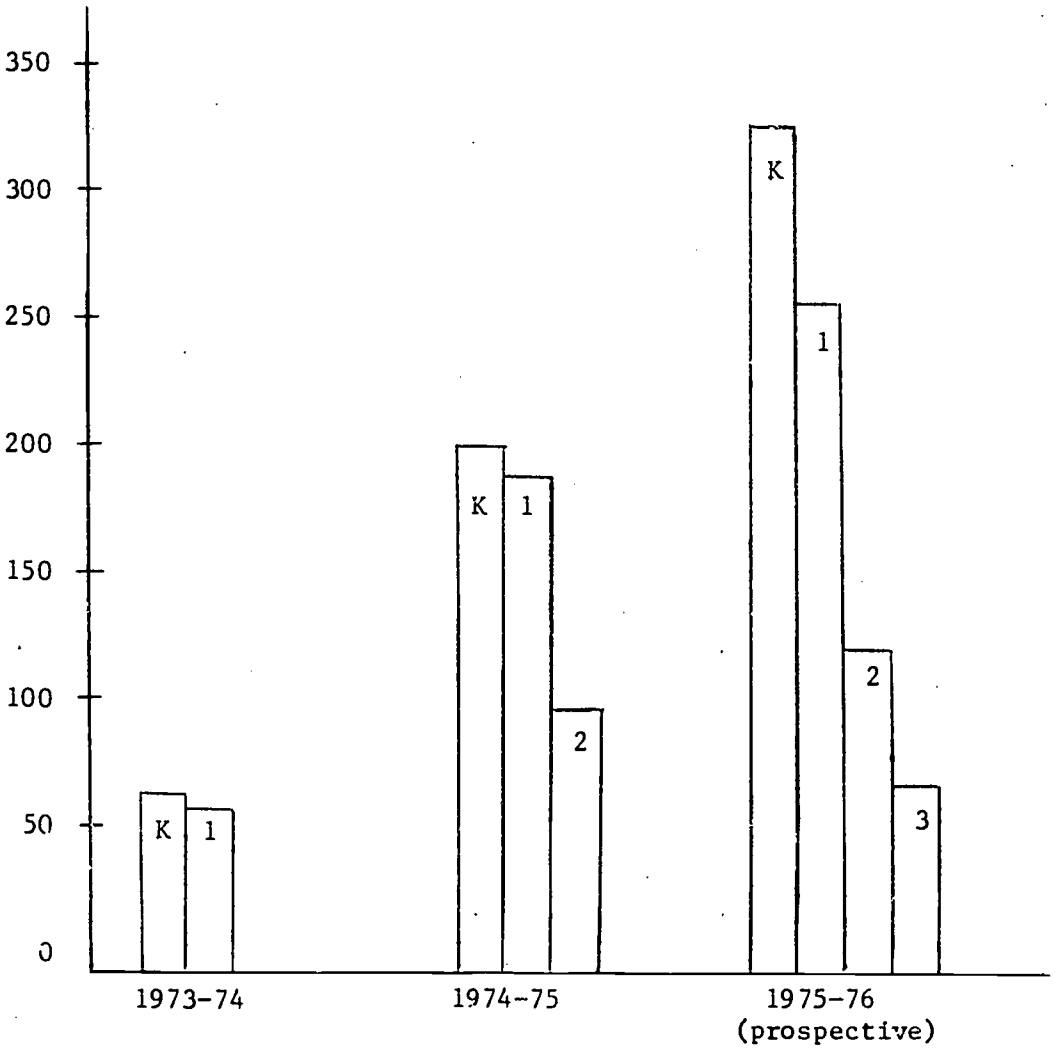
Will it be possible for a school system to adopt the program system-wide? As lamentable as the idea may be to those who see alternative approaches to education as an answer to some of the problems faced by school systems, many school systems take the view that curricular programs must eventually be either adopted district-wide or discontinued.

