DOCUMENT RESUME

ED 118 677 UD 015 703

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TITLE Special Emergency Education for the Disadvantaged. Final Evaluation Report.
INSTITUTION Northwest Regional Educational Lab., Portland, Oreg.
SPONS AGENCY California State Dept. of Education, Sacramento. Office of Program Evaluation.
PUB DATE 30 Jun 74
NOTE 102p.; Parts of this document may not be clearly legible on reproduction due to print quality of the original document; Best copy available.

EDRS PRICE MF-$0.83 HC-$6.01 Plus Postage
DESCRIPTORS *Compensatory Education Programs; Demonstration Programs; Educationally Disadvantaged; *Elementary Education; Elementary School Students; Elementary School Teachers; Inservice Teacher Education; *Mathematics Education; *Program Evaluation; Self Concept; State Programs; Student Motivation
IDENTIFIERS *California

ABSTRACT

This evaluation of Project Special Elementary Education for the Disadvantaged (SEED) sought to assess the impact of SEED instruction upon students enrolled in disadvantaged schools (grades three to six) in four major study areas: mathematics achievement, interest in math and other school subjects, motivation, and self concept. In addition, the teacher inservice training provided by the SEED Specialists was evaluated. Each of the evaluation instruments used was administered on a pre and post basis to students participating in the SEED program and to students in a control group. The present study revealed that the impact of Project SEED on achievement in mathematics was generally favorable for students who were in the program for a two-year period; however, the relative gain for students who had been in the program for only one year was less favorable. Measures of interest and motivation yielded only a few significant findings and these were not consistently in favor of the experimental treatment for any grade level or treatment group. Similarly, the findings for the measure of self image did not yield evidence of a substantial and consistent treatment effect. The inservice training for teachers was found to be quite extensive. In general, it did not prepare teachers for implementing SEED by themselves. (Author/JM)

SPECIAL ELEMENTARY EDUCATION FOR THE DISADVANTAGED

FINAL EVALUATION REPORT

June 30, 1974

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Portland, Oregon 97204

Pursuant to a contract with the California Department of Education, Sacramento, California

Published by the Northwest Regional Educational Laboratory, a private non-profit corporation supported in part as a regional 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 by the Institute should be inferred.

EXECUTIVE SUMMARY

Purpose

The evaluation of Project SEED undertaken by the Northwest Regional Educational Laboratory sought to assess the impact of SEED instruction upon students enrolled in disadvantaged schools (grades 3-6) in four major areas:

(a) Mathematics achievement

(b) Interest in math and other school subjects

(c) Motivation

(d) Self concept

In addition to the assessment of the impact of the Project on the students, an evaluation of the teacher inservice training provided by the SEED Specialists was undertaken.

Method

A standardized test of contemporary mathematics and a specially designed test were used to assess achievement in mathematics.

An instrument developed by the evaluators was designed to assess interest and motivation in math and other school subjects. A self appraisal scale designed by the Instruction Objectives Exchange of UCLA was used to assess changes in self image.

Each of the foregoing instruments was administered on a pre and post

basis to students participating in the SEED Program and to students in a control group.

The evaluation of teacher training was accomplished through the use of survey and site visits procedures.

Major Findings

The present study revealed that the impact of Project SEED on achievement in mathematics was generally favorable for students who were in the program for a two year period; however, the relative gain for students who had been in the program for only one year was less favorable.

In comparing the performance of the second year SEED students ($SEED_2$) with that of the control students, it must be recognized that during the past two years, the $SEED_2$ students were provided with twice as much math instruction as the control students. In light of this exposure to math instruction, the superior attainment of $SEED_2$ students is not overwhelming.

Measures of interest and motivation on math and other school subjects yielded only a few significant findings and these were not consistantly in favor of the experimental treatment for any grade level or treatment group. Similarly, the findings for the measure of self image did not yield evidence of a substantial and consistent treatment effect.

The inservice training for teachers was found to be quite extensive. Apparently the training served the purpose of keeping the teachers oriented as regards to day to day classroom activities, but ingeneral it did not prepare teachers for implementing SEED by themselves.

Feasibility

In addition to the foregoing findings, the present report addressed

a number of issues intrinsic to the question of implementing the SEED Program on a large scale basis. These issues included: cost and benefit considerations, the availability of SEED Specialists, the scope, level, and sequence of Seed instruction, the quality of student classroom performance, the findings of previous research efforts, the amount of mathematics which should be taught to children and the historical directions of mathematics instruction. A recommendation was made that each of these issues be considered in detail before the SEED Program is implemented on a broad basis.

Audit and Evaluation Center
Northwest Regional Educational Laboratories
June, 1974

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I

INTRODUCTION

In 1972, the California Assembly passed Bill No. 1644, "The Abstract, Conceptually-Oriented Mathematics Program Act." The bill provided for the establishment of a special mathematics program in elementary schools of four California school districts. The program guidelines called for Project SEED to be instituted in approximately 40 classrooms distributed within the disadvantaged schools of the unified districts of Los Angeles, Oakland, Sacramento and San Jose. Additionally, Project SEED would provide inservice training for the regular classroom teachers of classes participating in the program.

The evaluation of the program covered in Assembly Bill No. 1644, called for an examination of differences between the treatment and control student performances in four areas and an evaluation of the inservice training for the classroom teachers. The four areas of student performance are: (a) mathematics achievement, (b) interest in mathematics and other school functions, (c) motivation to learn mathematics and other school subjects, and (d) pupil self-image.

Specific guidelines for the evaluation were outlined in the Request for Proposal to which the NWREL evaluators responded. As noted in the guidelines, the program and corresponding third party evaluation was to extend over a two-year period in order that a more pervasive study of the impact of the program might be obtained. This is the final report submitted in compliance with the agreement between the State of California and NWREL for the evaluation of Project SEED.

The present report has been designed to include the following information:

(a) A description of the student population included within the evaluation study.

(b) A general description of the SEED treatment including content coverage, the basic instructional procedure and the role of the regular classroom teacher in SEED.

(c) Discussion of the research design and description of the assessment instruments.

(d) A description of the results of student performances based on the assessment instruments.

(e) A discussion of the inservice training component.

(f) A discussion of the feasibility of statewide implementation of the SEED method.

(g) Summary comments and conclusions.

II

STUDENT POPULATIONS

Student Populations for the School Year 1972-73

The California Assembly Bill No. 1644, authorized SEED instruction to be instituted in a minimum of 40 classrooms in the four unified school districts. In order to be eligible for participation, each school had to meet three criteria: (a) the school had to be eligible for funding from Title I of the ESEA of 1965, as amended, or the equivalent, (b) participating teachers had to give approval of the program in their classes (i.e., grades 3-6), and (c) the teachers had to agree to comply with the requirements of the study.

For the 1972-73 school year, a total of 50 classrooms received SEED instruction, and 37 comparable classes participated as control classrooms. The First Year Interim Evaluation Report (July, 1973) provides details of the participating classrooms. Table 1 displays the distribution of participating classrooms of each grade level that were pretested and posttested for the 1972-73 school year.

TABLE 1

Participating Classrooms for 1972-73 School Year

	SEED			CONTROL		
DISTRICT	Grade Level	Pretest # Classes	Posttest # Classes	Grade Level	Pretest # Classes	Posttest # Classes
Los Angeles:						
	3	5	5	3	2	2
	4	4	4	4	2	2
	4/5	2	2	5	4	4
	5	6	8			
	5/6	2	2			
Los Angeles Total		19	21		8	8
Oakland:						
	3	1	1	3	1	1
	4	4	4	4	3	3
	5	5	5	5	2	2
	5/6	1	1	6	2	2
	6	2	2			
Oakland Total		13	13		8	8
Sacramento:						
	4	3	3	3	4	4
	5	1	1	4	3	3
	5/6	2	2	4/5	1	1
	6	1	1	5	4	4
Sacramento Total		7	7		12	12
San Jose:						
	2/3	1	1	3	1	3
	3	4	4	4	1	3
	4	3	3	5	1	3
	5	1	1			
San Jose Total		9	9		3	9
GRAND TOTAL		48	50		31	37

An estimate of the total number of students tested in the program during the 1972-73 school year was obtained by compiling the responses to one assessment instrument. Table 2 indicates the number of SE D and control students tested in each grade level.

TABLE 2

Number of Participating Students for 1972-73 School Year*

GRADE	SEED	CONTROL
3	259	180
4	375	176
5	393	371
6	117	40
TOTAL	1144	767

*Based on number of students taking FUN questionnaire for pretesting

The total number of SEED and control students participating in the study would be higher than indicated in Table 2 due to absences during the testing.

It should be recalled that the First Year Interim Evaluation Report identified two test groups: those SEED and control classes that were pretested in January and those SEED and control classes that were pretested in February. All groups were posttested at the same time, however. Students of the two test groups were combined in the compilation of Table 2.

Student Populations for the School Year 1973-74

The 1973-74 school year of operation was provided in order to obtain a more pervasive view of the impact of the program, i.e., where possible, the same students were to be included in the program for the two years. Participati

of the initial group of sixth grade students was precluded mainly by their graduation to other schools. The school districts were to replace graduating sixth grade classes with classes of their choice within the grade range of three to six.

For a variety of reasons, the classes were not kept intact for the 1973-74 school year, and accordingly, none were composed entirely of students who were in the project the previous year. Apparently, there were no prior arrangements for recruitment and continuation of the program in the same schools for the second year and as a consequence, new recruitment and reconstitution of SEED and control classes was necessary in a number of cases. In recruiting SEED classes, the intent was to obtain as many students as possible who participated in the program the previous year. For the control groups, the requirement of previous participation was waived. Table 3 displays the distribution of participating classrooms of each grade level that were pretested and posttested for the 1973-74 school year.

Participating Classrooms for 1973-74 School Year

DISTRICT	SEED Grade Level	SEED Pretest # Classes	SEED Posttest # Classes	CONTROL Grade Level	CONTROL Pretest # Classes	CONTROL Posttest # Classes
Los Angeles:						
	3	1	1	3	1	1
	3/4	1	1	4	3	3
	4	2	2	5	4*	3
	4/5	1	1	6	4*	3
	5	7	7			
	5/6	2	2			
	6	7	7			
Los Angeles Total		21	21		12	10
Oakland:						
	4/5	1	1	5	3	3
	5	3	2	5/6	1	1
	5/6	5	5	6	3	3
	6	5	4			
Oakland Total		14	12		7	7
Sacramento:						
	4	1	1	4	2	2
	4/5	1	1	5	2	2
	5	2	2	6	2	2
	5/6	1	1			
	6	2	2			
Sacramento Total		7	7		6	6
San Jose:						
	3	3	3	3	1	1
	3/4	2	2	4	1	1
	4	1	0	5	1	1
	5	2	2	6	1	1
	5/6	1	1			
San Jose Total		9	8		4	4
GRAND TOTAL		51	48		29	27

*Posttests were not administered in certain classes due to: (a) elimination of SEED program by teacher or principal's choice, (b) an inordinate amount of teacher turnover and the class did not take the posttest, and (c) the inclusion of an alternate class during the present tabulation.

A total of 51 SEED and 29 control classes were included in the program for the 1973-74 school year. The lower number of control classes was due largely to a reduction of the number of third grade classes, i.e., students for whom comparisons of the pervasiveness of the treatment was not appropriate. The 29 control classes provide an adequate number of students for evaluation, especially since the SEED students now had to be divided into two experimental groups; i.e., those students having previous experience in a SEED class ($SEED_2$ students) and those for whom the current experience was their first ($SEED_1$ students).

The total number of SEED and control students participating in the study for the 1973-74 school year is shown in Table 4. As noted in Table 4, 1,461 SEED students and 932 control students participated during the current year.

TABLE 4

Total Number of Participating Students for 1973-74 School Year*

GRADE	SEED	CONTROL
3	114	56
4	207	208
5	573	301
6	567	367
TOTAL	1461	932

*Based on class rosters provided by participating teachers for pretesting

For the 1972-73 school year, the evaluation of the students who were pretested in January was treated separately from those pretested in February. For the 1973-74 school year, no distinction between these groups is made, with students from both groups treated simply as continuing students. In

other words, it is assumed that over the period of nearly two school years, the difference of one month's instruction is relatively insignificant.

For a variety of reasons such as absences, improperly marked tests, language problems, etc., the actual number of students for whom data were retained for the pretest was, obviously, less than the total number of participating students. The reduced number is shown by the responses obtained for one instrument. Table 5 summarizes the number of $SEED_1$, $SEED_2$ and control students in each grade level for whom pretest data were obtained on the Wisconsin Contemporary Test of Elementary Mathematics.

TABLE 5

Participating Students by Experience for 1973-74 School Year*
(WCTEM Pretest)

GRADE	$SEED_1$	$SEED_2$	CONTROL
3	75	24	45
4	108	88	185
5	261	271	277
6	305	216	327
TOTAL	749	599	834

Table 5 indicates that 749 $SEED_1$ students, 599 $SEED_2$ students and 834 control students were pretested during the 1973-74 school year. This is a difference of about 100 SEED and 100 control students from one year to the next.

The final analysis of the data for the 1973-74 school year is based only on matched data groups, i.e., those students for whom both pretest and posttest data are available. During evaluators' site visits (and based on other communications) the teachers of two control classes indicated that, in

their judgments, the pretests were not administered properly, and therefore, the results should not be considered valid. Also, in two SEED classes, the regular teacher reported that at least 10 or 12 other substitute teachers had preceded her in teaching the class. She indicated that this lack of continuity seemed to have resulted in a "difficult" class. For this reason, the evaluators chose to delete these classes also. Finally, during the post-testing, one district reported a SEED specialist administered the tests in one class. According to reports, he also exerted improper influence by providing clues and prompting. Therefore, the data from this SEED class were also deleted. The final analyses of the data are based on the students as shown in Table 6 for one instrument.

