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Investigated was the effect of skill-level grouping on student achievement in mathematics in a Negro neighborhood elementary school. The investigation was conducted in the Clark County School District, Nevada, during the 1968-69 school year. The mathematics program in the control school was organized and taught in self-contained classrooms by the classroom teacher. The mathematics program in the experimental school was organized by ungraded Arithmetic Skill Levels. An analysis of growth in grade equivalents suggests that students in grades two, three, and four benefited more from skill-level grouping than those in grades five and six. No conclusive evidence favoring skill-level grouping was obtained and the null hypothesis -- no difference will result between the mean achievement scores of the experimental group and the control group -- was not rejected. [Not available in hard copy due to marginal legibility of original document]. (RP)

CLARK COUNTY SCHOOL DISTRICT

FINAL REPORT

Project No. 8-1-065
Grant No. OEG-9-8-081065-0159(010)

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

SKILL-LEVEL GROUPING IN MODERN MATHEMATICS K-6

June, 1969

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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SKILL-LEVEL GROUPING IN MODERN MATHEMATICS K-6

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Clark County School District

Las Vegas, Nevada

June, 1969

The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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SUMMARY

The purpose of this study was to determine the effects of skill-level grouping for Modern Mathematics, K-6, on student achievement in mathematics in a Negro neighborhood elementary school when previous instruction was almost totally in traditional mathematics.

Skill-level grouping is defined as grouping students for instruction in arithmetic by skills already mastered, rather than by traditional grade placement. Students in the primary grades (two and three) were grouped together in seven skill-level groups. Students in the intermediate grades (four, five, and six) were grouped together in six skill-level groups.

Pre-test data from the experimental and control schools was analyzed by grade placement to determine whether the two groups could have initially been drawn from the same population. No significant differences in initial achievement were apparent for grades four, five, and six, However, for grades two and three, there were significant differences in achievement in favor of the control school. Post-test results showed one significant difference (5th grade) in favor of the experimental school and one significant difference (4th grade) in favor of the control school. The second and third grades at the control school again scored significantly higher than those at the experimental school. In the light of these findings, no conclusive evidence favoring skill-level grouping exists, and the null hypothesis--no difference will result between the mean achievement scores of the experimental group and the control group--was not rejected.

However, an analysis of growth in grade level equivalents suggests that the students in grades two, three, and four benefited more from skill-level grouping than those in grades five and six. Those with highest initial achievement in grade two and grade three showed a growth above that expected, while those with lowest initial achievement in the intermediate grades showed a growth above that expected. When taught in skill-level groups, second and third grade students with low initial achievement and fifth and sixth grade students with high initial achievement attain the least growth. This implies further study with a variety of skill-level groupings, such as grades three and four together and grades five and six together.

INTRODUCTION

BACKGROUND FOR THE STUDY

PURPOSE

It was the purpose of this research study to determine the effects of skill-level grouping for modern mathematics in a Negro neighborhood elementary school when previous instruction was almost totally in traditional mathematics.

RATIONALE

In September, 1967, a modern mathematics program was implemented throughout the Clark County School District (Nevada) in kindergarten and grades 1 through 6. The new mathematics program was designed to provide curriculum continuity throughout the eighty-five schools in the District, and to provide curriculum articulation from the time a child enters kindergarten until he graduates from high school. All students in the District had one year's exposure to the modern mathematics curriculum at the time the project began, September 1968.

Results of the 1966-67 District Testing Program revealed that although schools in the high-density, low-income area were deficient in reading comprehension, reading vocabulary, mechanics of English, and arithmetic reasoning, these schools' norms fluctuated from year to year. However, arithmetic fundamentals held a constant level, although they, too, were below grade level. This constant norm factor in these schools and the verbal skill requirements of modern mathematics indicated possible implications that the modern mathematics curriculum might further retard the mathematics progress of students in these schools.

It was theorized that a different organizational approach (rather than self-contained classrooms) would enable teachers to concentrate on attainment of student objectives at a level specified for each individual student. After analyzing various organizational approaches, it was decided to completely ungrade the mathematics program. Ungraded is defined as not grouping students according to specified grade levels, but grouping according to those skills which have been mastered regardless of chronological age or grade placement in other curricular areas.

The null hypothesis - no difference will result between the mean achievement scores of the experimental group and the control group - was tested to determine whether grouping students by skills already mastered, for instruction in arithmetic, would lead to greater growths in achievement.

REVIEW OF LITERATURE

A review of the literature revealed that numerous research experiments on grouping - by I.Q., by reading achievement levels, by age, and by standardized test

scores - have been conducted (Olson, 1966). The research reports are about equally divided into findings of significant differences and non-significant differences resulting from grouping. One report dealt with research in modern mathematics using grade one subjects from culturally and educationally disadvantaged target areas (Folsom, 1967). These students had had no formal education in mathematics prior to the beginning of the experiment. No research reports were available on experiments dealing specifically with making the transition from a traditional approach in elementary mathematics to a modern approach in a Negro neighborhood school, grades K-6 inclusive.

GOALS

The overall goals of the project were attained. These were:

1. To identify mathematics skills mastered by each student and group students according to skill levels, as measured on a standardized test.

2. To set levels of anticipated achievement for each individual student in the school and teach toward attainment of that goal.

3. To develop and field test prototype test items for the Clark County School District Mathematics Curriculum Guide K-6.

METHODS

INTRODUCTION

Two elementary (K-6) schools each located in a high-density, low-income area of the Negro neighborhood were selected as participating schools. C.V.T. Gilbert Elementary School was chosen as the experimental school, since the mathematics program for grades 4-6 had already been ungraded during the 1967-68 school year.

Matt Kelly Elementary School was chosen as the control school, since population characteristics are identical to those of the experimental school, and the classroom organization is self-contained grade level grouping.

Both schools typify the Negro neighborhood school in a large school district, with the school population derived from a highly mobile, urban community. The only appreciable difference between the schools is the organization of the mathematics program.

PRE-TESTING

At the experimental school, the California Achievement Test, Elementary (Arithmetic) Form W as administered September 12-18, 1968 to students in grades 4-6. Scores from this test along with the results of a teacher-made diagnostic test were used in determining the placement of students into six Skill-Level Groups, for instruction in arithmetic. The S.R.A. Achievement series (Arithmetic 2-4) Form D, was administered to second and third grade students, October 21-25, 1968. Scores from this test, with scores from a teacher-made diagnostic test were used to determine the placement of these students into seven Skill-Level Groups for instruction in arithmetic.

At the control school the CAT Elementary (Arithmetic) Form Y was administered to fourth, fifth and sixth grade students, September 20-24, 1968. Th S.R.A. Achievement series (Arithmetic 2-4) Form. C, was administered to second and third grade students, at the control school November 12-15 (other District-wide testing caused the time lapse between testing at the experimental and control school). Students at the control school were not grouped by Skill-Level Mastery for instruction in arithmetic but were instructed in grade level groups.