What this implies, in terms of all questions raised in this category of "Practicality," is that eventually a school system must be able to give a non-negative response to each of them. That is to say, (a) the total regular budget for materials must be adequate to meet the costs of adopting the program system-wide. (b) The personnel requirements for system-wide adoption must not be outside the limitations of the regular staff of the system. (c) All the teachers must be able to cope with a faithful implementation of the program, not just those who would like to try it. (d) All the users (students and particularly teachers) must at least not totally dislike the program, not just those who more or less volunteered. In addition one might add that (e) the students in the district (as a whole) must be able to cope with the program and produce achievement scores at least as high as expected from past experience. Obviously the transferring student question is not heightened (but rather, somewhat lessened) by the adoption of the program system-wide.

The data summarized above has concentrated on the specific prerequisites deemed necessary for adoption. The other approach (that of analyzing the usage statistics) has been pursued only so far as to compile gross figures on the usage of CSMP materials as shown in the graph below.

Graph 1

Number of Classes Using
Various Grade Levels of CSMP



Within a year or so, it should be possible to begin analyzing these gross figures more closely. For example, are the increases in CSMP usage the result of both continued and increased usage on the part of the systems which adopted the program initially and the addition of other adopting systems? Or are the increases due to the large number of additional adopting systems which more than offsets the discontinued usage in some systems which adopted CSMP earlier?

As the EPT moves into its third and fourth years, it should be possible to gather much better evidence, whichever of the two approaches is used. However, perhaps a much more fruitful approach, from this point on, would be one which uses and dovetails the evidence gathered separately under the two previous approaches. Specifically, by paying close attention to which school systems are (and are not) continuing with the CSMP program, we should be able to gather much more meaningful evidence on which minimal requirements for adoption are being met, which are not, and under what circumstances this evidence is occurring.

Cognitive Outcomes for Students

As pointed out above, one aspect of this "Outcomes" issue would place it under the adoptability side of the issue of "Practicality." Nevertheless, since the whole point of developing a new and different math curriculum is to enable students to acquire the skills in arithmetic and the beginnings of understanding mathematics, the issue of cognitive outcomes for students deserves a category of its own. As a result, a major part of the evaluation effort has been devoted to gathering the best possible evidence to shed light on the issue. The reader's attention is called to the eight reports written on this issue so far in this series (numbered n-B-n). Herein, each of the three questions raised initially on this issue shall be reviewed.

Do students learn the basic concepts and skills, particularly computational skills, generally expected of students in elementary school? To gather evidence on this question, traditional tests of math achievement have been used. During the first two years of the EPT, the testing has involved almost exclusively those sites located in the St. Louis area. Therefore any statements in reference to data collected in answer to this question must be qualified by the fact that the evidence comes from not necessarily "typical" classrooms.

The evidence gathered so far has given a resounding, and almost universally positive, response to the question. On the average, CSMP students do better on traditional achievement tests than Non-CSMP students. In addition, similar results were obtained for students in each quartile of academic ability (as obtained with standard tests of same). The results in favor of CSMP students held true in first grade and second grade, and in urban, suburban and rural school districts.

To these generalizations, the only qualifiers which should be added (to the one in reference to "local" sites, above) are in regard to teacher quality, curriculum purity and differential time spent on math in CSMP classrooms.
(a) It is possible that, since teachers of CSMP have been volunteers (by and large), the positive test results are due to their enthusiasm. Although one might counter by saying that enthusiastic teachers (stimulated by CSMP) are precisely what one might desire, the question still remains as to whether teaching CSMP will enthuse non-volunteer teachers to an equivalent extent.
(b) A similar set of arguments and counter arguments can be raised on the issue which arises from the fact that CSMP teachers spend more time teaching

math than do Non-CSMP teachers. (c) As for the fact that not all CSMP teachers use CSMP materials exclusively, again the same arguments can be raised. However, in this case, it is not so clear to what extent CSMP materials are supplemented by other math materials, nor what effect varying amounts of supplementation have on these achievement test results.

Hence we see that, to the not inconsiderable extent to which data has been collected in regard to this question, the answer is "yes." As always with research, the answer must be qualified, in this case by the above qualifiers. Thus, it is evident that additional research must be done, even on the primary grades, in addition to that involving grades 3-6, in years to come.