TABLE 6

1973-74 PARTICIPATING STUDENTS FOR FINAL DATA ANALYSES*
(WCTEM Posttest)

GRADE	$SEED_1$	$SEED_2$	CONTROL
3	52	4	37
4	88	56	144
5	185	228	195
6	193	164	219
TOTAL	518	452	595

*Students for whom both pre and posttest scores are available

III

CHARACTERISTICS OF THE TREATMENT PROCESS

Information on the characteristics of the treatment process, i.e., the nature of the SEED classes, was derived from observations of classrooms and a questionnaire survey conducted during the 1972-73 school year, as well as from structured observations and interviews conducted during the 1973-74 school year. Certain of the characteristics correspond to the necessary conditions of the program as specified in Assembly Bill No. 1644, Section I, Chapter 17. Other characteristics are identified to provide a more comprehensive description of the treatment process.

Extent of Treatment

The SEED classes, for the most part, began shortly after the time of the pretest evaluation, and were scheduled to continue for the entire school year. All participating classroom teachers indicated that the SEED mathematics course was taught in addition to the mathematics taught by the regular classroom teacher; thus, SEED students received a "double dose" of math four days per week.

Content Coverage in SEED Classes

The evaluators attempted to determine the curriculum for the SEED classes, i.e., the content to be covered, sequence, and general schedule. Teachers did not have a curriculum guide or syllabus, nor was one made available for the evaluators. A document containing topics and illustrations for presenting them according to SEED procedures was the only material made available, yet

this was not taken to be the SEED curriculum. When asked about the sequence of materials, the specialists indicated that the subsequent topics were generally dictated by classroom events, e.g., if the class seemed to be headed for the concept of "limits," that topic would be covered next. Thus, to the SEED specialists, it did not appear appropriate or necessary to have a formal curriculum guide or syllabus in the traditional sense.

Dr. Arthur Mittman, a mathematics educator and NWREL consultant, who made site visits to a sample of schools in each school district, reported that the lessons he observed appeared well organized and well presented. Written materials for past or subsequent lessons were not available, however, so he was unable to examine the sequencing or scheduling of lessons. In the absence of a course syllabus, the evaluators were unable to determine the content of the curriculum covered to-date, or the content to be covered by the SEED program for every classroom or grade level.

Site visits by the evaluators revealed a variety of topics being taught in the SEED classrooms. These topics seemed unrelated to grade levels in which, at times, sixth graders could be dealing with the same topics as fourth graders in another classroom. Modern math topics such as exponentiation, positive and negative numbers, number series, polynomials, inverse, binary code, limits, sets, coordinates and equivalents were observed being taught. Regular math classes were largely devoted to the basic mathematics involving the basic operations with more descriptive problems involved at higher grade levels.

The Basic Instructional Procedure

In observations of the SEED classes, the evaluators were impressed by the uniformity among the SEED specialists* in conducting the classes. That

* It should be emphasized that SEED specialists were: (a) generally individuals with graduate training in mathematics, and (b) employed by the SEED Project (rather than directly employed by the participating district).

is, the basic instructional procedure employed was the Socratic Method and this was employed throughout each lesson observed by the NWREL team. The only noticeable differences from classroom to classroom consisted largely in the mathematical concepts being presented during a given lesson. Perhaps the statement, "if you've seen one SEED class, you've seen them all," is particularly applicable.

The Role of the Regular Classroom Teacher

The role of the regular classroom teacher during the SEED class was somewhat passive, although the teachers were occasionally called upon to respond much like a student or to check the written work of students as an aide to the specialist. The involvement of the teacher depended to a large extent on the specialists and the teachers, themselves. Nevertheless, the teachers were always observed to be present in the classroom for the duration of the SEED instruction.

Math Instruction in the Control Classes

There were variations in the math classes of the control schools that were observed. In fact, teachers would rightfully be insulted if their classes were referred to as "traditional" classes. These variations include "Sullivan" math, IPI, small group techniques, individual study, and a variety of teaching materials. In a sense, the control classes represent a collection of "other" techniques, some of which drew the praise of the NWREL math consultant. Thus, it should be emphasized that the control classes are not a collection of classes, all of which are taught in the "traditional manner." It is also pointed out that the control classes uniformly represented a single dosage approach to math instruction. That is, even though an attempt was made to locate comparable classes which were receiving a "double dose" of mathematics, the effort was not successful. Finally, it is important to note that the

decorum of the control and SEED classes observed was equally good, and that in general, students tended to the task of learning mathematics, regardless of the method employed.

Summary of Previous Observations of SEED Instructional Processes

Observations of the classrooms and interviews during the 1972-73 school year were accomplished by NWREL evaluators located in each school district. The information gained was subjective and impressionistic, but is considered important to an understanding of the treatment process for the two years of study. Each evaluator submitted a brief report which is included in total in the First Year Interim Evaluation Report.

Three of four evaluators mentioned noticeable variations in the styles of the SEED specialists within each district; no cross district observations were made. These variations, perhaps in part, account for the varied impressions of teachers about the program. These impressions ranged from extremely favorable to extremely unfavorable. It was not entirely clear if the teachers were reacting to the specialists and the way they behaved and conducted the program, or to the nature of the program, itself.

Observations by evaluators of the uniformity of the treatment across districts was not possible inasmuch as each evaluator only made observations in one district. C. W. Schminke, a mathematics educator, who served as consultant to the NWREL evaluation team, made observations in two school districts. His report, which was included in the First Year Interim Evaluation Report, consisted of a detailed description and analysis of the treatment process. It is repeated here:

> "In an address delivered in 1912, to the Educational Section of the International Congress of Mathematics, Professor A. N. Whitehead said:

'. . . When you analyze in the light of experience the central task of education, you find that its successful accomplishment depends on a delicate adjustment of many variable factors. The reason is that we are dealing with human minds, and not with dead matter. The evocation of curiosity, of judgment, of the power of mastering a complicated tangle of circumstances, the use of theory in giving foresight in special cases--all these powers are not to be imparted by a set rule embodied in one schedule. . .'*

Most thoughtful educators today subscribe to the notion that children and teachers ought become active partners in the process of learning mathematics. Yet we know from working with children in mathematics, that is from teaching, illustrating and demonstrating, it is not so easy as most imagine. Teachers often give simple, logical, concise explanations only to become frustrated and exasperated when they are misunderstood, ignored or rapidly forgotten. It is against this historical background that the remaining statements in this section are made. The remarks are not lengthy but they have been carefully considered and they are important. They are made without prejudice and grow principally from a limited but intensive two days of observation of SEED teachers in action.

Part I. Promise: The Pedagogy

For this observer, the startling promise of SEED lies in its pedagogy. It is clearly evident, in the Sacramento and Oakland classrooms observed, that the SEED teachers have created a 'positive classroom climate' to surround their instruction. They appeared at times, to this observer, to utilize a teaching style as though it were generated by a programmed format. The following statements best summarize the positive aspects of SEED pedagogy and appeared equally in evidence whether the SEED class was in existence six weeks or six months.

1. The children enjoyed the instructional period with their SEED teachers apparently as a direct result of the process of inquiry in mathematics.

2. The children consistently displayed evidence of confidence in their ability to 'do mathematics.'

3. A child's sense of personal worth was never at stake as a result of 'participation.' In short, children were never told directly they were wrong.

4. There was a constant focus on instruction and consequently the children were always at task.

5. The teachers were always enthusiastically teaching mathematics during the instructional period, thus subtly communicating something about the importance of mathematics.

* A. N. Whitehead, The Aims of Education and Other Essays (New York: The Macmillan Company, 1929) Chapter 1, Page 8.

6. The teachers consistently displayed a conscious awareness of pace and space, appropriately modifying modes of response required of children, moving about the room in and out of close proximity to children and utilizing questioning patterns in an engaging and logical manner.

As one important aspect of the elementary school curriculum, the mathematics period ought help contribute to the generally accepted objectives of the total school curriculum in such effective areas as tolerance, creativeness, self-direction, self-confidence, social sensitivity and open mindedness. There is little doubt that the pedagogy of SEED, properly executed, can provide an excellent model for a generalized classroom teaching style. It appears to have its foundations in the relatively simple but powerful notion that above all else, children need opportunity and some encouragement.

Part II. The Problem: Content and Some Attendant Questions

Beyond the contributions of SEED cited in the previous section, the mathematics curriculum of the elementary school years must provide children with specific skill in the broad arithmetical mathematical areas of number, operation, measurement, space-form position, relationship, symbolism and problem solving. These contributions of Project SEED are not so readily observable on a firsthand basis and the quantitative aspects of this total evaluation are found elsewhere in this report. Nonetheless, thoughtful consideration of the substantive nature of SEED gives rise to several related questions about which one may only make conjectures at this point in time.

1. Does the 'abstract, conceptually-oriented mathematics' of Project SEED provide a sound basis for general mathematics education? Currently increasing numbers of students for whom public education is terminal may find some serious deficits in their ability to deal with the arithmetic of general mathematics. Knowledge of the theoretical derivation of some mathematical notions may not be valuable for all.

2. Just how abstract is 'the abstract, conceptually-oriented mathematics' of Project SEED? It would be the cruelest form of deceit and dishonesty to 'make children believe they are smart' only to have them later discover they had not really developed the skill to deal effectively with higher level mathematics. We ought guard carefully against the possibility of 'creaming.' (Selection of a narrow range of esoteric mathematical propositions that lend themselves to a psuedo sophistication at the verbal level.) As an example, 'the factor form of 3E2' is not immune to associative learning, i.e., a form of rote responding.

3. Is Project SEED able to contribute in any visible manner to eradication of that historic fiction that 'mathematics is a dark and shadowy place where only the more able tread?' The abundant symbolism of SEED, the advantageous position of the SEED teacher in the elementary school culture and the 'culture' of SEED itself may subtly suggest the prerequisite for effective teaching of elementary school mathematics requires, at minimum, some graduate mathematics training. If this were a 'side effect' of SEED, it would be both unfortunate and untrue.

4. Is sequencing of the content of the SEED curriculum important? This question is raised because within one district, a SEED class (fourth grade) which had been constituted only five weeks prior to observation was engaging essentially the same substance as a fifth grade class within that same district that had been in operation approximately six months. If this condition is appropriate, then it is incumbent upon the educational enterprise to seriously examine some currently held notions regarding the hierarchical nature of mathematics.

5. What has evidence in local districts shown over time relating to children who have experienced one, two or three years of SEED? Do increasing numbers of these children pursue greater amounts of mathematics in Junior and Senior High School and with increasing success? Although ancillary to this evaluation, one cannot escape the question of costs and the ability of local districts to provide sustained effort. Nonetheless, the articulation of the scope and sequence of the mathematics curriculum must be given serious consideration in view of the legitimate public demand for accountability.

The previous observations were made prior to and independent of any knowledge of the 'objective' results of the current evaluation. Still, they are compelling questions and they ought to be appropriately addressed in any reasonable curriculum development activity."

Interests of Classroom Teachers and SEED Specialists

During the 1972-73 school year, a survey was conducted among classroom teachers and SEED specialists to examine the similarities and differences between SEED specialists and classroom teachers regarding selected areas. The Second Interim Evaluation Report, June 9, 1973, provides a detailed compilation of the results of the survey. The reader is referred to that report for greater detail.

In general, the SEED specialists and teachers showed some similarities and differences in their areas of special interests with regard to mathematical concepts. Specialists listed algebra, analysis, geometry and topology as areas of interest. Teachers, likewise, listed algebra and geometry, but instead of analysis and topology, listed the more conventional areas of multiplication, division, and operations. These differences were also reflected in their choices of topics taught or to be taught. A large number of specialists chose positive and negative numbers, exponentiation and series. A moderate number also listed graphing, geometry, summation and limits. Teachers, on the other hand, listed the four basic operations, fractions, sets and geometry. Few teachers, if any, chose positive and negative numbers, exponentiation, series, summation and limits. In general, there was very little overlap in the math concepts taught by the teachers and specialists, but partial similarities in areas of special interest.

Instructional Focus of Classroom Teachers and SEED Specialists

Both teachers and SEED specialists listed "reasoning" as a general characteristic they were trying to instill in the students. To a lesser extent, teachers were concerned with "self-confidence," but this was a

great concern of the specialists. The specialists also listed several characteristics such as questioning, discovery, interest and enjoyment in math. Several teachers also listed discovery and interest and enjoyment, but on the other hand, listed the more conventional topics of basic facts, grasp of concepts and practical application of mathematics. Thus, teachers tended to favor basic factual knowledge and the ability to perform mathematics, while the specialists tended to favor self-confidence and abstract values such as reasoning and questioning.

Attitudes of Classroom Teachers and SEED Specialists

A comparison of the attitudes of SEED specialists with those of the SEED classroom teachers and those of the control teachers on 13 items for all four grades, consistently showed the attitudes of the specialists to be more like those of the SEED classroom teachers regarding test preparation, teaching and pupils. Attitudes of the control teachers and the specialists for all four grades were similar only on innovation. To a slight extent, then, the attitudes of the SEED specialists and SEED classroom teachers were more similar than the attitudes of the specialists and control teachers.

IV

DESIGN OF THE STUDY AND THE ASSESSMENT INSTRUMENTS

The design of the study and the instruments selected for assessment for the 1972-73 school year were different from those for the 1973-74 school year. For this reason a separate description of instruments and procedures used during each of the two years of this study will be presented.

1972-73 School Year

Starting with the 1972-73 school year, the initial evaluation plan called for the administration of a battery of tests and quesionnaires to experimental and control groups at two points in time: at the beginning of SEED instruction (pretest), and near the end of the school year (posttest). Two sets of 20 experimental and 20 control groups in each set would thus be tested, according to the plan as follows:

	PRETEST	POSTTEST
Group 1	November, 1972*	April, 1973
Group II	January, 1973*	April, 1973

*NOTE: These dates were subsequently changed to January and February, 1973.

Due to the lateness of contract negotiations, scheduling anomalies and Christmas and New Year holidays, the dates of the pretest administration were delayed until January and February, 1973. Ultimately, 27 SEED and 19 control classes were pretested in January, 1973, and 21 SEED and 12 control classes were pretested in February, 1973. All classes, including two additional SEED

and six controls, were posttested during the two-week interval of April 23 to May 4, 1973. A total of 50 SEED and 37 control classes were ultimately involved in the study during the 1972-73 school year.