TREATMENT

Two psychological factors contributed largely to the success of the program. The first was a public relations function--that of convincing the students at the experimental school, that grouping by Skill-Level Mastery was the only fair way to expect students to learn arithmetic. The idea, that all participants in a "contest" should start at the same place so that each participant has an equal chance of "winning," was compared to the learning of arithmetic, and used to set the climate

for ungraded groups.

The second factor contributing to the psychological success of the program was the flexibility of the grouping. At any time during the year that a student showed sufficient progress, he was moved to a higher level group. At the same time, students who were experiencing repeated failure in one group were moved to a lower group. The "good word," at the experimental school, "ARITHMETIC IS FUN" was emphasized by trying to make the learning experiences interesting and successful.

The Mathematics Specialist was responsible for planning (with the teachers) the learning activities for each group. At times, motivational, introductory, or enrichment lessons were conducted by the Specialist. This was done not only in the individual groups, but at times several groups were put together for a large group presentation. The Math Specialist also served as a resource person in helping all of the teachers, including special education and kindergarten, and first grade teachers, even though their students were not participating in the Ungraded Program.

During the year many instructional aids - manipulative devices, audio-visual materials, mathematical games, enrichment books, remedial and developmental work sheets - were purchased. While teacher recommendations were given due consideration, a team consisting of the Mathematics Specialist, the Principal, and the Project Director made the final decision on purchases. Aids which were non-consumable and could be used to good advantage at more than one level of instruction were given first priority.

CONSULTANTS

During the year, three consultants were brought in to observe the program and to work with the Math Specialist, the Principal, the Project Director, and the teachers. Their comments and suggestions were valuable not only in the area of mathematics, but most important to the success of the program, in the sociological and psychological aspects of working with culturally disadvantaged students. (Appendix A).

POST-TESTING

During the week of May 19, 1969, the CAT Elementary (Arithmetic) Form Y was administered to the fourth, fifth, and sixth grade students at the experimental school. The SRA Achievement Series (Arithmetic 2-4) Form C, was administered to the second and third grade students at the experimental school during that week.

At the control school, the final testing was done one week later, from May 26-29, 1969. Here the CAT Elementary (Arithmetic) Form W was used with the intermediate (4-6) grades and the SRA Achievement Series (Arithmetic 2-4) Form D was used with the primary (2-3) grades.

For the intermediate grades, the number of weeks between the fall and spring

testings was the same (31 weeks). For the primary grades, the period between testings for the control school was two weeks less than that for the experimental school. The time lapse between pre- and post-testing at the experimental school was 26 weeks, while at the control school it was twenty-four weeks.

TEST DEVELOPMENT

During the entire year, the Project Director and the Math Specialist worked with the District Research and Development Department in the construction and analysis of tests designed to measure the achievement of the objectives outlined in the Clark County School District, Curriculum Guidelines, Mathematics K-6. A team of seven classroom teachers was hired to prepare test items for each of the objectives. The Project Director and Math Specialist selected those items to be used in each test. Copies of the examiners' manuals and answer keys for these tests are included in Attachment I of this report.

These tests were administered at approximately twenty schools in the District in May, 1969. Since in both the experimental and control schools grades five and six were tested, the results of this testing have been included in the findings.

FINDINGS

STATISTICAL TREATMENT

The "t" test was chosen as the appropriate statistical test to analyze the data. "Whenever only two groups are being compared, "t" is appropriate for the test of significance of the difference between the groups."[1] Since the groups were compared by grade levels, only two groups were involved at one time.

The "t" values were obtained using the formula

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\dfrac{\Sigma x_1^2}{k_1(k_1 - 1)} + \dfrac{\Sigma x_2^2}{k_2(k_2 - 1)}}}$$

where $\overline{X}$ is the mean, x is the variation from the mean, and k is the number of cases.

When using this formula with sample groups of unequal size, the degrees of freedom for group 1 are $k_1 - 1$, and for group 2 are $k_2 - 1$. "If a difference is noted in the 't' value entries, the desired 't' value lies somewhere between these two tabled values. Usually it is quite satisfactory to accept as the desired 't' value, the midpoint of the entries shown for $k_1 - 1$ and $k_2 - 1$ degrees of freedom."[2]

RESULTS

The frequency distributions for each test are shown by grade level in Appendix C. "t" tests were used to compare mean raw scores of the experimental and control groups on the pre-tests and also on the post-tests. This was done to determine whether or not the two groups could have been drawn from the same population prior to treatments. If this was true, then a significant difference on the post-test results would mean that the growth was due to difference in treatment.

The results of the "t" tests are shown in tables 1 through 5 on the following pages.

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[1] Wert, James E., Neidt, Charles O., and Ahman, J. Stanley, Statistical Methods in Educational and Psychological Research. New York, Appleton-Century-Crofts, Inc. 1954. p.172

[2] Ibid. p.133

GRADE SIX

For grade 6, the only significant difference in achievement scores was on the Mathematics Concept Test, Basic Test: Level 6, Parts I and II. (This is the test developed to test the achievement of the objectives in the Clark County Curriculum Guideline-Mathematics 6.) The experimental school scored significantly higher than the control school.

	Experimental School	Control School	
	PRE-TEST		t = .738
$\overline{X}$	47	49	Not significant at the .05 level
$\sum x^2$	9984	11692	
k	49	62	Degrees of freedom 48-61
	POST-TEST		t = .781
$\overline{X}$	56	53	Not significant at the .05 level
$\sum x^2$	8224	11591	
k	49	62	Degrees of freedom 48-61
	BASIC TEST LEVEL 6		t = 3.518
$\overline{X}$	*53	46	Significant at the .001 level
$\sum x^2$	5366	5979	
k	48	62	Degrees of freedom 47-61

TABLE 1. Results of Sixth Grade Testing

GRADE FIVE

The results shown in Table 2 reveal that there were no significant differences on achievement scores for grade five.

	Experimental School	Control School	
	PRE-TEST		t = 1.11
$\overline{X}$	35	38	Not significant at the .05 level
$\sum x^2$	9692	12630	
$\overline{X}$	68	58	Degrees of freedom 57-67
	POST-TEST		t = 1.18
$\overline{X}$	46	49	Not significant at the .05 level
$\sum x^2$	10568	10118	
k	68	50	Degrees of freedom 57-67
	BASIC TEST LEVEL 5		t = .394
$\overline{X}$	44	45	Not significant at the .05 level
$\sum x^2$	4246	8459	
k	46	50	Degrees of freedom 45-49

TABLE 2. Results of Fifth Grade Testing

GRADE FOUR

For grade 4, the experimental and control schools showed no significant difference in achievement on the pre-test. However, the results of the post-test showed that the students at the control school scored significantly higher than those at the experimental school. These results are shown in Table 3.