Do students learn the specific skills and concepts of the CSMP curriculum? Evidence in regard to this question has been gathered on a wide variety of students (just as in the one above). However, since the CSMP curriculum is unique in many respects and since it is really unfair to ask school officials their permission to test Non-CSMP students in areas that they are unfamiliar with, no comparative data has been collected.

Nevertheless, considerable amounts of direct and indirect evidence have been gathered on CSMP students to provide a qualified answer to the question. CSMP students have demonstrated some success with a variety of items, involving the acquisition of the skills and concepts of the CSMP curriculum. Naturally, not all students demonstrate complete mastery (nor is it required in the program). As a result, it is very difficult to interpret the results obtained. As for indirect evidence, teachers report that students do acquire the skills and concepts of the CSMP curriculum, with the exception of some teachers who report not unexpected difficulties with less able students.

Are CSMP students, particularly after two or three years in the program, better able to deal with certain kinds of mathematical situations than are students who have not studied CSMP? So far, students have received, at most, two years of CSMP instruction, and hence it may be too soon to give an adequate answer to this question. However, attempts have been made to gather evidence in this most difficult area.

Several test scales have been devised, for both group and individual administration, which involve relatively novel mathematical situations for both CSMP and Non-CSMP students. While these have been developed in the absence of a strong overall theoretical framework, the results have indicated that CSMP students are indeed better able to deal with certain mathematical situations, there being no significant differences on the others.

For the three questions dealing with the issue of "Outcomes," the answers thus far are largely positive, but limited primarily by the facts that the EPT is only two years old and that most of the data comes from "local" schools.

From the foregoing treatment of the evaluation effort to date, the reader can easily surmise the kind of emphasis the evaluation effort will be having in the near future. Clearly, both kinds of evidence gathered on the "Practicality" issue will be looked at more closely and in confunction with each other, particularly as it relates to system-wide adoptions. Also, the data gathered on the "Outcome" issue should henceforth come from not only "local" sites but also from sites in the "outer ring", where the implementation effort approximates more closely the situation that would most likely prevail as the program is more extensively adopted nation-wide.

Appendix

Excerpt from the Report of a Site Visit to the
Comprehensive School Mathematics Program

May 19 to May 22, 1975
by
Jack Churchill, Shirley Frye, Gail Young

"4. The CSMP Program

We believe that CSMP has succeeded in opening up some of the riches of mathematics to elementary students in a way that can be taught with success by teachers given the minimal inservice programs developed by the project. CSMP's stated view of mathematics, their objectives and goals in the teaching of it, and their spiral curriculum approach impress us as sound and well exemplified in their materials.

Indeed, we find the materials often richer than is exploited by particular lessons. This is as it should be, since it allows creative teachers and students to explore these riches as far as their interests and abilities allow. In short, we find CSMP delivers well on what it promises to do, and we heartily approve of the promise.

It is quite possible that the long period of developmental work by CSMP, including trials of various approaches and instructional modes, was a necessary preparation to the successful development of the project's current course materials. In other words, curriculum projects of the past may have fallen short simply by not persevering long enough to develop materials that were at the same time sufficiently rich in mathematics and successfully usable by teachers and students. In this we believe CSMP has certainly succeeded to an extent that deserves support for the development of its 4-5-6 curriculum.

A characteristic of the CSMP program is its emphasis on mathematical ideas, treated in a unified fashion. The mathematician can recognize in the content of the K-3 program an imposing list of concepts: set intersection and union, function, inverse function, parallel displacement, Venn diagrams, functional composition, bases other than 10, algorithms, permutations, and the number line, to name just a few. It is 20th century mathematics; the old elementary curriculum was 15th century mathematics.

But even to list these terms is to give a misleading impression of the program. Neither the teacher nor the children will be aware that they are studying such 'advanced' or 'modern' topics.

Other curriculum projects introducing such mathematical concepts have, by and large, tried to give the children a conscious, verbal, awareness of the mathematical formalisms in which such concepts are described. Mathematicians and mathematical educators have in their professional training all passed through the experience of realizing that 5 and -5 are each the additive inverses of the other in the ring of integers, and found that at that stage formalism was illuminating, and many have attempted to recreate that experience in the elementary school curriculum. These attempts have not been particularly successful (though an improvement on the older curricula), partly because they are not natural to the child, but also because such an approach makes greater demands on the mathematical background of the teacher than is realistic in this country.