The procedures followed for pretesting and posttesting were basically the same. The test materials were delivered to the classrooms where they were administered by the regular classroom teachers in accordance with the instructions for the administration of each instrument. The completed test materials were collected daily from each school by NWREL representatives who were available for assistance if problems arose.

Three instruments were originally selected for use in the evaluation during the 1972-73 school year. These were:

(a) Wisconsin Contemporary Test of Elementary Mathematics (WCTEM)

(b) Self-Concept and Motivation Inventory (SCAMIN)

(c) FUN questionnaire

These instruments were used in both pretest and posttest administrations to SEED and control groups.

A fourth instrument, SEED Special Test, was designed by NWREL consultants especially to accommodate the content of the SEED Program and the California State Course of Study. This instrument was only available for the posttest administration.

The WCTEM is a test which measures achievement in elementary school mathematics, and is oriented toward modern topics in mathematics. It consists of two levels, one for grades 3-4, and another for grades 5-6. Three scores are derived from the WCTEM:

(a) Facts

(b) Concepts

(c) Total Score

The SCAMIN (Farrah, Milchus, Pertz, 1968) is an instrument designed to

measure self-concept and motivation. It is a 48-item scale which uses facial expressions to represent five points along various dimensions of student attitudes. It was anticipated that within the grades and context of the project, pictorial representations offered a clear means of assessing the required complex variables.

NWREL staff members developed the FUN questionnaire to measure interest in mathematics and other school subjects, and motivation to learn mathematics and other school subjects. This instrument was field tested in the Portland Public School System prior to its use.

The SEED Special Test was a 50-item, multiple-choice format test that yielded a single score. The range of item difficulty was sufficient to apply to all four grade levels of 3-6.

Copies of all four instruments used during the 1972-73 school year are included in the First Year Interim Evaluation Report, along with details of their use and first year results.

In addition to the four instruments designed to measure student performance and attitudes, three questionnaires were also developed to provide descriptive characteristics, as well as attitudes and purposes, of both regular classroom teachers and SEED specialists.

1973-74 School Year

At the beginning of the 1973-74 school year the evaluators determined it appropriate, and in some cases necessary, to modify the 1972-73 evaluation plan. Some modifications were brought about simply because the project was in its second year of operation, and circumstances dictated changes. Other modifications were made to improve scientific evaluation procedures.

For the 1972-73 school year, the SEED Program served children in grades three through six. The sixth grade students from the first year of operation would not be continued in the program for the second year because most would be graduating to another school. The participating school districts were to replace the graduating sixth grade classes with classes of another choice within the grade range of three through six.

For a variety of reasons, the SEED classes could not be kept intact for the 1973-74 school year, nor was it possible to compose classes entirely of students who were in the project the previous year. Accordingly, arrangements were made to secure SEED classes with as many students as possible who participated in the program the previous year. Eventually, 51 SEED classes—one more than the previous year--were secured.

Control group classes, likewise, were not continued for the second year, so it became necessary to recruit several new ones. The main requirement in recruiting control classes was that these classes could not contain students who participated in the SEED classes the previous year. The 29 classes that were finally recruited appeared to provide a sufficient number of students for the evaluation, especially since the SEED students had to be divided into two experimental groups, i.e., those students who had previously been enrolled in SEED for the 1972-73 school year, and those enrolled in SEED for the first time during the 1973-74 school year.

Several teachers of control groups for the 1972-73 school year were reluctant to involve the same students again as controls, and the evaluators were hard-pressed for sufficient argument for the requirement. Therefore, no distinction was made between new and continuing control students. The design of the evaluation for the 1973-74 school year, then, involved two treatment groups and one control group with each group divided according to grade levels. All groups were pretested, and later posttested, at approximately the same time.

The basic design of the study for the two-year period is presented as Table 7:

TABLE 7
EXPERIMENTAL DESIGN FOR THE SEED PROGRAM EVALUATION

	1972-73			1973-74		
GROUP	T1	T2	T3	T4	T5	T6
E1	Pretest	Treatment	Posttest	Pretest	Treatment	Posttest
E2				Pretest	Treatment	Posttest
C	Pretest		Posttest	Pretest		Posttest

T=time E=Experimental or SEED Group C=Control Group
E1=First year SEED students
E2=Second year SEED students

As with the previous school year, the evaluation plan called for the administration of the tests and questionnaires at the beginning of the SEED instruction (pretest) and again near the end of the school year (posttest). The pretesting was accomplished during the last two weeks of October, 1973, and the posttesting was completed during the first two weeks of April, 1974.

The procedures for both the pretests and posttests were basically the same for the first and second year. This year the teachers requested, and received, assistance in testing. This assistance was provided by SEED specialists and was generally limited to test distribution and proctoring activities. The test materials were delivered to the classrooms by NWREL representatives where administration was accomplished by the regular classroom teacher who followed the instructions that were provided (see Testing for Project SEED, NWREL Evaluation Files). The materials were collected daily by NWREL representatives who were available for assistance if problems arose.

Deviations from the instructions for administration of the tests were carefully checked to determine if the data were acceptable. A site visit and a number of telephone calls were made in this endeavor.

The evaluation of student performances was again conducted in four areas: (a) mathematics achievement, (b) interest in mathematics and other school functions, (c) motivation to learn mathematics and other school subjects, and (d) pupil self-image.

The four measures of student performances are as follows:

(a) Wisconsin Contemporary Test of Elementary Mathematics (WCTEM)

(b) Special Mathematics Achievement Test

(c) FUN questionnaire

(d) IOX Self Appraisal Inventory

The WCTEM was again used in the assessment of achievement in mathematics. In addition, the SEED Special Test was revised and divided into two grade level tests—one form for grades three and four, and one for grades five and six. The name was also changed to Special Mathematics Achievement Test. The revision attempted to incorporate more of the content of SEED instruction. This content was also consistent with the California State Course of Study in mathematics.

The FUN questionnaire was again used to assess interest in mathematics and other school functions, and motivation to learn mathematics and other school subjects. It was extended, however, to include these attitudes toward several other school subjects.

As a measure of self-image, the SCAMIN was replaced by the IOX Self Appraisal Inventory produced by the UCLA Instructional Objectives Exchange. The instrument consists of two forms, one for each of two grade categories. While other component scores are possible for this instrument, only the General Score was used in this evaluation inasmuch as the other scores did not seem to apply to the SEED Project.

In addition to the instruments designed to measure student performances, a survey instrument "SEED Classroom Teacher Inservice Training Record Form," was developed to determine the characteristics of the inservice training effort and to assess the effectiveness of this training. A "Site Visit Observation and Inservice Form" was also used to gather further information on the inservice training component, and to obtain detailed information about the SEED and control classes.

V

FINDINGS FROM THE ANALYSES OF THE DATA

The analyses of the data from the current students are presented in the present section. As stated in Chapter IV of this report, four instruments were used to collect information compatible with the terms of Assembly Bill No. 1644. That document requires study of four areas of student performance, i.e., (a) mathematics achievement, (b) interest in mathematics and other school functions, (c) motivation to learn mathematics and other school subjects, and (d) pupil self-image.

The data afforded by the students' scores on the Wisconsin Contemporary Test of Elementary Mathematics (WCTEM), and the Special Mathematics Achievement Test will be used to treat the first of these. Student responses to the Fun Questionnaire will serve as the basis for items (b) and (c), and the IOX Self Appraisal Inventory data the basis for item (d). The results of the analyses of these data are presented in that order in the paragraphs that follow.

Findings from the Analyses of the WCTEM

In Table 8, the means and standard deviations of the students' WCTEM scores are presented by grade levels. The differences between the pretest means of the control group and SEED 1 group were not significant. The only statistically significant posttest difference between the control and SEED 1 means occurred in the sixth grade which also had the largest pretest differences. Obviously, the SEED 2 experimental group performed better

than either the control or SEED 1 classes at all grade levels. This is a reasonable expectation because they have spent approximately twice as much time in mathematics class during the past two years as the control students and one and one-half times as much as the SEED 1 students. The question: "would the same results have been obtained if the same amount of time had been spent in a regular or more traditional mathematics class?" remains unanswered. One of the deficiencies of the present evaluation which was beyond the control of the evaluation team was the inability to compare a SEED class and a control class with total instructional time held constant.

For convenience of the reader, Tables 9A through 9D, present the differences between the posttest means. These data were obtained from the values given in Table 8.

TABLE 8

Pretest and Posttest
Means and Standard Deviations
WCTEM Scores by Grade Level

1973-74

		FALL (Pretest)			SPRING (Posttest)		
GRADE	GROUP	CONTROL	SEED 1	SEED 2	CONTROL	SEED 1	SEED 2
3	n	37	52	4	37	52	4
	M	20.57	20.10	23.25	23.97	24.92	31.75
	S.D.	7.53	6.86	4.27	10.42	7.63	4.03
4	n	144	88	56	144	88	56
	M	23.48	24.67	30.96	30.24	29.32	36.32
	S.D.	9.12	6.23	8.45	8.79	8.63	7.88
5	n	195	185	228	195	185	228
	M	17.11	16.88	19.89	19.43	20.46	24.96
	S.D.	6.29	5.24	6.80	7.26	7.75	9.38
6	n	219	193	164	219	193	164
	M	21.67	23.07	24.93	25.64	28.60	29.54
	S.D.	8.89	8.89	9.72	10.19	10.63	11.29

TABLE 9A

Grade 3 - Differences Between Posttest on WCTEM

	SEED 1	SEED 2*
CONTROL	.95	7.82*
SEED 1		6.83

* These differences are of questionable value because there were only four students in SEED 2.

TABLE 9B

Grade 4 - Differences Between Posttest Means

	SEED 1	SEED 2
CONTROL	-.82	6.08*
SEED 1		7.00*

* t .05 = 1.96 df = ∞

TABLE 9C

Grade 5 - Differences Between Posttest Means on WCTEM

	SEED 1	SEED 2
CONTROL	1.03	5.53*
SEED 1		4.50*

* t .05 = 1.96

TABLE 9D

Grade 6 - Differences Between Posttest Means on WCTEM

	SEED 1	SEED 2
CONTROL	2.94*	3.90*
SEED 1		.94

* t .05 = 1.96

It was of interest to the evaluation team to investigate the possibility of differential effects of SEED instruction among students who performed at different levels on the pretest. As can be seen from Tables 10A through 10D, the results of the analyses are consistent. In grade three, the lower third of the class on the pretest performed better than comparable control students, but the interpretation must be tempered by the realization of the small number of students involved. Grades four and five revealed little difference between the achievement of the SEED 1 and control classes. As would be suspected, the difference between the middle and upper third means in both classes were approximately twice as large as the differences between the lower and middle thirds.

The posttest performance of each third of the grade six SEED 1 group was uniformly better than that of the control group.

In summary, the analyses of the WCTEM test data reveals that first year SEED students performed as well as or better than the control group, but statistically so only in grade six. Whether or not that difference is of practical significance (in terms of what the difference represents) will be studied further in the analyses of the Special Mathematics Achievement Test.

TABLE 10A

Differences in the Amount of Gain
on the WCTEM Test Exhibited by Students of Various Ability Levels
Grade 3

	CONTROL			SEED 1		
	MEAN			MEAN		
	Pre	Post	Dif.	Pre	Post	Dif.
Upper 1/3	29.09	34.0	4.91	28.06	30.00	1.94
Middle 1/3	20.86	22.79	1.93	19.61	24.61	5.00
Lower 1/3	12.42	16.17	3.75	12.65	20.18	7.53

TABLE 10B

Differences in the Amount of Gain
on the WCTEM Test Exhibited by Students of Various Ability Levels
Grade 4

	CONTROL			SEED 1			SEED 2		
	MEAN			MEAN			MEAN		
	Pre	Post	Dif.	Pre	Post	Dif.	Pre	Post	Dif.
Upper 1/3	34.37	37.11	2.74	31.66	36.00	4.34	41.53	43.24	1.71
Middle 1/3	22.94	29.06	6.12	24.16	29.31	5.15	30.19	34.95	4.76
Lower 1/3	14.16	25.14	10.98	17.78	22.15	4.37	21.89	31.39	9.50

TABLE 10C

Differences in the Amount of Gain
on the WCTEM Test Exhibited by Students of Various Ability Levels
Grade 5

	CONTROL			SEED 1			SEED 2		
	MEAN			MEAN			MEAN		
	Pre	Post	Dif.	Pre	Post	Dif.	Pre	Post	Dif.
Upper 1/3	24.57	24.95	.38	22.69	24.62	1.93	27.51	32.05	4.54
Middle 1/3	17.03	17.62	.59	16.51	19.51	3.0	18.66	23.25	4.59
Lower 1/3	11.14	16.45	5.31	11.44	17.30	5.86	13.69	19.75	6.06

TABLE 10D

Differences in the Amount of Gain
on the WCTEM Test Exhibited by Students of Various Ability Levels
Grade 6

	CONTROL			SEED 1			SEED 2		
	MEAN			MEAN			MEAN		
	Pre	Post	Dif.	Pre	Post	Dif.	Pre	Post	Dif.
Upper 1/3	31.86	35.23	3.37	32.97	38.06	5.09	36.02	40.38	4.36
Middle 1/3	19.58	23.20	3.62	21.57	26.87	4.8	22.96	27.09	4.13
Lower 1/3	12.83	17.91	5.08	14.66	21.28	6.62	15.53	20.87	5.34

The Special SEED Mathematics Test

The Special SEED Mathematics Test has been described in a previous section of this report. Since it was designed especially for this evaluation project, the preliminary forms were tried out in a grade four class and a grade six class respectively. The data afforded from that administration were used in selecting the items comprising the present forms. The appropriate test form of the test was administered in October and again in April. The pretest scores were used as a covariate in the analysis. The pretest means are presented in Table 11. As can be seen from that display, slight initial differences did exist among the groups. The analysis of covariance technique accommodates initial differences that cannot be controlled experimentally.