	Experimental School	Control School	
	PRE-TEST		t = 1.19
$\bar{X}$	23	21	Not significant at the .05 level
$\sum x^2$	4634	7285	
k	57	73	Degrees of freedom 56-72
	POST-TEST		t = 4.00
$\bar{X}$	33	*44	Significant at the .001 level
$\sum x^2$	5883	11476	
k	57	73	Degrees of freedom 56-72

TABLE 3. Results of Fourth Grade Testing

GRADE THREE

Table 4 shows the results of third grade testing. The third grade testing. The third grade at the control school scored significantly higher than that of the experimental school on both pre- and post- tests.

	Experimental School	Control School	
	PRE-TEST		t = 6.154
$\bar{X}$	31	*43	Significant at the .001 level
$\sum x^2$	5912	15007	
k	77	74	Degrees of freedom 73-76
	POST-TEST		t = 5.02
$\bar{X}$	47	*62	Significant at the .001 level
$\sum x^2$	23406	26644	
k	77	74	Degrees of freedom 73-76

TABLE 4. Results of Third Grade Testing

GRADE TWO

The second grade at the control school scored significantly higher than that of the experimental school on both pre- and post-testing. These results are shown in Table 5.

	Experimental School	Control School	
	PRE-TEST		$t = 3.448$
$\bar{X}$	20	*24	Significant at the .001 level
$\sum x^2$	5735	3194	
k	98	66	Degrees of freedom 65-97
	POST-TEST		$t = 3.571$
$\bar{X}$	31	*40	Significant at the .001 level
$\sum x^2$	19502	14159	
k	98	66	Degrees of freedom 65-97

TABLE 5. Results of Second Grade Testing

MEAN GROWTH BY GRADE PLACEMENT - EXPERIMENTAL GROUP

The period between testing for the intermediate grades was .8 of a year. (Growth in achievement is measured in tenths, since the national norms for the CAT are computed in tenths.) Growths in grade level equivalents for the intermediate grades at the experimental school are shown in Table 6.

Grade	No.	Mean Growth	Number of individuals advancing			
			2.0 + grade level	1.5 + grade level	1.0 + grade level	.8 + grade level
4	57	.7 grade level	1	2	15	22
5	68	.6 grade level	1	7	19	25
6	49	.5 grade level	-	2	9	14

TABLE 6. Growth in Grade Level Equivalents (Intermediate)

For grade 4, 22 students advanced .8 or more grade levels, or what would be expected growth for an "average" fourth grade student in the given time interval. This is thirty-nine percent of the fourth grade students who were at the experimental school for the entire period.

For grade 5, 25 students advanced .8 or more grade levels, or what would be expected growth for an "average" fifth grade student in the given time interval. This is thirty-seven percent of the fifth grade students who were at the experimental school for the entire period.

For grade 6, 14 students advanced .8 or more grade levels, or what would be expected growth for an "average" sixth grade student in the given time interval. This is twenty-nine percent of the sixth grade students who were at the experimental school for the entire period.

The information in Table 7 reveals that the largest mean growth in achievement for the intermediate group is in the lowest group (6), with the means decreasing as the initial skill level increases.

GRADE LEVEL EQUIVALENT GROWTH 4 - 6

Grade Level Growth in Sch. Yrs.	Skill-Level Groups (Numbers of students)						
	1	2	3	4	5	6	
Mean growth	0.1	0.4	0.6	0.6	0.7	1.1	
2.2					1	1	
1.7			1			1	
1.6			1	2	1	1	
1.5			1		1		
1.4			2	1	1	2	
1.3				2			
1.2			1	5	1	2	
1.1		2	4	1	2		
1.0	1		2	3			
0.9	1	1	4	3	1	2	Expected
0.8		1		2		3	Growth 0.8 yr.
0.7	1	1	3	4	1	3	
0.6	1	4	6	1			
0.5	4	2		1	5		
0.4	1	3	4	4	2		
0.3	2	4	6	4			
0.2	2	5	2	1			
0.1	1	1	1	3	1		
0.0	2		1	1	2		
Regressions	7	2	4	9	1	0	

TABLE 7. Growth By Skill-Level Groups (Intermediate)

The period between testing for the primary grades was six and one-half months. (Growths in achievement are measured in months since the national norms for the SRA test are computed in months.) Growths in months for the primary grades at the experimental school are shown in Table 8.

Grade	No.	Mean Growth	Number of Individuals Advancing			
			2 yr. 5 mo.+	1 yr. 4 mo.+	1 yr. 0 mo.+	0 yr. 7 mo.+
2	98	8 mos.	1	4	35	48
3	77	8 mos.	-	9	32	48

TABLE 8. Growth in Grade Equivalents (Primary)

The expected growth for an "average" second or third grade student in the time interval between testings is six and one-half months. Forty-eight second grade students or forty-eight percent of those enrolled at the experimental school for the entire period exceeded this expected growth. Forty-eight third grade students or sixty-two percent of those enrolled at the experimental school for the entire period exceeded this expected growth.

In considering mean growth by Skill-Level Groups, Table 9 indicated that the highest Skill-Level Group for the primary grades showed the highest mean growth. (Group 1 was the highest Skill-Level Group.)

GRADE LEVEL EQUIVALENT GROWTH GRADES 2 - 3

Grade Level Equivalent Growth in School Months	Skill-Level Groups (Numbers of Students)							
	1	2	3	4	5	6	7	
Mean Growth	11 mo.	6 mo.	5 mo.	7 mo.	7 mo.	6 mo.	6 mo.	
17	1							
16	3							
15	1						1	
14				1	1		2	
13	2				1			
12	4	2	2	1	1		3	
11	3	2	5		1	2	2	
10	1	2	1		3		5	
9	1	2	5	2	1	1		
8	2	4	1	3	3	3	2	Expected
7	3	1	3	1	3			Growth 7 mo.
6		1	1	4	1	1	3	
5		2	1	1	2		5	
4	2	3	1	1	1	1	7	
3		2	2	3			1	
2		1	7				3	
1				1	1		3	
0			1		1		6	
Regressions		2	5		2	1		

TABLE 9. Growth by Skill-Level Groups (Primary)

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The null hypothesis - no difference will result between the mean achievement scores of the experimental group and the control group - was not rejected.

For grade six, the groups were not significantly different in achievement scores on either the pre- or post-tests. However, the sixth grade group at the experimental school did score signiticantly higher on the Mathematics Concept Test, Basic Level: 6, designed to test the achievement of objectives for grade six in the District's Curriculum Guideline.

For grade five, the groups were not significantly different in achievement scores on either the pre- or post-tests. Neither were they significantly different on the Mathematics Concept Test, Basic Level: 5, designed to test the achievement of the objectives for grade five in the District's Curriculum Guideline.

For grade four, the groups were not significantly different in achievement scores on the pre-test. The post-test revealed a significant difference in favor of the control school.

For grade three, the groups were significantly different in achievement scores on both the pre- and post-tests. The control school scored higher than the experimental school in both cases.

For grade two, the achievement scores on both pre- and post-tests for the control school were significantly higher than those for the experimental school.