The CSMP program is based on much sounder pedagogical principles. One is reminded of M. Jourdain in Le Bourgeois Gentilhomme and his discovery that he had been speaking prose all his life. The CSMP children will discover with the same surprise that they have been studying all of these impressive terms all their school days.

What makes all this feasible is the heavy use by CSMP on non-verbal languages. There are three principal ones of these. The language of strings replaces the formalism of set theory; the language of arrows replaces the formalism of functions; and the 'Minicomputer' replaces the formalism of algorithm and algebra.

In the classroom, all of these pedagogical devices appear simple and natural. Neither the children nor the teacher have any difficulty in grasping them.

The Minicomputer deserves some special comment. The name suggests some electronic device. An abacus will be a much better analogy. In essence, it consists of a number of squares, each subdivided into four squares, a number of markers such as checkers, and several simple rules for manipulation. It is a computer in the same sense that the abacus is; following the rules enables the child to carry out arithmetical computations well beyond what one can expect the child to do with the traditional methods at a given age. But it is primarily pedagogical, a tool to be dropped as soon as the child is able to spare it.

We will not attempt to describe the device here, but refer to the CSMP material. One can discuss it in quite sophisticated terms, as a hybrid binary-decimal computer. It has been criticized from that standpoint, as forcing the child to use binary arithmetic in doing ordinary arithmetic. Such criticisms must have been made in absence of classroom observation. The child is not doing anything more sophisticated than saying that one plus one equals two, two plus two equals four, four plus four equals eight. It is a little easier for him to represent these additions on the computer than it is to represent three plus three equals six, but that he is, in any sense, using two different bases will never occur to him, nor to his teacher, nor from our observations, does the child have any problems dealing with the computer. On the contrary, their facility with mental arithmetic and arithmetic in standard form was really impressive, well beyond their grade levels in the ordinary curriculum.

In any case, in a world of real computers, early familiarity with the basic ideas of computers seems to us well worth striving for, even in this very simple form. We were told, as a cute story, of a second grader who had been playing with one of the little electronic hand calculators now so common. He was asked what he thought was inside it, and he replied, 'A little man with a Minicomputer.' On reflection, the answer seems to be about as good as one could ever expect from a second grader. It shows a clear understanding of the possibilities of mechanizing computation, and if one replaces the little man by an electrical source of power, and the Minicomputer by the various binary circuits, it is not too far from a simplified technical explanation.

We can summarize what appears to us to be unique features of the program.

A. Content:

Includes the development of number systems and their operations and introduction of geometry, measurement and probability in all grades.
--is based on the unifying ideas of set, function, relations which are creatively incorporated without complicated symbolism.
--leads students to problem-solving techniques and applications of skills.
--does teach the student the computation skills that are usually included in an elementary mathematics program, but through non-standard methods.
--the transfer of concepts from 1-digit numbers to multi-digit numbers occurs in a casual way that seems to be very natural to the students.

B. Pedagogy:

--Minicomputer - both a counting and computing model. It reinforces quantifying as well as place value concepts. As a student tool, it is readily manipulated and enables the student to visualize an exchange of '2 for 1' much more easily than (a) '10 for 1' exchange. As a demonstration model, it is extremely usable by the teacher for large or small group instruction.
--the languages of strings and arrows generate math concepts and ideas and develop understanding through child-related discussion.
--story books - 'bring children into contact with mathematics at levels until now unexplored in education.'

C. Teacher's Guides:

--variety of presentation methods
--management suggestions
--flexibility of use with levels(*,**,***) of material in strands
--content clearly explained
--implementation at various stages suggested for teacher
--spiral approach permits teacher to move through strands without expecting a 'mastery level' for each student
--good suggestions for student activities other than the workbook pages.

Because of the outstanding organization and dialogue in the guides, teacher in-service training required is very brief."