The results of the Analysis of Covariance (which are based upon the adjusted posttest means) are reported in Table 12. The $SEED_2$ group for the third grade was <u>not</u> included in the analysis for reasons cited earlier. An examination of the adjusted means reveals that in grade three there is little difference between the control and $SEED_1$ groups. In grades four and five, the adjusted means for both SEED groups are higher than the means for the control group. However, in grade six, the adjusted mean on the posttest for the control group exceeds both the SEED group means. Table 13 presents the differences between the means. The differences were tested for significance using the Scheffé method of Multiple Comparisons following significant F tests. Asterisks indicate significance as the .05 level. Again, the results of the Special Mathematics Achievement Test are inconclusive in view of the results obtained in grade six. All groups in all grades scored higher on the posttest than on the pretest,

but the gain exhibited by the control group in grade six was larger than for either of the SEED groups at that grade level.

An attempt was made to determine if the SEED class students demonstrated an apparent advantage over the control classes on those items in the test covering topics emphasized in the SEED program. This was done by studying the percentage of students answering each item correctly in each group by grade levels. These data are given in their entirety in the Appendix. On the items dealing with exponentiation, the SEED students did somewhat better than the control.

The control students tended to do better in most cases where the item required the solution of a practical problem. It must be concluded that the students found this test difficult, as they did the WCTEM test discussed in the previous portion of this section of the report. (It should be noted that on the WCTEM Test the students involved in the project continue to perform at an achievement level below the population of three through six grade students in general.) Furthermore, even though the items in the Special Tests were constructed to minimize the amount of reading required, the items involving the reading of more than fifteen words were answered correctly a low percentage of the time. Table 14 presents a summary of the analysis by grade level.

The next part of this section treats the analysis of the FUN questionnaire data.

TABLE 11

PRETEST MEANS AND STANDARD DEVIATION
Special SEED Mathematics Test

Grade Level	Group	N***	Mean	Standard Deviation	Range*
3	Control	48	13.00	5.44	5-28
	$SEED_1$	75	13.69	4.42	5-26
	$SEED_2$	22	14.27	5.16	6-23
4	Control	175	15.14	5.89	3-30
	$SEED_1$	107	14.23	5.22	3-27
	$SEED_2$	90	18.91	6.11	5-30
5	Control	276	14.36	4.20	1-29 **
	$SEED_1$	267	14.28	4.02	6-33
	$SEED_2$	269	15.91	5.11	1-36
6	Control	329	16.23	5.14	1-33
	$SEED_1$	305	17.40	6.00	3-40
	$SEED_2$	212	18.48	5.96	6-43

*Test for Grades 3-4 contained 40 items
**Test for Grades 5-6 contained 50 items
***These N's represent all pretested students. The final analysis included only those students who took both pretest and posttest

TABLE 12

SPECIAL SEED MATHEMATICS TEST
Posttest Means and Adjusted Means

Grade Level	Group	N	Posttest Mean	Adjusted Mean	F
3	Control	41	16.24	16.51	n.s.
	$SEED_1$	57	16.26	16.10	n.s.
4	Control	139	18.84	* {19.12	6.34
	$SEED_1$	86	20.16	21.16} *	
	$SEED_2$	35	21.86	21.86	
5	Control	184	16.53	16.70	6.88
	$SEED_1$	195	16.82	17.55 *	
	$SEED_2$	227	19.17	18.40	
6	Control	232	20.02	* {20.93	8.42
	$SEED_1$	192	19.37	19.38} *	
	$SEED_2$	152	19.74	18.35	

$F_{.05} = 3.07$ df=2/120

*t Test Significant at .05 level

TABLE 13

SPECIAL MATHEMATICS ACHIEVEMENT TEST
Differences between Adjusted Posttest Means

Grade	$SEED_1$ versus Control	$SEED_2$ versus Control	$SEED_2$ versus $SEED_1$
3	0.41	($SEED_2$ data deleted)	
4	2.04	2.74	0.69
5	0.84	1.70	0.85
6	-1.55	-2.58	-1.03

TABLE 14

Percent of Correct Responses to Items
Containing More than Fifteen Words
in the Stem of the Question

		Item number on tests for grades 3 & 4				
		14	16	20	38	39
Grade 3	Control	34%	46%	45%	30%	24%
	$SEED_1$	31%	44%	38%	31%	35%
Grade 4	Control	48%	49%	61%	26%	30%
	$SEED_1$	42%	56%	55%	31%	31%
	$SEED_2$	57%	74%	83%	24%	40%

		Item number on tests for grades 5 & 6				
		30	31	40	41	45
Grade 5	Control	23%	8%	35%	20%	22%
	$SEED_1$	19%	10%	30%	18%	23%
	$SEED_2$	16%	11%	39%	17%	21%
Grade 6	Control	26%	17%	39%	14%	33%
	$SEED_1$	15%	10%	30%	12%	29%
	$SEED_2$	12%	7%	40%	14%	30%

FUN Analysis

The FUN Questionnaire was designed especially to assess interest and motivation in math and in other school subjects. The same instrument was used in both the pretest and posttest administration.

By grouping items, it was possible to derive four component scores as measures of interest and motivation. These components are identified as:

(1) interest in math

(2) interest in subjects other than math,

(3) math motivation, and

(4) motivation - general, i.e., an expression of motivation to engage in subjects other than math.

A method was developed for coding pretest-posttest score combinations to account for level of interest or motivation, i.e., favorable or unfavorable, and direction of change.* The pre- posttest scores were then tabulated as (1) unfavorable pretest - unfavorable posttest (2) unfavorable pretest - favorable posttest, (3) favorable pretest - unfavorable posttest, and (4) favorable pretest- favorable posttest for each of the four component measures of interest and motivation. Comparisons among experimental and control groups on the paired scores for each component resulted in 3x4 contingency. The Chi-square test was applied to the tabulated data.

In the third grade, the distributions of paired pretest-posttest scores for the control and SEED groups were significantly different on the component math motivation. ($SEED_2$ students were deleted from analyses as explained earlier.) More control students indicated an unfavorable

*In the present instance, a "favorable" rating was achieved by responding in the "favorable" direction for at least three of the five items on each component score.

motivation for math for both the pretest and the posttest. Conversely, more SEED students indicated a favorable motivation for math for both the pretest and posttest. The Chi-squares for the other three components were not significant.

In grade four, a larger proportion of $SEED_1$ students expressed favorable interest in math both in the pretest and posttest than did the control or $SEED_2$ students. At the same time, smaller proportions of students changed their expressions of "favorableness" in interest in math. In terms of motivation in general, larger proportions of $SEED_1$ and $SEED_2$ students than control students changed from favorable motivation in the pretest to unfavorable motivation in the posttest. This is contrary to the expectations of the SEED program. The test of significance for interest other than math and math motivation did not yield any significant findings.

None of the tests of significance for the four components for grade five reached acceptable levels of significance; however, those for two components for grade six did. In grade six larger proportions of the $SEED_1$ and $SEED_2$ students (than their corresponding controls) changed from favorable interests other than math to unfavorable interests. Again, the change is contrary to the expectations of the program. As for math motivation, a larger proportion of the $SEED_2$ students compared to $SEED_1$ and controls changed from favorable math motivation in the pretest to unfavorable motivation in the posttest. Again the change is opposite to the expectations of the program. On the other hand, a larger proportion of control students changed from unfavorable math motivation in the pretest to favorable motivation in the posttest. The Chi-square test for the other two components did not yield significant relationships.

In general, the results of the FUN questionnaire when analyzed in terms of two measures of interest and two measures of motivation did not show any distinct association of increased interest and/or motivation with the experimental treatment. In fact, portions of the data suggested a decline in interest/motivation associated with the experimental treatment.

TABLE 15

Summary of Chi-Square Analysis
Changes in Student Responses (Pre-Post) on the FUN Questionnaire

GRADE	INTEREST IN MATH	INTEREST OTHER THAN MATH	MATH MOTIVATION	MOTIVATION GENERAL
3	2.83	2.89	UU UF FU FF C=14 9 9 7 S1= 5 11 16 23 S2=Void x^2=12.60*	.18
4	UU UF FU FF C=37 28 32 42 S1=14 12 10 42 S2=10 18 11 18 x^2=17.42*	7.69	10.91	UU UF FU FF C=20 25 29 65 S1= 7 7 18 46 S2=14 9 16 18 x^2=14.32*
5	8.67	3.51	10.35	6.21
6	8.80	UU UF FU FF C=16 22 18 152 S1=21 6 26 150 S2= 8 13 34 120 x^2=21.44*	UU UF FU FF C=55 52 26 78 S1=58 43 36 66 S2=69 18 28 61 x^2=19.62*	7.66

KEY:

* Indicates the significance at the .05 level

Pretest		Posttest	
Unfavorable	-	Unfavorable	= UU
Unfavorable	-	Favorable	= UF
Favorable	-	Unfavorable	= FU
Favorable	-	Favorable	= FF

C=Control
S1=SEED 1
S2=SEED 2

IOX Analysis

The IOX Self Appraisal Inventory (IOX) described earlier was used as a measure of self image. The same forms were used in both the pretest and posttest administrations. In scoring, only the general scale was used. The test publishers did not establish norms for the inventory so interpretations based on absolute scores are not appropriate. However, the mean performance of the various groups is summarized in Table 17. A review of Table 17 reveals no substantial differences. The primary consideration was change in self concept or self image during the 1973-74 school year. The pretest and posttest scores of each student were matched and tabulated according to these categories: (1) posttest less than pretest, (2) posttest greater than pretest, and (3) posttest equal to pretest. These tabulations are shown in Table 16.

TABLE 16

		less than (-)	greater than (+)	equal (0)	
Grade 3	Control	17	20	3	
	$SEED_1$	28	20	10	
	$SEED_2$	Deleted from analysis			
Grade 4	Control	49	61	16	
	$SEED_1$	30	34	15	
	$SEED_2$	20	23	11	
Grade 5	Control	60	93	26	$p < .01$
	$SEED_1$	75	89	15	
	$SEED_2$	77	122	33	$p < .01$
Grade 6	Control	63	100	32	$p < .01$
	$SEED_1$	76	99	22	
	$SEED_2$	67	71	28	

Frequencies of students whose IOX posttest scores were less than (-), more than (+) or equal to (0) their pretest scores

TABLE 17
Summary of Student Performance on the IOX
By Grade and Treatment
1973-74

		CONTROL			SEED 1			SEED 2		
		Mean	Median	Range	Mean	Median	Range	Mean	Median	Range
GRADE 3 (Maximum 9)		n= 40			n= 58			n= 17		
	Pre	6.38	7	3 - 9	6.53	7	3 - 9	6.00	7	1 - 8
	Post	6.53	7	2 9	6.40	7	1 9	5.58	5.5	2 9
	Difference	+.15			-.13			-.42		
GRADE 4 (Maximum 19)		n=126			n= 79			n= 54		
	Pre	12.52	13	3 - 18	12.96	13.5	5 - 19	11.89	13	5 - 19
	Post	12.88	14	3 - 19	12.54	13	5 - 19	12.57	13.5	5 - 19
	Difference	+.36			-.42			+.68		
GRADE 5 (Maximum 19)		n=179			n=179			n=232		
	Pre	12.78	13.5	3 - 19	11.98	12.5	3 - 19	12.76	13	4 - 19
	Post	13.33	14.5	2 - 19	12.28	12	3 - 19	13.47	15	2 - 19
	Difference	+.55			+.30			+.71		
GRADE 6 (Maximum 19)		n=195			n=197			n=166		
	Pre	13.43	14	4 - 19	13.49	14.5	3 - 19	13.36	14	1 - 19
	Post	14.04	14	4 - 19	13.63	14.5	3 - 19	13.38	14	2 - 19
	Difference	+.61			+.14			+.02		

The tabulations for each group within each grade level were tested for significance using the Sign Test. The numbers of students whose post-test scores were greater than their pretest scores were found to be significant for the two control groups in grades five and six. The $SEED_2$ group in grade five was the only experimental group yielding a significant change. This change was in the appropriate direction. With the single exception, then, the experimental treatment did not appear to result in a significant change in self image or self concept as measured by the IOX.

VI

EVALUATION OF INSERVICE TRAINING

Project Inservice Training

Inservice training was identified as taking place under two conditions. Teachers, by virtue of their presence and participation in the classroom during the SEED class, four class periods per week, were receiving inservice training. In the other condition, the fifth SEED class period per week, or its equivalent, was to be devoted entirely to inservice training for the participating classroom teachers. The latter condition was the target for the evaluation in which a survey strategy was employed.

In general, teachers usually regard the purpose of the inservice training as helping them to do a better job. How these improvements are to be reflected in specific performances and behaviors, however, are rarely identified. The evaluation of the inservice training of the SEED Project was problematical for this very reason, i.e., the behavioral objectives for the training were not specified, nor were appropriate objectives readily discernible from inquiries of the evaluators or California State Office of Education personnel. Our approach to the evaluation of the inservice component, then, is to display the training in some detail, determine some perceived objectives and to present some measure of effectiveness through responses from the teachers to questions concerning the relevance of materials covered, their judgment of their ability to conduct a SEED class, and their judgments of the training staff. The two primary sources of information were: (a) a questionnaire completed by teachers covering the training for a predetermined four-week period, and (b) site visit interviews with teachers in which questionnaire information was confirmed and more extensive explorations into the purpose and effectiveness of the training were made.

The 51 participating classroom teachers were randomly assigned to one of three groups. A letter and questionnaire (Exhibit B) were sent to first group of teachers for the four-week periods, November 5-30, 1973, and February 4-March 1, 1974. Similar materials were sent to the second group for the four-week periods of December 3, 1973-January 4, 1974, and March 4-29, 1974, and to the third group for the periods January 7-February 1, 1974, and April 1-26, 1974. The sampling was completed in this manner so as not to impose extensively on the teachers' time, and yet, to obtain an adequate sample of the training for the entire school year.

Approximately ten days following the completion of a four-week interval, follow-up letters requesting the return of the completed questionnaires were sent to the teachers. This effort entailed some record keeping and additional mailing, however, the effort appeared to be instrumental in encouraging returns. The site visitors also reinforced the value of the returned questionnaires.