On the basis of these findings of this one-year study, the null hypothesis was retained, and it was concluded that no differences resulted between the mean achievement scores of the experimental and the control group.

Considering mean growths for Grade Level and Skill-Level Groups, and the number of students who achieved higher than the expected growth for the period of treatment, the treatment seems to have made a difference. The following conclusions appear to be valid:

1) Skill-Level grouping produces the most growth among culturally disadvantaged Negro children who are achieving much below grade level.

2) The greatest growth in achievement is attained, in Skill-Level Groups by second, third, and fourth grade students. Fifth grade students do not achieve as highly, however, their achievement is higher than that of sixth-grade students.

3) For the primary grades the students with the highest initial achievement attain the greatest growth, while for the intermediate grades, students with the lowest initial achievement attain the greatest growth.

The following conclusions are drawn from a summary of answers to teacher questionaires. (Appendix C.)

1) Most students at the experimental school benefited from the program.

2) For the majority of the students involved there were no adverse psychological effects due to the skill-level grouping.

3) The majority of teachers at the experimental school were "written work" oriented.

4) The majority of teachers found the services of a Mathematics Specialist useful, and would like to have the same services available next year.

5) The majority of teachers at the experimental school would like to see the program continued.

COMMENTS

Based on the experiences of conducting this study, the following comments have bearing on the results:

1) The major weakness of this study was that it involved too many people, both students and teachers in both the experimental and control groups. The teacher variable which was most difficult to control became a major factor in the success of the program, since more than thirty teachers were involved. Teacher resignations, substitute teachers, and teachers assigned to the program while it was in progress were factors that could not be avoided. Shortening the length of the treatment could help to alleviate this problem. A further weakness due to the number of people involved is the testing situation. It was impossible for <u>one</u> person to administer <u>all</u> of the tests. Thirty or more people administering test instruments resulted in a wide variation of instructions, conditions, situations, etc. The following two examples indicate what could happen when the testing is not done by <u>one</u> person:

   A) Instructions explicitly state that the "story" problems are <u>not</u> to be read to the students. No help is to be given. However, every student in one third grade group (30+) completed correctly an entire page of "story" problems on the post-test.

   B) One fourth grade student marked more than twenty correct answers in a row. Erasures indicated that each correct answer was a second, third, or fourth choice.

2) If possible both control and experimental groups should be in one school. This would minimize the probability that the treatment of the control group would be significantly altered during the course of the study. A situation such as the control school changing from an instructional organization in which arithmetic is taught by the classroom teacher to an organizational plan involving a Mathematics Specialist teaching all the arithmetic at several grade levels, would be avoided.

3) More time needs to be spent with teachers (especially primary teachers) showing them the desirability of using manipulative devices, motivational materials, and oral discussion to replace some of the written work.

4) It seems reasonable to place a large number of students in the group which score highest on the initial testing, in order to allow teachers to work with smaller groups of low-achievers. The results of this study indicate that this does help the low-achieving groups, but minimizes the growth of the group of high-achievers.

5) The high growth in achievement of the high group of primary students and the low group of intermediate students may suggest that these are basically from the same population and lends credence to Skill-Level grouping as an organizational pattern for instruction in arithmetic.

RECOMMENDATIONS FOR FURTHER STUDY

Based on the findings and conclusions reached in this study, the following recommendations should be considered:

1) Studies involving smaller numbers of students, at one school, taught by one or two teachers should be conducted using Skill-Level Groups. These could be for shorter periods of time, involving only one unit of the curriculum.

2) The contrasting growth patterns in achievement between primary and intermediate students indicates that at the beginning studies should be conducted un-grading the mathematics program in grades three and four together, and grades five and six together.

3) Studies should be conducted comparing two organizational plans--one group in which the arithmetic is taught in a heterogeneously grouped self-contained classroom, and the other group in which students are grouped by skill-level rather than by grade level. The consultant services of a Mathematics Specialist should be available to each group of teachers.

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APPENDIX A

COMMENTS AND SUGGESTIONS OF CONSULTANTS

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COLLEGE OF EDUCATION

January 15, 1969

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Las Vegas, Nevada 89101

Dear Dr. Gilbert:

It was a pleasure and an experience to evaluate your federally funded Modern Mathematics Program January 9th and 10th, 1969. The behavorial objectives for the various levels are articulated and realistic in terms of the target area population.

According to the results of the California Achievement Test, the pupils have made considerable gains over their pre-test scores. Possibly, varied activities that are different from the traditional mathematics have had an impact on the program.

As one assesses a program of this nature, the teachers cannot be overlooked as vital motivators in the success or failure of a new program. The newness of a program often effects teacher behavior to the extent that a new enthusiasm begins to generate and old myths and preconceived ideas are often discarded as students acquire new concepts and begin to generalize.

Needless to say, I personally feel that your program has been successful and greater success may be in store if attitudes of both pupils and teachers are enhanced by each other's success. As a possible result, individuals may draw from their reservoirs of potential. a new attitude towards mathematics. This is not to say that every area is perfect, but an indication that some of the small areas of conflict may dissipate as success comes into focus. The fullest cooperation from every faculty member will be necessary to insure positive results from a program of this magnitude.

I would like to make a point that disadvantaged pupils of this age group, are eager and willing to learn in an environment that is not too

Dr. Virginia Gilbert January 15, 1969

threatening and one where goals can be obtained. Further, the target area population needs some structure because it is only through some structure that we can provide for meaningful flexibility. Without structure we will have difficulty in reaching our objectives.

Probably, additional extended exercises, after mathematical concepts are learned, along the lines of practical application, may reinforce those concepts and bring meaning to the situation. Further, your introduction of various visual aids and devices will surely assist the program in a positive way.

You are fortunate to have Mr. Earl McKie as a specialist --- he is sensitive to the needs of the disadvantaged.

I am very pleased that you embarked upon this project and that you have been instrumental in it's success. It is only through individuals like you that the disadvantaged may get another chance while they are young enough to take advantage of it.

Sincerely,

John L. Edwards

John L. Edwards, Ed.D.
Asst. Professor of Education

JLE/vb

COMMENTS & RECOMMENDATIONS by: Charles E. Allen
Math Consultant
Los Angeles City School District

THE PROGRAM I was most impressed with how closely the program in operation represented the program in writing. Very few attempts have been made at grouping the students according to computational skills. This program should have implications locally and nationally.

Would recommend a diary type report on the program be kept with the teachers making entries daily or weekly and the staff making observations and evaluation remarks periodically.

THE DIRECTOR Very enthusiastic about the program. Her convictions about the possible success of the project is contagious. Her approach is evident with the teachers, the students, and all connected with the project.

THE MATERIALS Time only permitted a brief look at some of the ideas and gimmicks developed. These compare favorably with the many materials produced on similar projects across the nation.

Would recommend that these materials be workshopped by the teachers in the project. After modifying and field testing, they should be published by the District for official use throughout the system. Would suggest that the concern for student materials, task cards, and activities be given preference over course of studies.