Return of Questionnaires

The return of questionnaires for each of the six four-week periods was as follows:

PERIOD	# RESPONDING
11/5-30/73	13 of 17
12/3/73-1/4/74	16 of 17
1/7/74-2/1/74	15 of 17
2/4/74-3/1/74	11 of 17
3/4/74-3/29/74	13 of 16
4/1/74-4/26/74	10 of 16

This represents a return of 78% of all questionnaires that were sent. The less than 100% response is in part accounted for by the fact that one of the teachers ultimately did not participate in the SEED program. In another, the teacher was changed mid-year in the program without notice to the evaluators. In a third class, the teacher responded that since she had participated the previous year, and since she was exceptionally busy with other matters, the inservice was sacrificed. Finally, in a fourth class, it was reported by the current teacher that by April 1, the class had had 10 to 12 different teachers since school started. The change of teachers was not reported to the evaluators.

It should be pointed out that where tabulations of data are used to present the findings, the number of responses for each tabulation may vary since some teachers did not respond to each item on the questionnaire.

Frequency of Training Sessions

In most instances, the inservice training was scheduled for one period per week. The one exception was the method employed in one school district in which two two-hour sessions were held every other week. Table 18 shows the frequencies of inservice training sessions reported by respondents for each four-week period (identified simply as first through sixth week period), and total number of sessions:

TABLE 18

Frequencies of Reported Training Sessions for Each of Six (Four-Week) Periods

NUMBER OF SESSIONS	FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH
1	0	1	0	1	2	1
2	2	5	2	2	3	1
3	4	7	2	0	0	7
4	4	3	9	8	7	1
5	0					
6	1					
n=	11	16	13	11	12	10
TOTAL SESSIONS:	38	44	46	33	36	28

The average of less than four sessions per teacher per four-week period was largely attributed to holidays, special school events (e.g., parent-teacher conferences, special programs), and in some instances, illness. The duration of the sessions ranged from 20 minutes for a few classes to two hours. The shorter sessions were sometimes held twice a week. Most of the sessions, however, were from 40 to 60 minutes in duration with an average of slightly over 50 minutes per session. (The two-hour sessions were treated as one-hour sessions, four times per month.)

Except for three instances where SEED classroom teachers held their inservice sessions together, there were very few inservice sessions in which personnel other than the SEED classroom teacher and perhaps the teacher aide

were in attendance. On occasion, other teachers, student teachers, principals and/or other SEED specialists would be in attendance.

Location of Training

The time of the inservice training frequently dictated where the sessions were held. Several teachers consistently reported sessions held during or near lunch period. These were generally held in the cafeteria, teachers' lounge, or in several instances, the teachers' classrooms. Most of the sessions, however, were usually scheduled before school, during class periods or after school and were usually held in the teachers' classrooms. A large number of teachers indicated that the blackboard was used in most sessions. The constancy of the time period from week to week and for the two four-week intervals for the same teacher seemed to indicate that the inservice training was a regularly scheduled activity for most teachers.

Content of Training Sessions

In about half the sessions, both the teachers and SEED specialist jointly determined the topics for the inservice sessions. On several occasions, the teachers indicated that they suggested topics. Topics for discussion were selected by the specialist slightly less than half the time. The topics selected by the specialist tended to deal largely with particular math concepts--working out math problems. Those in which the teachers indicated that both parties agreed on the topics, tended to deal with teaching methods together with math concepts, i.e., approaches to teaching and presenting particular math concepts, and the relation of SEED to regular math. Apparently, most of the time was spent on these topics with an occasional discussion of class problems, e.g., class motivation, individual student problems, or other classroom management issues. The one-on-one training sessions were generally open discussions or tutorial sessions between the two participants. The group sessions

tended to be more lecture or workshop type sessions in which two or three SEED specialists participated.

From the array of topics covered in the inservice training sessions and the comments made by the teachers in responding to the survey, it did not appear that a planned program for inservice training was being followed. Throughout the evaluation, no mention was made by any teacher or specialist of an inservice training curriculum or guide.

Appropriateness of the Training

To determine the appropriateness of the inservice training, the teachers were asked, "did the inservice sessions deal with something you want to apply to your classroom?" Table 19 shows the frequencies of the three possible responses for each of the six four-week sessions.

TABLE 19

Relevance to Application in Classroom
(Frequencies for Periods)

RESPONSE	FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH
Yes	31	32	37	27		
No	4	2	5	5		

*Teachers responded for each session, therefore, total is larger than number of respondents. Also, teachers did not respond for every session or write in other comments, so the total does not equal the number of sessions held each period.

The responses seem to indicate that the training sessions dealt with something the teachers wanted to apply in their classrooms.

Another index of appropriateness was the extent to which the inservice training dealt with teacher deficiencies or needs. Teachers were asked, "indicate the extent to which the session(s) was related to one of your need areas," by using a five-point rating scale. Table 20 shows the frequencies

of ratings for each of the six four-week periods (1 representing little or no relation, 3 moderate relation and 5 very much relation.)

TABLE 20

Frequencies for Ratings in Relation to Teacher Needs

RATING	FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH
5	8	19	21	13	20	15
4	11	12	9	12	10	8
3	7	7	10	8	5	2
2	1	1	2	1	0	1
1	1	0	2	1	0	0
TOTAL*	28	39	44	31	35	26

* Teachers responded for each session, therefore, the total is larger than the number of respondents. Also, teachers did not respond for every session or write in comments, so the total does not equal the number of sessions held.

With few exceptions, the inservice training sessions tended to be judged at least moderately or more related to the teachers' need areas. In general, this is supported by the observation that during the site visit observations and interviews, most teachers confessed a weakness in mathematics, and that the training sessions helped them to understand better what the SEED specialist was trying to accomplish in the classroom.

During the site visits, the teachers were asked several questions about the inservice training. The purpose was to determine the arrangements of the sessions largely to verify responses to the inservice survey form, perceived intentions of the training and the extent to which the sessions addressed and met the intentions.

The key points of the arrangements were duration and frequency/regularity. In general, these points were verified at least for those teachers who were interviewed, except in one instance. In response to the survey form, the teacher who had indicated that she could not participate in the inservice

training was found to be meeting regularly with the SEED specialist during lunch; thus, each teacher who was questioned indicated that inservice sessions were held regularly. Although teachers other than the SEED classroom teachers were not prohibited from participating, they were not always encouraged to do so, therefore, few did.

Several SEED specialists were queried regarding their perceptions of the purpose of the inservice training. Following are some examples: "to relate SEED math to the State requirements and to that of the regular classroom teacher," "to help the teacher understand the program better," "to teach teachers the mathematical concepts and teaching strategies," "to orient teachers on the plan for the next week," "to teach other teachers," and "to teach contemporary mathematics to the teachers." The responses of the teachers, in turn, generally corresponded to those of the specialists, i.e., the purpose was "to coordinate SEED with their regular math," "to gain a better understanding of SEED," "to be familiar with the plan for the week," and "to gain some experience with the mathematical concepts." To the extent that the sessions dealt with these circumstantial needs, they were relevant.

When asked for their comments or impressions of the training the teachers generally spoke quite favorably to very favorably of the training. Several teachers used terms such as "excellent," "very satisfied," and "would not miss it." On the other hand, one teacher indicated that the training was probably worthwhile; however, it used up her free period which was usually devoted to other pressing matters. The evaluator is unable to interpret this as being favorable or unfavorable.

Summary of Evaluation of SEED Inservice Training

Attempts by the evaluators to identify previously determined behavioral objectives of the inservice training were fruitless. The specifications were simply stated as instructional process objectives indicating the conditions of training rather than outcomes. Given these circumstances, the evaluators approached the task by providing a description of the inservice training, determining some perceived objectives, and providing indices of effectiveness in terms of relevance and need fulfillment.

A sampling procedure was used in a time-series design to obtain information via a written questionnaire. In addition, a structured interview and site visit observations were conducted to verify portions of the questionnaire data, and to obtain additional information. Ultimately, all teachers participated in the written survey of inservice training and approximately half of them were interviewed during the site visits.

Training Schedule

Training sessions were held by SEED specialists with individual teachers. These sessions were generally scheduled (and held) on a regular basis. Holidays, special events, etc., accounted for the average of slightly less than four training sessions per four-week intervals. The average duration of the session was about 50 minutes. With few exceptions, the training sessions were attended only by the regular SEED classroom teachers.

Training Topics

In one sense, the teacher training activities paralleled the SEED classroom activities; that is, there appeared to be no defined training curriculum and no

training manual was evidenced by the evaluators. In general, the participants utilized the training session to cover relatively specific math concepts, i.e., worked math problems together for the purpose of orienting the teacher on materials being covered, or to be covered, in the classroom. Occasionally, problems in the management of the classroom and student problems were discussed. To the extent that the orientation was to facilitate the teachers' participation in the classroom, the training was viewed as directed toward a desirable need. Several teachers reported that they attempted to incorporate some ideas into their regular math and other classes, however, they apparently were not urged to do so. With very few exceptions, the inservice training sessions were considered favorably by the teachers.

Training Effectiveness

If one takes the view that the purpose of the inservice training was to enable the teachers to conduct the SEED classes themselves, one would have to conclude that the training did not achieve this purpose. Information provided elsewhere indicates that few, if any, teachers possessed the necessary skills, e.g., capabilities in math and the teaching technique, to conduct the class according to the established procedures for an entire school year. This finding is especially noteworthy in that the present year represents the second year that the SEED program has operated in some of the schools. This, in turn, implies that subsequent operation of the SEED program may continue to be primarily reliant upon the use of SEED specialists rather than upon classroom teachers.

VII

FEASIBILITY OF IMPLEMENTING THE SEED PROGRAM ON A STATEWIDE BASIS

In the present section of the report, the issue of implementing the SEED Program on a statewide basis is considered. In dealing with this topic, the NWREL evaluation team addressed a series of topics which appear to have a direct bearing upon the feasibility issue; thus, in the present section, a series of topics and/or germane questions are raised and an analysis of each is provided.

The Level of Abstraction

One of the features of SEED Mathematics that stands out when compared to the mathematics typically taught in grades three through six is the level of abstraction. Mathematics, per se, is abstract and the application of the concepts is of little concern to the pure mathematician. This does not resolve the perennial dilemma of elementary educators with regard to the issue of what is the appropriate level of abstraction. In other words, should mathematics instruction beginning in grade three emphasize abstract mathematical concepts or should the principal thrust be on the fundamental operations using concrete examples from the student's immediate environment? Obviously, if the child can acquire proficiency in the basic arithmetic skills and at the same time understand the abstract concepts of mathematics which underlie the basic skills, so much the better.

One of the principal goals of the SEED evaluation program was to investigate the extent to which these things could be accomplished simultaneously through SEED.

Direction of Mathematics Instruction

It should be noted that there is not complete accord among mathematics educators or mathematicians as to the appropriate direction mathematics instruction should take. The so called "new" mathematics programs which became dominant in the late 50's and the 60's was an attempt to make mathematics instruction somewhat more rigorous (from a mathematics point of view) than the basic arithmetic programs had been. At this time, there is some evidence that ability in basic skills was not enhanced through this approach and perhaps even diminished under these new math programs. Research in this area is handicapped by the difficulty of exercising control over many of the variables which may be salient factors in the student's achievement. Similar difficulties were encountered in the SEED evaluation project.

SEED Specialist Availability

One feature of the SEED Program which makes it unique in comparison to other mathematics instructional programs, such as SMSG, is the SEED Specialist. The requirement that the SEED Specialist be a mathematician first and then trained to teach in SEED is certainly in contrast to the typical elementary teacher. The latter is not a trained mathematician, and in most cases, has a minimal amount of training in mathematics. Mathematics majors on most university or college campuses are few in number and constitute a very small percentage of the total student

population. Schools such as Cal Tech or MIT represent exceptions to this rule. Therefore, another of the obvious questions with respect to the feasibility of instituting SEED statewide, or even districtwide, is the availability of qualified personnel to service the SEED Program. From both observation of SEED classes and discussions with the classroom teachers, it is highly improbable the typical elementary classroom teacher could be "tooled up" to handle a SEED class without a large amount of advanced training in mathematics. Only nine of 42 regular teachers surveyed at the time of posttesting felt they had sufficient knowledge and experience to handle a SEED teaching situation independently. This still leaves unanswered the question: How many classroom teachers are motivated to study mathematics to the extent essential to handle SEED-type mathematics instruction?

Amount of Mathematics Desireable

For the moment, suppose it were possible to find enough mathematics specialists to service every third through sixth elementary classroom in the State of California. In view of what was said previously with respect to the high level of abstraction of SEED mathematics, the question must be raised: How much abstract mathematics does every child need to know? The writer of this section considers himself to have a reasonable degree of proficiency in mathematics and has made his living for over 25 years teaching mathematics and applied mathematics. He would think it was great if every student completed the calculus before leaving the secondary school. Out of fairness, and the desire to maintain a degree of objectivity, however, he would consider that idea of questionable merit and an unproductive

enterprise for many students. In fact, only a small percentage of the total student population could either handle that much mathematics or benefit from it. The SEED Program teaches sound mathematical principles in an exciting manner. But again, does every student need it: could their time be more profitably spent doing something else; and, is anything essential in the educational development of the child being lost through the extra time spent in SEED? These are additional questions which deserve consideration and require answers before expansion of the SEED program takes place.

Scope and Sequence of SEED

Still another factor that must be given thought when thinking in terms of feasibility of expanding SEED is the scope and sequence of the SEED Program itself. Based upon our experience, it appears that the SEED staff operates according to the premise that any topic in Algebra is worth teaching and is equal in transfer value and generalizability. Up to this point in time, there is not in hard copy a unified curricular plan for the SEED Program. A Chapter IV, dated 1971, is available but Chapters I-III and V, VI, etc., have not been located by the evaluation team. It would be the hope of the evaluators of the program that a more complete set of plans for SEED would be prepared prior to any instructional agency embarking upon a more ambitious program than those discussed in this report. From classroom observations in the four school districts in which SEED was operative during 1973-74, there was a common thread evident in the instruction and across grades. It was impossible for this observer to make a clear distinction, contentwise, of the instruction at the different grade levels.