THE STAFF Though the approaching meeting on whether to strike or not was foremost in the teachers' minds, they participated actively in the work session after school. Some stayed later than expected to. The morale of the staff is indicative of the type of leadership it has.

Would recommend more monthly or weekly gatherings to share, to interact, to evaluate in an informal manner. This will further tax the teachers' time, but, it will say that the project and their involvement is important.

THE STUDENTS Real enthusiastic about mathematics - relaxed - anxious to participate in the demonstration - and very receptive. Infrequently, their behavior suggested the types of discipline problems that could occur in the classroom. The teachers are to be complimented for the job that they have done with these children. Some students were able to handle the most difficult challenges. Some students were unable to handle challenges that were below their grade level.

Would recommend More frequent meetings with more than one group or class. Students need to learn to function in larger groups. Would also recommend that lessons be developed with a wider range of concept mastery required. Monthly meetings for fun and games, competition, and informal chances to look at mathematics would be an asset to the present program.

THE DEMONSTRATION

UPPER GRADES: Very successful as students and teachers saw the possibility of holding a large group of students attentive for a period. The students seem to enjoy the competition between groups and classes.

LOWER GRADES: The only negative comments about this demonstration are attributable to the inexperience of the demonstrator with working at this grade level. Sending the teachers to the rear of the room with this group was rather risky. I am glad that I tried this though. Dismissing these children in a random or disorganized manner was catastrophic. (I'm sorry)

Much could be said about the students' attitudes toward studying mathematics. These are the things that should be measured rather than actual achievement at this stage. Time will tell whether the approach paid off, yet, the immediate indications will come from change of attitudes toward the subject.

OVERALL COMMENTS

I have no doubts that your project is on the right track. I am proud to have had the chance to become involved with it. You are coming closer to meeting the students where they are and advancing than most of the projects I have had the chance to see.

Would suggest infrequent meetings with the staff to informally share, evaluate, and record experiences. A diary type of report should suffice to keep a running commentary on the project.

Would suggest that the teachers develop demonstration lessons similar to mine and then present them to the entire group.

Hope that you are considering meetings with parents to share the experiences of the project. Demonstrations at P.T.A. meetings and at Open House are excellent for this. Perhaps video-taped demonstrations for sharing District-wide would be of great help.

I know that you are considering better means of moving students from one group to another once they have mastered the necessary computational skills.

Please get some type of report on your project into the mainstream of ideas for working for the low achiever. The NCTM publications and others should be provided with reports on the project.

Successful techniques should be tried in other schools with students of average and above average ability.

PROJECT S.E.E.D.*

1011 Keith Avenue
Berkeley, California 94708

William F. Johntz
Director

(415) 526-1334 (home)
(415) 841-1422 (office)

June 9, 1969

Dr. Virginia Gilbert
J. H. Brinley Junior High School
P. O. Box 551
Las Vegas, Nevada -89101

Dear Dr. Gilbert,

On Thursday, May 8, 1969 I spent one day visiting your mathematics project in Las Vegas. It was an interesting experience for me in that your project involves the principle of achievement grouping--a principle about which there is great disagreement in educational circles. The potential virtues of relatively homogeneous achievement levels with a particular mathematics class are well known, whereas the potential hazards of this kind of grouping are less well known. I was delighted to observe that you were very careful to avoid the main pitfalls of achievement grouping while apparently gaining some of the most important benefits. The three main hazards to which I refer are the following:

1) Derogation: The students that are placed in the "lower" groupings often feel a sense of derogation and consequent lowering of their self-concept. This in turn reduces not only the students motivation but also, I believe, lowers his effective intelligence. Every effort must be made to have the children in the lower groups feel that the work they are doing is every bit as important and valuable as the work done by the other groups. All hierarchical status conotations must be avoided.

2) Immobility: Many achievement groupings suffer from a complete lack of mobility, particularly upward, between groups. It is absolutely essential that children be able to move smoothly from one group to another. It is my understanding that you were able to achieve a high degree of mobility between groups. This is not easy and it is an excellent indication not only that children are learning and moving but that there is an expectation of success surrounding the project. These expectations are of prime importance.

3) Teacher placement: Another very common mistake in achievement grouping is that the poorest teachers are placed with the lowest groups. This, of course, tends to exacerbate both of the aforementioned problems. Children have excellent intuitions about the quality and status ratings of various teachers. It is extremely important that some of the very best teachers be placed with the "lowest" groups.

*SPECIAL ELEMENTARY EDUCATION FOR THE DISADVANTAGED

Apparently you have made a serious effort to avoid these mistakes and are to be commended for your sensitivity and energy in implementing the very challenging project you have undertaken. It would be extremely desirable for the project to be continued over a period of years in order that your excellent start not be wasted.

I wish you every success.

Sincerely,

William F. Johntz

William F. Johntz, Director
Project SEED

APPENDIX B

FREQUENCY DISTRIBUTIONS

EXPERIMENTAL SCHOOL PRE-TEST

GRADE 6 RAW SCORES MEAN RAW SCORE 47

X	x	x^2	N	N(X)	$N(x^2)$
74	27	729	1	74	729
69	22	484	1	69	484
68	21	441	1	68	441
63	16	256	2	126	512
62	15	225	1	62	225
61	14	196	2	122	392
60	13	169	1	60	169
59	12	144	1	59	144
58	11	121	2	116	242
57	10	100	4	228	400
56	9	81	1	56	81
55	8	64	1	55	64
54	7	49	2	108	98
52	5	25	3	156	75
51	4	16	3	153	48
49	2	4	1	49	4
48	1	1	1	48	1
47	0	0	2	94	0
46	-1	1	1	46	1
44	-3	9	1	44	9
42	-5	25	4	168	100
40	-7	49	1	40	49
39	-8	64	1	39	64
37	-10	100	1	37	100
36	-11	121	1	36	121
35	-12	144	1	35	144
32	-15	225	1	32	225
31	-16	256	1	31	256
29	-18	324	2	58	648
23	-24	576	1	23	576
21	-26	676	1	21	676
12	-35	1225	1	12	1225
6	-41	1681	1	6	1681
			N = 49	ΣX = 2331	$\Sigma(x^2)$ = 9984

CONTROL SCHOOL PRE-TEST

GRADE 6 -RAW SCORES MEAN RAW SCORE 49

X	x	x^2	N	N(X)	$N(x^2)$
84	35	1225	1	84	1225
70	21	441	1	70	441
66	17	289	3	198	867
64	15	225	2	128	450
63	14	196	2	126	392
62	13	169	2	124	338
60	11	121	2	120	242
59	10	100	1	59	100
58	9	81	4	232	324
57	8	64	1	57	64
56	7	49	3	168	147
55	6	36	1	55	36
54	5	25	4	216	100
53	4	16	3	159	48
52	3	9	3	156	27
51	2	4	1	51	4
50	1	1	1	50	1
49	0	0	1	49	0
48	-1	1	2	96	2
46	-3	9	1	46	9
43	-6	39	4	172	144
41	-8	64	1	41	64
40	-9	81	1	40	81
37	-12	144	2	74	238
35	-14	196	2	70	392
34	-15	225	1	34	225
33	-16	256	3	99	768
31	-18	324	1	31	324
30	-19	361	1	30	361
29	-20	400	1	29	400
28	-21	441	1	28	441
27	-22	484	2	54	968
22	-27	729	2	44	1458
18	-31	961	1	18	961
			N = 62	$\Sigma X = 3008$	$\Sigma(x^2) =$ 11692

EXPERIMENTAL SCHOOL POST-TEST

GRADE 6 RAW SCORES MEAN RAW SCORE 56

X	x	x^2	N	N(X)	$N(x^2)$
83	27	729	1	83	729
79	23	529	1	79	529
78	22	484	1	78	484
76	20	400	1	76	400
75	19	361	1	75	361
70	15	225	1	70	225
69	13	169	2	138	338
68	12	144	1	68	144
67	11	121	3	201	363
66	10	100	1	66	100
64	8	64	2	128	128
63	7	49	1	63	49
61	5	25	2	122	50
60	4	16	1	60	16
59	3	9	1	59	9
58	2	4	2	116	8
57	1	1	2	114	2
56	0	0	3	168	0
55	-1	1	1	55	1
54	-2	4	1	54	4
53	-3	9	1	53	9
52	-4	16	2	104	32
50	-6	36	1	50	36
48	-8	64	2	96	128
47	-9	81	3	141	273
45	-11	121	1	45	121
44	-12	144	2	88	288
43	-13	169	1	43	169
42	-14	196	2	84	392
40	-16	256	2	80	512
36	-20	400	1	36	400
26	-30	900	1	26	900
24	-32	1024	1	24	1024
			N = 49	ΣX = 2743	$\Sigma(x^2)$ = 8224

CONTROL SCHOOL POST-TEST

GRADE 6 RAW SCORES MEAN RAW SCORE 58

X	x	x^2	N	N(X)	$N(x^2)$
92	34	1156	1	92	1156
83	25	625	1	83	625
81	23	529	1	81	529
80	22	484	1	80	484
78	20	400	1	78	400
77	19	361	2	154	722
76	18	324	1	76	324
74	16	256	2	148	512
69	11	121	2	138	242
68	10	100	2	136	200
67	9	81	1	67	81
66	8	64	1	66	64
65	7	49	1	65	49
64	6	36	4	256	144
61	3	9	6	366	54
60	2	4	2	120	8
59	1	1	2	118	2
58	0	0	5	290	0
56	-2	4	1	56	4
55	-3	9	2	110	18
54	-4	16	1	54	16
53	-5	25	2	106	50
52	-6	36	3	156	108
51	-7	49	3	153	147
49	-9	81	1	49	81
48	-10	100	2	96	200
47	-11	121	1	47	121
46	-12	144	1	46	144
44	-14	196	1	44	196
41	-17	289	2	82	578
39	-19	361	1	39	361
37	-21	441	1	37	441
36	-22	484	1	36	484
33	-25	625	1	33	625
28	-30	900	1	28	900
19	-39	1521	1	19	1521
			N = 62	$\Sigma X = 3605$	$\Sigma(x^2) = 11591$

EXPERIMENTAL SCHOOL BASIC TEST: LEVEL 6 (I & II)

GRADE 6 RAW SCORES MEAN RAW SCORE 53

X	x	x^2	N	N(X)	$N(x^2)$
79	26	676	1	79	676
71	18	324	1	71	324
70	17	289	2	140	578
69	16	256	1	69	256
66	13	169	1	66	169
65	12	144	2	130	288
63	10	100	1	63	100
60	7	49	2	120	98
59	6	36	2	118	72
58	5	25	1	58	25
57	4	16	1	57	16
56	3	9	3	168	27
55	2	4	3	165	12
54	1	1	1	54	1
53	0	0	1	53	0
52	-1	1	1	52	1
51	-2	4	3	153	12
50	-3	9	2	100	18
49	-4	16	2	98	32
47	-6	36	4	188	144
46	-7	49	2	92	98
45	-8	64	3	135	192
43	-10	100	1	43	100
40	-13	169	2	80	338
38	-15	225	1	38	225
36	-17	289	2	72	578
34	-19	361	1	34	361
28	-25	625	1	28	625
			N = 48	ΣX = 2524	$\Sigma(x^2)$ = 5366

CONTROL SCHOOL BASIC TEST: LEVEL 6 (I & II)

GRADE 6 RAW SCORES MEAN RAW SCORE 46

X	x	x^2	N	N(X)	$N(x^2)$
78	32	1024	1	78	1024
73	27	729	1	73	729
69	23	529	1	69	529
65	19	361	1	65	361
63	17	289	1	63	289
61	15	225	1	61	225
56	10	100	2	112	200
55	9	81	3	165	243
53	7	49	4	212	196
51	5	25	3	153	75
50	4	16	2	100	32
49	3	9	1	49	9
48	2	4	1	48	4
47	1	1	3	141	3
46	0	0	1	46	0
45	-1	1	2	90	2
44	-2	4	4	176	16
43	-3	9	3	129	27
42	-4	16	3	126	48
41	-5	25	4	164	100
40	-6	36	6	240	216
39	-7	49	1	39	49
38	-8	64	5	190	320
37	-9	81	3	111	243
35	-11	121	1	35	121
33	-13	169	2	66	338
30	-16	256	1	30	256
28	-18	324	1	28	324
			N = 62	ΣX = 2859	$\Sigma(x^2)$ = 5979

EXPERIMENTAL SCHOOL PRE-TEST

GRADE 5 RAW SCORES MEAN RAW SCORE 35

X	x	x^2	N	N(X)	$N(x^2)$
71	36	1296	1	71	1296
57	22	484	1	57	484
55	20	400	1	55	400
52	17	289	1	52	289
51	16	256	2	102	512
50	15	225	2	100	450
49	14	196	1	49	196
47	12	144	2	94	288
46	11	121	2	92	242
45	10	100	3	135	300
44	9	81	2	88	162
43	8	64	2	86	128
42	7	49	1	42	49
41	6	36	3	123	108
40	5	25	2	80	50
38	3	9	3	114	27
36	1	1	1	36	1
35	0	0	1	35	0
34	-1	1	3	102	3
33	-2	4	2	66	8
32	-3	9	2	64	18
31	-4	16	1	31	16
30	-5	25	2	60	50
29	-6	36	2	58	72
28	-7	49	3	84	147
27	-8	64	2	54	128
26	-9	81	3	78	243
25	-10	100	3	75	300
24	-11	121	2	48	242
23	-12	144	1	23	144
22	-13	169	4	88	676
21	-14	196	2	42	392
19	-16	256	1	19	256
18	-17	289	1	18	289
17	-18	324	1	17	324
14	-21	441	1	14	441
7	-31	961	1	7	961
			N = 68	ΣX = 2359	$\Sigma(x^2)$ = 9692