Quality of Student Participation:

Related to the scope and sequence issue is the matter of student participation. The students' participation is limited largely to oral response to questions raised by the instructor. The evaluators observed nearly one-half of the SEED classes. In these classes, the students, in unison, expressed approval or disapproval of what the SEED specialists said or wrote on the blackboard by means of hand signals.

On the surface, the amount of student participation seemed greater in the SEED class than in more conventional class situations. However, the evaluators noted that while nearly every SEED classroom student responded by giving the hand signals, for some students the responses appeared to be simply a mimicking of the majority. In fact, a teacher who did not elect to participate in the program the second year reported, "Many students merely mimicked the actions of their classmates and did not bother to think what they were doing." This observation is supported in part by a "reaching for" response or sometimes a lack of response, when students are called upon to correct a calculation error made by the SEED specialist in working the problem on the board or to provide an answer to a question. The lack of a response does not necessarily indicate that the student did not distinguish an error, but the lack of a response to a question to which the student had raised his hand seems to indicate a mimicking. This behavior was observed in several instances.

When the specialist seeks responses, usually several students, the classroom teacher, and/or even a visitor, may be called upon to respond. In this context, incorrect answers are not reinforced negatively. In fact, SEED personnel stated that incorrect answers were frequently pursued to determine if the student's incorrect response was logical, i.e., to determine

"where the student was coming from." The apparent purpose of this pursuit is to reinforce the students' "thought processes." On the other hand, very little (in fact, almost none) written work was being done and the only written evidence of value available which indicated the students' ability to solve mathematical problems independently were the test scores attained through the evaluation process.

Will students be able to maintain an interest in oral participation over the long run without experiencing the satisfaction of being able to work out solutions to problems on paper in a systematic and orderly manner? It has been the writer's observation that not until a student demonstrates this ability to himself/herself, does he/she feel progress and a sense of accomplishment. It may be that the old adage "talk is cheap" should be amended to read, "talk is cheap and not very rewarding in and of itself." Using the latter as a premise, the rewards from participation in the SEED Program in grades three through six may prove shallow in the long run of events.

Understandably, the advocates and originators of SEED were and are interested in finding means of maintaining and sustaining interest in mathematics, especially for those students with limited reading skills. This is a commendable goal and cannot be discounted or denigrated. However, at some point in time the novelty of participation in oral exercises may tarnish. What do the founders of SEED propose take place beyond the sixth grade? What happens to a former SEED student in the seventh grade? Are there plans to extend the SEED idea or to incorporate the idea into the junior high or middle school mathematics activity?

Previous Research Findings

Project SEED has been in operation for about 10 years. Claims are made that SEED classrooms existed from coast to coast. Many have been in operation in California in previous years. A number of newspaper, magazine, and journal articles report a variety of anecdotes and descriptions of observations extolling the virtues of SEED. Some research has been done. The Miller Mathematics Improvement Program which included the Mathematics Specialist Project, currently known as SEED, was conducted in 1968-70. Students in five ethnic classifications in grades 2, 3, 5, and 6 were included. Five measures of math achievement were used. The results generally favored the experimental group (i.e., SEED students) over their counterparts in control classes.

Another study in the Berkeley Unified School District (1967), involved 13 students and a matching group of controls. The study followed the students as they advanced from the fourth through the sixth grade. The results showed an increase in the mean IQ score of the experimental group, while that of the controls remained unchanged during the period of the study. A measure of reading achievement was also included. No difference in the gains in reading achievement were noted. Generalizations from such a small number of cases must be made with extreme caution, if at all.

More recently, Project SEED was implemented in selected elementary schools in the State of Michigan during the 1970-71 school year. Classes in grades three through six were included. Comparisons of SEED and control groups on total arithmetic achievement test grade equivalent scores (Comprehensive Test of Basic Skills - Arithmetic Total Score) showed the means of the experimental groups (i.e., SEED classes) to be higher for all grade

levels, but only those of the fourth and fifth grades reached the accepted level of significance. The research design for the study did not include a pretest. Comparability of the groups was based only on age and sex, so comparability in terms of initial math achievement was questionable.

Other findings of the Michigan program showed no difference between SEED and control groups in their expressed preference for arithmetic-mathematics. Similarly no consistent group differences were found in their expressed preferences for seven other school subjects. The subjective responses of students, teachers, and principals who participated in the Michigan program were obtained to a number of items in questionnaires. In general, the responses were favorable to the SEED program.

Finally, a report entitled "Review of Some Project SEED Activities fo the New York City Board of Education by the Mathematics Education in the Inner-City" deserves some mention. The report was highly critical of a promotional film produced by SEED. The name "National Council of Teachers of Mathematics" was superimposed on the film giving the impression that the Council endorsed the SEED Project. Also some editing practices were found to be "alien to strict decorum."

The same study reported that several classroom incidents and a number of issues were raised and discussed, each somewhat critical of Project SEED. In addition, the lack of a curriculum guide, syllabus, or SEED instructor's manual would seem to detract from the replicability of the program from year to year, to say nothing of the sequencing of material. The Michigan study reported no syllabus of topics was provided for the SEED instructors. They tended to develop their own topics.

The studies cited above shed some light on the feasibility of SEED,

but the results are inconclusive and imply additional study of the issues is essential.

Costs and Benefits Considerations

The amount budgeted for the continuation of 70 classes (20 classes not included in the present study), excluding funds allocated for evaluation, was approximately $315,000. The average cost for the 70 classes was $4,500—the maximum amount specified per class in Assembly Bill No. 1644. With the estimate of 30 students per class, the cost is approximately $150 per student for the four units of instruction per week.

Another "cost" is the time which might have been devoted to other subjects. SEED instruction represents an addition to the regular math class, and, therefore, time had to be taken from other subjects to provide SEED. During the site visits, the evaluators did not find any compensations for time, e.g., extended school day, shortened lunch or break periods. Each teacher used his or her own system in obtaining time for SEED. Teachers used a variety of arrangements varying from occasionally substituting an entire class period for SEED to shortening two or more subjects by a sufficient amount of time to allow for a full period of SEED instruction. The number of variations made it impractical, if not impossible, to determine at what cost to other subjects SEED instruction was implemented.

The benefits, on the other hand, do not appear dramatic. Measures of interest and motivation in school subjects including math did not show appreciable benefits attributable to SEED. Similarly, the measure of self-concept failed to show any experimental effect. Some gains in mathematics ability which is reasonably attributable to SEED instruction were noted largely for $SEED_2$ students, i.e., those who were in the program for over two

successive school years. The gains in math ability for students who were in the program for only the current school year were not significantly different from those of their corresponding control students. An item analysis showed that the superiority in math ability of the SEED students appeared to be in modern math items which were stressed in the SEED instruction and relatively untouched in the control classes. A question that remains is "Do the benefits in math ability justify the cost?"

To summarize, the feasibility of continuation of the SEED Program or its expansion raises several issues some of which have been addressed above. They were: 1) the level of abstraction; 2) the direction of math instruction; 3) the SEED teacher supply; 4) the need of elementary students for mathematics of the SEED variety; 5) the unknown aspects of the scope and sequence of SEED; 6) the uni-dimensional mode of student participation in the SEED Program and its long-range holding powers; 7) previous research findings, and 8) cost-benefit considerations. It is our recommendation that these issues be considered in detail before the present program is expanded.

VIII

SUMMARY COMMENTS AND CONCLUSIONS

Summary and Conclusions

The Northwest Regional Educational Laboratory has attempted to meet its contractual obligations through the procedures described in the foregoing sections of this report. Six issues in particular received concentrated attention from the NWREL evaluation team. Specifically, the six areas are: student performance in four domains, the issue of staff training and the questions surrounding the implementation of SEED procedures on a broad basis.

In the area of student performance, the thrust of the evaluation effort was to obtain data that would permit comparisons between students in the SEED mathematics program and comparable students in regular mathematics classes on each of the four domains.

Throughout the 1973-74 school year, members of the NWREL evaluation team monitored both SEED and control classes and subsequently collected and analyzed the resultant information. The principal findings from the analyses of the student performance data were:

1. Students in SEED classes generally did as well or better than students in control classes on the WCTEM. However, the only significant differences detected between $SEED_1$ and control were in grade six.
2. An analysis of covariance of the Special SEED Mathematics Tests indicated the SEED students did as well as or better than their control counterparts in all grades except grade six. In the latter grade, the situation was reversed.

3. Students in both the SEED and control classes performed below the average of students in the general population in the same grades on the WCTEM (Wisconsin Contemporary Test of Elementary Mathematics).

4. Analysis of the performance of subgroups of children (i.e., grouped according to initial level of abilities) revealed that students who performed in the lower one-third initially tended to ma the largest gains; this was true of both SEED and control students.

5. There was no consistent pattern in the responses of either the SEED or control groups with respect to their:

   a) interest in math,
   b) interest in subjects other than math,
   c) motivation for mathematics, and
   d) motivation in general,

   as revealed by the responses to the FUN Questionnaire.

6. The self-concept as measured by the IOX Self-Appraisal Inventory increased from the pretest to posttest for the control group in the fifth and sixth grades and the $SEED_2$ group in grade five. The Sign Test yielded significant results in those instances.

7. The regular classroom teachers in the SEED classrooms approve of the SEED program. This is an understandable outcome because they volunteered to participate. No apparent disenchantment developed during the course of the year.

8. Relative to SEED training efforts, two items should be noted: (a) The SEED staff regularly provided training sessions; however, (b) only nine of 42 respondent teachers, after one or more years of inservice training considered themselves adequately prepared to conduct a SEED class with no assistance.

9. The SEED classes observed by the NWREL evaluation team members were engaged in the study of mathematics. The classes were conducted in a professional manner and the students on the whole were receptive to the instruction.

In summary; the evidence afforded by the instruments employed in the evaluation is not dramatic either in support of SEED nor in negating the SEED program. The SEED students achieved as well as the control students, and, in most instances, somewhat better, but not always significantly.

Limitations of the Evaluation

The current evaluation project encountered problems which are expected whenever field work is undertaken. In the first place, it would have been desireable to be able to simulate an experimental setting. To do so would have required the authority to assign classrooms on a random basis in each of the districts to either the experimental or control condition. Teachers who volunteer their classrooms for an experimental project are often the more enthusiastic and interested teachers and hence results must be questioned for spuriousness due to that factor. Whether or not this occurred in the present instance cannot be answered but the reader should be alerted to this feature.

Another factor which hindered the evaluation of the project in the opinion of the NWREL team members was the lack of a syllabus for the SEED program. It made the construction of a test that would be fair and appropriate to both the control and experimental students as well as to the curriculum extremely difficult. Without an improved and better-defined

curricular plan for SEED, future evaluation of it will be handicapped because the observers will have difficulty in determining the aims and direction of the program which are essential to any assessment process.

It was also unfortunate that the question of achievement per unit of time of SEED versus control could not be investigated. To do this would have required SEED mathematics only be taught in certain classes five days a week just as regular mathematics. Would the basic skills of such a program as the more conventional approach seems to be a reasonable question that remains unanswered at this writing.

This study, as all others which require an attempt to study interest, motivation, and self-concept had to make do knowingly with less than the ideal measuring instrument. This is not an apology for what was used, but rather a reminder to the reader of the report that measurement in these areas is still in its infancy; adulthood may be a long time in the future. In defense of the instruments, it can be said that they were easily administered, as direct questions which were understood by the students and the results were properly handled in the opinion of the staff.

Concluding Statements

The SEED program must be commended for its dedication in teaching sound mathematical principles and concepts to disadvantaged youth. The personnel are enthusiastic, evidence some uniform training as well as, in most instances, competencey in mathematics. It is the conclusion of the evaluation team that most elementary teachers are at this point in time not equipped to teach the caliber of mathematics of SEED.

From the results of the mathematics achievement tests it is apparent that the population of the classes in which SEED is operative have a large

deficit in mathematics to overcome. Will a "double dose" of mathematics do the trick, or will it require double doses of reading, spelling, and writing?

With regard to reading, it would seem appropriate for the SEED program to try out a modified scheme to the present, strictly oral approach. The alternate plan could use some written materials and also supplementary-assigned written work. Under the present program, there is nothing the child can hold as tangible evidence of achievement or progress. Of course, the modified plan would require careful planning study and evaluation.

The NWREL evaluation team is empathetic to the aims of the SEED program and supportive of the State of California's interest in seeking fair and impartial assessment. New programs need to be tried and investigated and compared on as rigorous schedule as possible. Through such a process, education can advance.

END OF REPORT

APPENDIX

ITEM ANALYSIS OF THE SPECIAL SEED MATHEMATICS ACHIEVEMENT TEST

The data in Exhibit A indicates the difficulty level of each item on the Special Mathematics Achievement Test. The difficulty index (a proportion) is based upon (a) the number of students who attempted each item, and (b) the number of students who responded correctly to each item.