CONTROL SCHOOL PRE-TEST

GRADE 5 RAW SCORES MEAN RAW SCORE 38

X	x	x^2	N	N(X)	$N(x^2)$
79	41	1681	1	79	1681
71	33	1089	1	71	1089
67	29	841	1	67	841
62	24	576	1	62	576
61	23	529	1	61	529
58	20	400	1	58	400
56	18	324	1	56	324
52	14	196	1	52	196
51	13	169	1	51	169
50	12	144	2	100	288
48	10	100	1	48	100
47	9	81	1	47	81
46	8	64	2	92	128
45	7	49	4	180	196
44	6	36	1	44	36
42	4	16	3	126	48
41	3	9	4	164	36
40	2	4	2	80	8
38	0	0	1	38	0
37	-1	1	2	74	2
34	-4	16	1	34	16
33	-5	25	4	132	100
32	-6	36	2	64	72
31	-7	49	2	62	98
30	-8	64	3	90	192
27	-11	121	1	27	121
24	-14	196	1	24	196
23	-15	225	1	23	225
21	-17	289	1	21	289
20	-18	324	1	20	324
19	-19	361	3	57	1083
18	-20	400	1	18	400
15	-23	529	2	30	1058
14	-24	576	3	42	1728
			N = 58	$\Sigma X = 2194$	$\Sigma(x^2) =$ 12630

EXPERIMENTAL SCHOOL
GRADE 5

RAW SCORES

POST-TEST
MEAN RAW SCORE 46

X	x	x^2	N	N(X)	$N(x^2)$
71	25	625	1	71	625
66	20	400	1	66	400
65	19	361	2	130	722
63	17	289	1	63	289
62	16	256	1	62	256
61	15	225	1	61	225
59	13	169	3	177	507
57	11	121	4	228	484
56	10	100	5	280	500
54	8	64	2	108	128
53	7	49	2	106	98
52	6	36	2	104	72
51	5	25	1	51	25
50	4	16	1	50	16
49	3	9	6	294	54
48	2	4	2	96	8
47	1	1	2	94	2
46	0	0	1	46	0
45	-1	1	1	45	1
44	-2	4	2	88	8
42	-4	16	3	126	48
41	-5	25	1	41	25
40	-6	36	3	120	108
38	-8	64	1	38	64
37	-9	81	2	74	162
35	-11	121	1	35	121
34	-12	144	1	34	144
33	-13	169	1	33	169
32	-14	196	1	32	196
31	-15	225	2	62	450
30	-16	256	3	90	768
27	-19	361	2	54	722
26	-20	400	2	52	800
25	-21	441	1	25	441
22	-24	576	1	22	576
21	-25	625	1	21	625
19	-27	729	1	19	729
			N = 68	$\Sigma X = 3098$	$\Sigma(x^2) =$ 10568

CONTROL SCHOOL POST-TEST

GRADE 5 RAW SCORES MEAN RAW SCORE 49

X	x	x^2	N	N(X)	$N(x^2)$
81	32	1024	1	81	1024
70	21	441	1	70	441
69	20	400	2	138	800
67	18	324	1	67	324
66	17	289	1	66	289
65	16	256	1	65	256
64	15	225	2	128	450
63	14	196	1	63	196
62	13	169	1	62	169
61	12	144	1	61	144
60	11	121	3	180	363
59	10	100	1	59	100
58	9	81	1	58	81
57	8	64	1	57	64
54	5	25	2	108	50
53	4	16	2	106	32
52	3	9	3	156	27
51	2	4	3	153	12
50	1	1	4	200	4
49	0	0	1	49	0
47	-2	4	2	94	8
46	-3	9	4	184	36
45	-4	16	1	45	16
41	-8	64	1	41	64
40	-9	81	1	40	81
39	-10	100	1	39	100
38	-11	121	3	114	363
37	-12	144	4	148	576
36	-13	169	1	36	169
35	-14	196	1	35	196
34	-15	225	1	34	225
33	-16	256	1	33	256
32	-17	289	1	32	289
26	-23	529	1	26	529
21	-28	784	1	21	784
9	-40	1600	1	9	1600
			N = 58	ΣX = 2858	$\Sigma(x^2)$ = 10118

EXPERIMENTAL SCHOOL BASIC TEST: LEVEL 5 (I & II)

GRADE 5 RAW SCORES MEAN RAW SCORE 44

X	x	x^2	N	N(X)	$N(x^2)$
73	29	841	1	73	841
60	16	256	2	120	512
58	14	196	1	58	196
57	13	169	2	114	338
56	12	144	1	56	144
52	8	64	2	104	128
51	7	49	4	204	196
49	5	25	1	49	25
48	4	16	1	48	16
46	2	4	2	92	8
44	0	0	3	132	0
43	-1	1	3	129	3
42	-2	4	4	168	16
41	-3	9	1	41	9
40	-4	16	3	120	48
39	-5	25	1	39	25
38	-6	36	4	152	144
37	-7	49	3	111	147
36	-8	64	2	72	128
35	-9	81	1	35	81
32	-12	144	1	32	144
30	-14	196	1	30	196
29	-15	225	1	29	225
18	-26	676	1	18	676
			N = 46	$\Sigma X = 2026$	$\Sigma(x^2) = 4246$

CONTROL SCHOOL BASIC TEST: LEVEL 5 (I & II)

GRADE 5 RAW SCORES MEAN RAW SCORE 45

X	x	x^2	N	N(X)	$N(x^2)$
88	43	1849	1	88	1849
70	25	625	1	70	625
66	21	441	1	66	441
65	20	400	1	65	400
62	17	289	1	62	289
61	16	256	1	61	256
60	15	225	1	60	225
58	13	169	2	116	338
57	12	144	2	114	288
56	11	121	1	56	121
51	6	36	1	51	36
50	5	25	4	200	100
48	3	9	3	144	27
47	2	4	2	94	8
45	0	0	4	180	0
44	-1	1	2	88	2
43	-2	4	1	43	4
42	-3	9	1	42	9
41	-4	16	1	41	16
39	-6	36	2	78	72
38	-7	49	1	38	49
37	-8	64	2	74	128
36	-9	81	2	72	162
35	-10	100	3	105	300
34	-11	121	1	34	121
33	-12	144	3	99	432
31	-14	196	3	93	588
23	-22	484	1	23	484
12	-33	1089	1	12	1089
			N = 50	ΣX = 2269	$\Sigma(x^2)$ = 8459