SPECIAL MATHEMATICS ACHIEVEMENT TEST - GRADES 3 AND 4
1973 - 74

1. 4 + 3 is the same as

   a) 3 x 4

   b) 3 + 4

   c) 3 ÷ 4

   d) 4 - 3

2. 8 + (5 +2) = 10 is

   a) a closed sentence which is false

   b) a closed sentence which is true

   c) an open sentence

   d) none of these

3. To make 5 + ☐ = 0, a true sentence

   a) ☐ = 0

   b) ☐ = 1

   c) ☐ = +5

   d) ☐ = -5

4. 17 + 9 =

   a) 8

   b) 16

   c) 25

   d) none of these

5. 15 - 11 - 4 = ?

   a) OMIT 15

   c) 26

   d) 30

Grade/Test		C	S1	S2
3	Pre	.87	.82	*
	Post	.83	.84	
4	Pre	.84	.73	
	Post	.85	.87	.97
3	Pre	.28	.35	
	Post	.49	.37	
4	Pre	.36	.57	
	Post	.43	.60	.77
3	Pre	.44	.34	
	Post	.44	.45	
4	Pre	.38	.46	
	Post	.36	.61	.74
3	Pre	.57	.45	
	Post	.68	.67	
4	Pre	.54	.55	
	Post	.75	.69	.66

* In the pretest analyses, SEED 1 and SEED 2 data were combined

6. $7 + (4 + 12)$ is the same as

a) $7 \times (4 + 12)$

b) $(7 + 4) + 12$

c) $(7 + 4) \times 12$

d) $(7 + 4) + (7 + 12)$

Grade/Test	C	S1	S2
3 Pre	.33	.44	
Post	.59	.55	
4 Pre	.58	.54	
Post	.68	.71	.83

7. $(34 + 6) + (14 + 10) =$

a) 64

b) 40

c) 24

d) none of these

3 Pre	.34	.48	
Post	.46	.47	
4 Pre	.57	.53	
Post	.63	.64	.77

8. $\begin{array}{r} 138 \\ +92 \\ \hline ? \end{array}$

a) 98

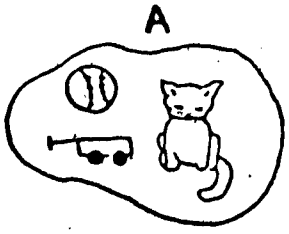
b) 130

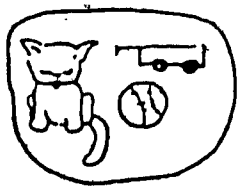
c) 230

d) none of these

3 Pre	.44	.51	
Post	.54	.46	
4 Pre	.50	.52	
Post	.65	.75	.79

9. The sets shown are called





a) equivalent sets

b) equal sets

c) empty sets

d) disjoint sets

3 Pre	.33	.35	
Post	.59	.41	
4 Pre	.52	.42	
Post	.60	.48	.51

10. In example 9 above n (A) is equal to

a) 0

b) 3

c) 6

d) none of these

3 Pre	.30	.21	
Post	.33	.14	
4 Pre	.33	.30	
Post	.38	.43	.51

Grade/Test C S1 S2

11. Math period starts at 10:25 and ends at 11:10. How long is it?

a) 15 minutes

b) 30 minutes

c) 45 minutes

d) 85 minutes

3	Pre	.22	.30	
	Post	.42	.39	
4	Pre	.43	.35	
	Post	.49	.40	.66

12. (72 + 18) - 80 =

a) 0

b) 10

c) 170

d) 1216

3	Pre	.37	.42	
	Post	.66	.55	
4	Pre	.47	.48	
	Post	.63	.70	.91

13.
$$\begin{array}{r} 296 \\ -178 \\ \hline ? \end{array}$$

a) 118

b) 128

c) 474

d) none of these

3	Pre	.37	.23	
	Post	.38	.27	
4	Pre	.39	.44	
	Post	.55	.54	.66

14. You gave the lady at the check-out counter $1.00 to pay for 1 can of cat food. She gave you 2 quarters and 2 nickels in change. How much did the cat food cost?

a) 20¢

b) 40¢

c) 60¢

d) none of these

3	Pre	.44	.25	
	Post	.34	.31	
4	Pre	.31	.36	
	Post	.48	.42	.57

15. If A = $\{0, 1, 2\}$ and B = $\{2, 3, 4\}$ what is A U B?

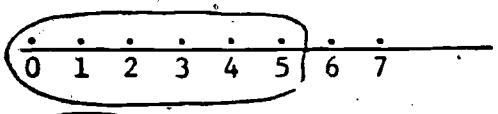
a) A U B = $\{0, 1, 2, 3, 4, 5\}$

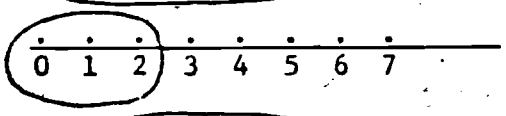
b) A U B = $\{0, 1, 2, 3, 4\}$

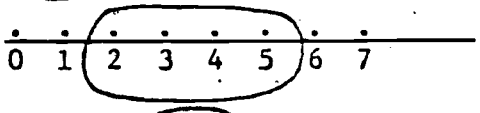
c) A U B = $\{0, 1, 3, 4\}$

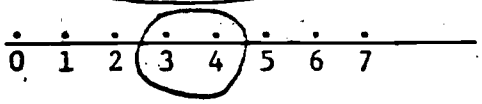
3	Pre	.30	.29	
	Post	.24	.31	
4	Pre	.35	.36	
	Post	.40	.51	.40

16. Which one of the following number lines is circled properly to show the numbers less than 5 but more than 2?

a) 

b) 

c) 

d) 

3	Pre	.23	.30	
	Post	.46	.44	
4	Pre	.41	.43	
	Post	.49	.56	.74

17. 17 - 0 = ?

a) 0

b) 1

c) 17

d) none of these

3	Pre	.67	.65	
	Post	.70	.83	
4	Pre	.73	.66	
	Post	.78	.77	.94

18. 17 x 0 = ?

a) 0

b) 1

c) 17

d) none of these

3	Pre	.24	.41	
	Post	.73	.63	
4	Pre	.52	.52	
	Post	.74	.87	1.00

19. 17 ÷ 0 = ?

a) 0

b) 1

c) 17

d) none of these

3	Pre	.11	.17	
	Post	.11	.23	
4	Pre	.10	.16	
	Post	.08	.09	.11

Grade/Test		C	S1	S2
20. You had 68¢ and spent 19¢ for a box of crayons. How much money did you have left?				
a) 41¢	3	Pre	.24	.21
b) 49¢		Post	.45	.38
c) 51¢	4	Pre	.45	.50
d) 59¢		Post	.61	.55 .83
21. If one box of crayons cost 10¢, how much do 3 boxes cost?				
a) 22¢	3	Pre	.43	.42
b) 38¢		Post	.60	.60
c) 57¢	4	Pre	.55	.57
d) none of these		Post	.81	.74 .89
22. If $2 \times 2 = 2^2$, what does $2^2 \times 2$ equal?				
a) 2 x 2	3	Pre	.29	.32
b) 2 x 2 x 2		Post	.28	.33
c) 2 x 2 x 2 x 2	4	Pre	.27	.25
d) none of these		Post	.33	.31 .54
23. In the number 23, what does the 2 equal?				
a) 2 x 0	3	Pre	.36	.41
b) 2 x 1		Post	.53	.42
c) 2 x 10	4	Pre	.37	.34
d) none of these		Post	.40	.48 .46
24. 33 x 3 =				
a) 9	3	Pre	.58	.43
b) 27		Post	.58	.58
c) 36	4	Pre	.61	.60
d) 99		Post	.76	.87 .94

30. Two hundred nine is the same as

a) 2009

b) 209

c) 29

d) none of these

31. Which number has a 6 in the hundreds place?

a) 176

b) 167

c) 6051

d) 2651

32. $\frac{217}{7}$ = ?

a) 3

b) 30

c) 31

d) none of these

33. 960 ÷ 16 =

a) 6

b) 16

c) 60

d) none of these

34. If 5/8 = n/80; what is n ?

a) 5

b) 10

c) 15

d) 50

Grade/Test		C	S1	S2
3	Pre	.52	.44	
	Post	.49	.43	
4	Pre	.58	.57	
	Post	.67	.71	.83
3	Pre	.19	.19	
	Post	.32	.27	
4	Pre	.30	.46	
	Post	.37	.45	.62
3	Pre	.27	.27	
	Post	.19	.25	
4	Pre	.29	.26	
	Post	.23	.34	.51
3	Pre	.31	.38	
	Post	.57	.28	
4	Pre	.32	.36	
	Post	.33	.45	.54
3	Pre	.46	.50	
	Post	.34	.36	
4	Pre	.35	.31	
	Post	.37	.41	.49

a)

b)

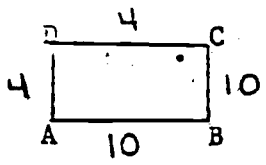
c)

d)

3 Pre .46 .52
Post .47 .46

4 Pre .46 .38
Post .64 .72 .50

36.



3 Pre .21 .25
Post .25

ABCD is a rectangle. $\overline{AB} = 10$. $\overline{AD} = 4$. How far is it around the rectangle?

a) 14

b) 24

c) 40

d) none of these

4 Pre .26 .25
Post .28 .29 .46

37. How would you find the number of inches in 3 1/2 feet?

a) 3 1/2 x 12

b) 3 1/2 ÷ 12

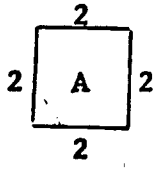
c) 3 1/2 + 12

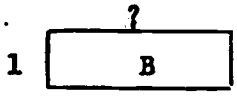
d) none of these

3 Pre .16 .21
Post .06 .17

4 Pre .20 .27
Post .20 .16 .29

38.





3 Pre .30 .29
Post .30 .31

You want the area of rectangle B to be the same as the area of the square A. What should be the length of figure B?

a) 1

b) 2

c) 3

d) 4

4 Pre .29 .34
Post .26 .31 .29

Grade/Test		C	S1	S2
3	Pre	.26	.28	
	Post	.24	.35	
4	Pre	.38	.42	
	Post	.30	.31	.40

39. You can buy 6 candy bars for a dollar.

How many candy bars could you buy for $1.50?

a) 6

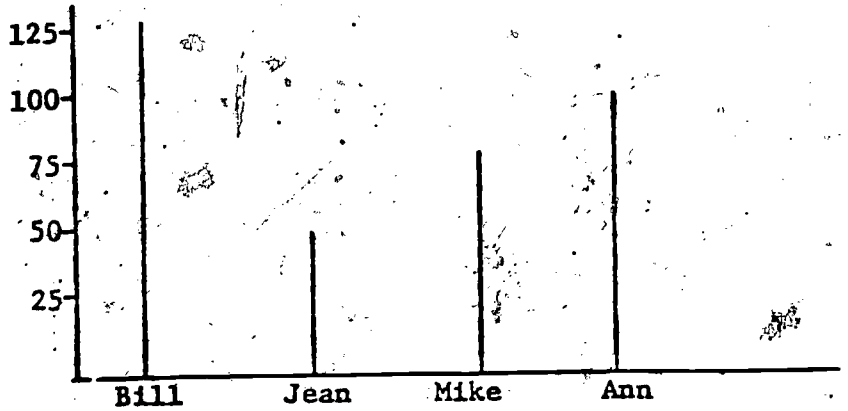
b) 9

c) 25

d) none of these

3	Pre	.25	.33	
	Post	.39	.33	

40:



Graph of number of tickets sold

How many tickets were sold by Bill, Jean, Mike and Ann together?

a) 200

b) 300

c) 350

d) none of these

4	Pre	.34	.34	
	Post	.45	.47	.63

SPECIAL MATHEMATICS ACHIEVEMENT TEST - GRADES 5 AND 6
1973 - 74

1. In the number 86241, the 6 stands for

   a) 6×10^0

   b) 6×10^1

   c) 6×10^2

   d) 6×10^3

Grade/Test		C	S1	S2
5	Pre	.39	.36	
	Post	.54	.42	.41
6	Pre	.39	.42	
	Post	.48	.53	.59

2. If A = $\{1, 2, 3\}$ and B = $\{4, 5\}$, A and B are

   a) equal

   b) equivalent

   c) disjoint

   d) empty

Grade/Test		C	S1	S2
5	Pre	.34	.30	
	Post	.50	.30	.36
6	Pre	.37	.39	
	Post	.49	.34	.50

3. If A = $\{1, 2, 3\}$ and B = $\{3, 4, 5\}$, A U B is equal to

   a) $\{3\}$

   b) $\{1, 2, 3, 4, 5\}$

   c) $\{1, 2, 4, 5\}$

   d) none of these

Grade/Test		C	S1	S2
5	Pre	.47	.48	
	Post	.45	.57	.58
6	Pre	.51	.52	
	Post	.57	.51	.60

4. Which number has a 7 in the ten's place

   a) 3267

   b) 769

   c) 4875

   d) 7902

Grade/Test		C	S1	S2
5	Pre	.62	.65	
	Post	.62	.70	.79
6	Pre	.70	.73	
	Post	.72	.80	.80

5. If A = $\{1, 2, 3\}$ and B = $\{4, 5\}$ their intersection set is

   a) $\{1, 2, 3, 4, 5\}$

   b) $\{1, 2, 3\}$

   c) $\{4, 5\}$

   d) empty

Grade/Test		C	S1	S2
5	Pre	.16	.19	
	Post	.19	.15	.24
6	Pre	.24	.22	
	Post	.29	.27	.28

6. Which number below is a prime number?

a) 9

b) 7

c) 6

d) 4

Grade/Test				
5	Pre	.21	.22	
	Post	.36	.32	.43
6	Pre	.27	.30	
	Post	.46	.50	.58

7. What is the smallest number divisible by 8 and 6?

a) 2 x 2 x 2 x 2 x 3

b) 2 x 2 x 2 x 3

c) 2 x 2 x 3

d) none of these

5	Pre	.12	.13	
	Post	.22	.16	.12
6	Pre	.14	.16	
	Post	.17	.20	.16

8. Which of the following is a subset of A = 0, 1, 2, 3

a) B = $\{4\}$

b) B = $\{0, 4, 5\}$

c) B = $\{1, 2, 10\}$

d) B = $\{0, 3\}$

5	Pre	.24	.30	
	Post	.35	.33	.33
6	Pre	.35	.35	
	Post	.40	.43	.45

9. If $\square$ + 4 = 28,

a) $\square$ = 7

b) $\square$ = 14

c) $\square$ = 24

d) $\square$ = 32

5	Pre	.63	.68	
	Post	.68	.68	.75
6	Pre	.71	.76	
	Post	.78	.77	.80

10. 2+ (7 + 8) =

a) 112

b) 30

c) 17

d) none of these

5	Pre	.73	.75	
	Post	.72	.71	.83
6	Pre	.82	.83	
	Post	.87	.85	.91

11. (4 + 8) + (4 + 12) =

a) 24

b) 36

c) 80

d) none of these

12. Add

112
74
96
70

a) 252

b) 342

c) 352

d) none of these

13. (8 + 0) + (19 + 0) = ?

a) 0

b) 27

c) 152

d) none of these

14. (72 + 18) - 80 =

a) 0

b) 10

c) 1216

d) none of these

15. 87695
-78777
?

a) 8918

b) 8928

c) 9912

d) none of these

Grade/Test		C	S1	S2
5	Pre	.54	.57	
	Post	.78	.61	.75
6	Pre	.70	.73	
	Post	.79	.85	.86
5	Pre	.52	.51	
	Post	.57	.61	.58
6	Pre	.55	.65	
	Post	.65	.66	.73
5	Pre	.72	.75	
	Post	.75	.77	.85
6	Pre	.81	.84	
	Post	.87	.88	.95
5	Pre	.49	.60	
	Post	.58	.62	.66
6	Pre	.63	.70	
	Post	.67	.72	.81
5	Pre	.44	.44	
	Post	.52	.47	.54
6	Pre	.45	.58	
	Post	.62	.63	.69

16. If 5 + □ = 0,

a) □ = 0

b) □ = 1

c) □ = 5

d) □ = − 5

17. 53 x □ = 7208

a) □ = 7253

b) □ = 136

c) □ = 53

d) □ = 23

18. Find the product

$$\begin{array}{r} 364 \\ \times 86 \\ \hline ? \end{array}$$

a) 278

b) 450

c) 5,096

d) 31,304

19. 3 x (24 x 0) = T

a) T = 0

b) T = 24

c) T = 72

d) T = 240

20. If 21/7 = 3, then 210/7 = ?

a) 3 x 10

b) 3 + 10

c) 3 + 10

d) 3 x 70

Grade/Test				
5	Pre	.39	.43	
	Post	.40	.58	.72
6	Pre	.48	.57	
	Post	.56	.77	.79
5	Pre	.41	.43	
	Post	.46	.45	.54
6	Pre	.48	.58	
	Post	.65	.67	.72
5	Pre	.41	.39	
	Post	.51	.50	.58
6	Pre	.52	.61	
	Post	.69	.68	.75
5	Pre	.32	.32	
	Post	.29	.35	.44
6	Pre	.32	.42	
	Post	.42	.52	.55
5	Pre	.22	.23	
	Post	.20	.29	.34
6	Pre	.27	.34	
	Post	.39	.42	.52

21. (20 x 3) x (20 x 5) = ?

a) 160

b) 320

c) 6000

d) none of these

Grade/Test				
5	Pre	.23	.28	
	Post	.29	.32	.34
6	Pre	.27	.29	
	Post	.28	.36	.45

22. 40 ⟌ 165 =

a) 4

b) 14

c) 40

d) none of these

5	Pre	.33	.31	
	Post	.38	.37	.45
6	Pre	.30	.40	
	Post	.37	.46	.48

23. Six thousand fifty-nine is the word name for

a) 659

b) 6,059

c) 6,590

d) 600,059

5	Pre	.40	.48	
	Post	.49	.49	.61
6	Pre	.54	.64	
	Post	.70	.67	.76

24. 3 x (2 + 0) =

a) 11

b) 12

c) 24

d) none of these

5	Pre	.54	.52	
	Post	.65	.61	.75
6	Pre	.65	.68	
	Post	.73	.78	.79

25. (75 + 25) ÷ 0 =

a) 0

b) 3

c) 100

d) none of these

5	Pre	.17	.14	
	Post	.20	.16	.15
6	Pre	.13	.14	
	Post	.08	.14	.13

26. $\frac{12 - 15}{6}$ =

a) 2

b) 5

c) 20

d) none of these

5	Pre	.12	.13	
	Post	.08	.17	.21
6	Pre	.16	.20	
	Post	.21	.28	.30

27. 2214 ÷ 123 = ?

a) 18

b) 18 + Remainder 100

c) 18 + Remainder 123

d) none of these

5	Pre	.12	.16	
	Post	.20	.21	.18
6	Pre	.18	.23	
	Post	.30	.34	.31

28. If 3/5 x ☐ = 1,

a) ☐ = 5/3

b) ☐ = 1

c) ☐ = 2/5

d) ☐ = 1/3

5	Pre	.30	.27	
	Post	.28	.34	.38
6	Pre	.24	.28	
	Post	.32	.36	.51

29. 40% of 100 =

a) 4000

b) 400

c) 40

d) 4

5	Pre	.30	.29	
	Post	.25	.31	.35
6	Pre	.38	.40	
	Post	.49	.35	.46

30. If the basketball team won 20 out of 25 games, what percent of its games did it win?

a) 20%

b) 40%

c) 80%

d) none of these

5	Pre	.23	.25	
	Post	.23	.19	.16
6	Pre	.23	.18	
	Post	.26	.15	.12

31. You pick 3 apples and weigh them. One weighs 5 ounces, another weighs 7 ounces, and the third weighs 6 ounces. If you picked another apple, what would be your best guess of what it would weigh?

a) 5 ounces

b) 6 ounces

c) 7 ounces

d) 8 ounces

5	Pre	.09	.15	
	Post	.08	.16	.11
6	Pre	.16	.12	
	Post	.17	.10	.07

32. If 8/9 = n/81, n =

a) 8 x 1

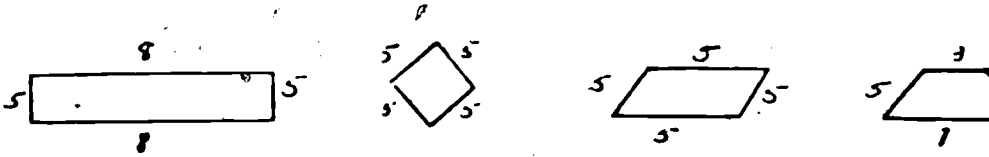
b) 8 x 8

c) 8 x 9

d) none of these

5	Pre	.29	.35	
	Post	.32	.36	.33
6	Pre	.39	.39	
	Post	.40	.36	.32

33. Which figure is a square?



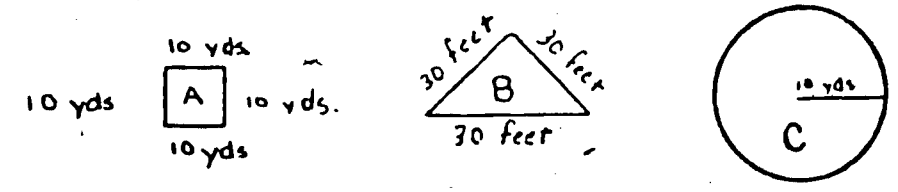
(a) (b) (c) (d)

5	Pre	.39	.37	
	Post	.51	.40	.52
6	Pre	.44	.41	
	Post	.59	.51	.53

34. Bill ran around A

Edna ran around B

Sue ran around C



Who ran the farthest?

a) Bill

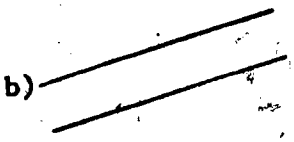
b) Edna

c) Sue

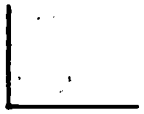
5	Pre	.31	.28	
	Post	.31	.30	.31
6	Pre	.29	.30	
	Post	.30	.23	.24

35. Which pair of lines are perpendicular?

a) 

b) 

c) 

d) 

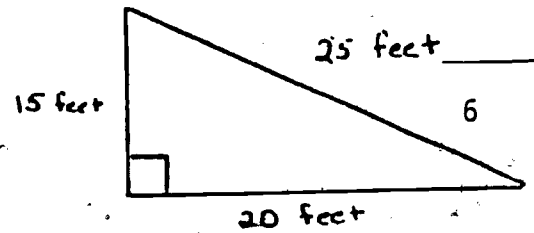
36. What is the area of the triangle below: Hint A = 1/2 bh

a) 75 square feet

b) 150 square feet

c) 250 square feet

d) 300 square feet



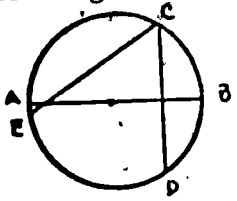
37. What line in the circle is longest?

a) $\overline{AB}$

b) $\overline{CD}$

c) $\overline{CE}$

d) They are all equal in length



38. What fraction equals .24?

a) 12/100

b) 6/50

c) 6/25

d) none of these

39. Which of the numbers below is <u>largest</u>?

a) .021

b) .241

c) .048

d) .42

Grade/Test		C	S1	S2
5	Pre	.18	.21	
	Post	.22	.22	.15
6	Pre	.20	.19	
	Post	.18	.19	.22
5	Pre	.21	.25	
	Post	.26	.26	.26
6	Pre	.25	.22	
	Post	.31	.30	.29
5	Pre	.38	.40	
	Post	.38	.45	.50
6	Pre	.48	.51	
	Post	.50	.48	.59
5	Pre	.28	.27	
	Post	.24	.21	.20
6	Pre	.21	.23	
	Post	.22	.16	.16
5	Pre	.09	.13	
	Post	.19	.17	.21
6	Pre	.14	.17	
	Post	.28	.20	.26

Grade/Test	C	31	32

40. If in a race a runner ran one mile in 4 minutes and 20 seconds, how many miles did he run in 13 minutes?

a) less than 3 miles

b) more than 3 miles

c) 3 miles

5	Pre	.35	.34	
	Post	.35	.30	.39
6	Pre	.36	.41	
	Post	.39	.30	.40

41. In a number system which uses only 0 and 1, 101 is the same as the decimal number

a) 3

b) 5

c) 101

d) none of these

5	Pre	.13	.19	
	Post	.20	.18	.17
6	Pre	.14	.14	
	Post	.14	.12	.14

42. What is n if $n^4 = 16$?

a) 2

b) 4

c) 12

d) none of these

5	Pre	.08	.13	
	Post	.09	.12	.32
6	Pre	.11	.18	
	Post	.14	.34	.37

43. If $2^2 = 2 \times 2$ and $2^3 = 2 \times 2 \times 2$, what is $2^2 \times 2^3 =$?

a) 2^5

b) 2^6

c) 2^{12}

d) none of these

5	Pre	.14	.17	
	Post	.12	.28	.39
6	Pre	.16	.27	
	Post	.18	.36	.45

44. What is the value of i if $3^i = 81$?

a) 3

b) 4

c) 9

d) 27

5	Pre	.12	.22	
	Post	.16	.16	.25
6	Pre	.14	.19	
	Post	.14	.23	.34

Grade/Test	C	S1	S2

45. If 2/3 of an acre costs $3,000, what would an acre cost?

a) $2000

b) $4500

c) $6000

d) $9000

5	Pre	.21	.24	
	Post	.22	.23	.24
6	Pre	.29	.23	
	Post	.33	.29	.30

46. If 3/7 x N is less than 3/7, then N is

a) less than 1

b) equal to 1

c) more than 1

5	Pre	.21	.23	
	Post	.21	.17	.31
6	Pre	.23	.30	
	Post	.28	.34	.34

47. If $\frac{16}{4} = \frac{2 \times 2 \times 2 \times 2}{2 \times 2} = \frac{2^4}{2^2} = 2^4 - 2 = 2^2$

$2^0 =$

a) 0

b) 1

c) 2

d) none of these

5	Pre	.13	.19	
	Post	.20	.21	.18
6	Pre	.18	.18	
	Post	.22	.17	.14

48. 1/4 ÷ 3/4 =

a) 1/3

b) 3/16

c) 3

d) none of these

49. If 63/3 = 21, then 63/30 is equal to

a) 21 x 10

b) 21 ÷ 10

c) 21 - 10

d) none of these

5	Pre	.25	.24	
	Post	.23	.27	.19
6	Pre	.23	.24	
	Post	.24	.24	.21

Grade/Test	C	S1	S2
5 Pre	.19	.13	
Post	.13	.21	.19
6 Pre	.14	.15	
Post	.16	.25	.21

50. What is the second number after 36 in the series 4, 12, 36 ..... ?

a) 76

b) 132

c) 216

d) 324

EXHIBIT B

Northwest
Regional
Educational
Laboratory

Lindsay Building · 710 S.W. Second Avenue
Portland, Oregon 97204 · Telephone (503) 224-3650

Dear :

A part of the SEED Project is an "Inservice Training" component. In addition to conducting four SEED classes per week, the Project calls for one additional hour a week for consultation between SEED specialists and the regular classroom teacher.

We would appreciate information from you for two-four week periods concerning this consultation session. Enclosed you will find a SEED Classroom Teacher Inservice Training Record Form. This form is to be filled out for the period of _____ to _____. Other teachers have been completing similar forms for other two-month periods throughout the school year. We are attempting this "sampling" approach in order to lessen the individual teacher's workload and at the same time to provide us with adequate data. Please return this completed form at your earliest convenience using the enclosed stamped self-addressed envelope.

We appreciate your cooperation and effort in this endeavor.

Sincerely,

Kan Yagi
Project SEED Coordinator

KY:tlj:pc

Enclosure

SEED CLASSROOM TEACHER INSERVICE TRAINING RECORD FORM

Name of Teacher_____Grade Level_____

Name of School_____School Dist._____

Please complete a record for each of the four weeks as indicated for you. When the four weeks are completed, return the Record Form in the preaddressed envelope. Please feel free to comment on any item you wish.

Week:_____to_____

Date(s) of additional inservice session(s):_____

If none, indicate reason._____

_____

Name of specialist conducting the session(s):_____.

Approximate duration of the session(s):_____.

1. Were others present at the inservice session(s)? Yes No

   If yes, indicate number and positions, e.g., teachers, school administrators.

   _____

   _____

2. What were the topic(s) for each inservice session(s)? Indicate if the topics dealt with teaching methods, mathematics concepts, both or neither.

   _____

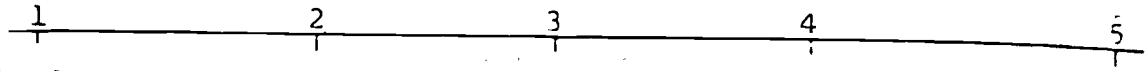
   _____

   _____

3. Who suggested the topic(s) for the session(s)?
   You/Specialist/Other (Indicate)_____

4. Did the inservice session(s) deal with something you w... to apply in your classroom? Yes No

5. Indicate the extent to which the session(s) was related t... one of your need areas. (Circle a number)



Little or no relation — Moderate relation — Very m... related

6. Briefly describe each session(s), e.g., where it took place, activities, time of day, etc.

7. Recommendations to improve the inservice session(s):