EXPERIMENTAL SCHOOL PRE-TEST

GRADE 4 RAW SCORES MEAN RAW SCORE 23

X	x	x^2	N	N(X)	$N(x^2)$
47	24	576	1	47	576
45	22	484	1	45	484
40	17	289	1	40	289
36	13	169	1	36	169
35	12	144	2	70	288
34	11	121	1	34	121
33	10	100	1	33	100
32	9	81	1	32	81
31	8	64	1	31	64
30	7	49	1	30	49
29	6	36	2	58	72
28	5	25	5	140	125
27	4	16	3	81	48
26	3	9	5	130	45
25	2	4	3	75	12
24	1	1	2	48	2
23	0	0	4	92	0
20	-3	9	5	100	45
19	-4	16	2	38	32
17	-6	36	2	34	72
16	-7	49	1	16	49
15	-8	64	1	15	64
14	-9	81	2	28	162
13	-10	100	1	13	100
12	-11	121	2	24	242
11	-12	144	1	11	144
10	-13	169	1	10	169
9	-14	196	1	9	196
7	-16	256	1	7	256
6	-17	289	2	12	578
			N = 57	ΣX = 1339	$\Sigma(x^2)$ = 4634

CONTROL SCHOOL PRE-TEST

GRADE 4 RAW SCORES MEAN RAW SCORE 21

X	x	x^2	N	N(X)	$N(x^2)$
51	30	900	2	102	1800
46	25	625	1	46	625
38	17	289	1	38	289
36	15	225	1	36	225
35	14	196	1	35	196
34	13	169	2	26	338
33	12	144	1	33	144
31	10	100	3	93	300
30	9	81	1	30	81
29	8	64	1	29	64
28	7	49	3	84	147
27	6	36	1	27	36
26	5	25	3	78	75
25	4	16	2	50	32
24	3	9	3	72	27
23	2	4	2	46	8
22	1	1	4	88	4
21	0	0	2	42	0
20	-1	1	4	80	4
19	-2	4	2	38	8
18	-3	9	4	72	36
17	-4	16	5	85	80
16	-5	25	3	48	75
15	-6	36	2	30	72
14	-7	49	3	42	147
13	-8	64	3	39	192
11	-10	100	3	33	300
10	-11	121	3	30	363
9	-12	144	1	9	144
8	-13	169	2	16	338
7	-14	191	1	14	196
4	-17	289	2	8	578
2	-19	361	1	2	361
			N = 73	$\Sigma X = 1501$	$\Sigma(x^2) = 7285$

EXPERIMENTAL SCHOOL POST-TEST

GRADE 4 RAW SCORES MEAN RAW SCORE 33

X	x	x^2	N	N(X)	$N(x^2)$
55	22	484	2	110	968
52	19	361	1	52	361
51	18	324	1	51	324
50	17	289	1	50	289
49	16	256	2	98	512
48	15	225	1	48	225
46	13	169	3	138	507
45	12	144	1	45	144
41	8	64	2	82	128
40	7	49	1	40	49
39	6	36	4	156	144
37	4	16	1	37	16
35	2	4	2	70	8
34	1	1	2	68	2
32	-1	1	1	32	1
31	-2	4	5	155	20
30	-3	9	1	30	9
29	-4	16	4	116	64
28	-5	25	3	84	75
27	-6	36	2	54	72
26	-7	49	4	104	196
25	-8	64	2	50	128
24	-9	81	3	72	243
23	-10	100	2	46	200
22	-11	121	1	22	121
21	-12	144	1	21	144
19	-14	196	1	19	196
18	-15	225	1	18	225
17	-16	256	2	34	512
			N = 57	ΣX = 1902	$\Sigma(x^2)$ = 5883

CONTROL SCHOOL POST-TEST

GRADE 4 RAW SCORES MEAN RAW SCORE 41

X	x	x^2	N	N(X)	$N(x^2)$
85	44	1936	1	85	1936
64	23	529	1	64	529
59	18	324	2	118	648
57	16	256	1	57	256
56	15	225	2	112	450
55	14	196	2	110	392
53	12	144	1	53	144
52	11	121	3	156	363
51	10	100	2	102	200
50	9	81	3	150	243
49	8	64	2	98	128
48	7	49	2	96	98
47	6	36	2	94	72
46	5	25	2	92	50
45	4	16	1	45	16
44	3	9	4	176	36
43	2	4	1	43	4
42	1	1	4	168	4
41	0	0	2	82	0
40	-1	1	1	40	1
39	-2	4	3	117	12
38	-3	9	3	114	27
37	-4	16	3	111	48
36	-5	25	3	108	75
35	-6	36	1	35	36
34	-7	49	1	34	49
33	-8	64	1	33	64
30	-11	121	4	120	484
29	-12	144	2	58	288
28	-13	169	2	56	238
27	-14	196	2	54	392
25	-16	256	2	50	512
23	-18	324	1	23	324
21	-20	400	2	42	800
18	-23	529	1	18	529
15	-26	676	3	45	2028
			N = 73	ΣX = 2959	$\Sigma(x^2)$ = 11476

EXPERIMENTAL SCHOOL PRE-TEST

GRADE 3 RAW SCORES MEAN RAW SCORE 31

X	x	x^2	N	N(X)	$N(x^2)$
55	24	576	1	55	576
52	21	441	1	52	441
50	19	361	1	50	361
48	18	324	1	48	324
47	16	256	2	94	512
46	15	225	1	46	225
45	14	196	2	90	392
44	13	169	1	44	169
43	12	144	1	43	144
40	9	81	2	80	162
39	8	64	2	78	128
38	7	49	2	76	98
37	6	36	1	37	36
36	5	25	1	36	25
34	3	9	1	34	9
33	21	4	4	132	16
32	1	1	3	96	3
31	0	0	2	62	0
30	-1	1	5	150	5
29	-2	4	6	174	24
28	-3	9	2	56	18
27	-4	16	6	162	96
26	-5	25	12	312	300
25	-6	36	2	50	72
24	-7	49	2	48	98
23	-8	64	4	92	256
22	-9	81	2	44	162
21	-10	100	2	42	200
20	-11	121	1	20	121
18	-13	169	1	18	169
16	-15	225	1	16	225
15	-16	256	1	15	256
14	-17	289	1	14	289
			N = 77	ΣX = 2366	$\Sigma(x^2)$ = 5912

CONTROL SCHOOL PRE-TEST

GRADE 3 RAW SCORES MEAN RAW SCORE 43

X	x	x^2	N	N(X)	$N(x^2)$
83	40	1600	1	83	1600
80	37	1369	1	80	1369
74	31	961	1	74	961
70	27	729	1	70	729
69	26	676	1	69	676
65	22	484	1	65	484
63	20	400	2	126	800
61	18	324	2	122	648
58	15	225	1	58	225
57	14	196	2	114	392
56	13	169	2	112	338
55	12	144	1	55	144
54	11	121	1	54	121
52	9	81	1	52	81
51	8	64	2	102	128
50	7	49	2	100	98
49	6	36	3	147	108
48	5	25	1	48	25
47	4	16	2	94	32
46	3	9	2	92	18
45	2	4	3	135	12
44	1	1	1	44	1
43	0	0	2	86	0
42	-1	1	3	126	3
41	-2	4	1	41	4
40	-3	9	3	120	27
39	-4	16	1	39	16
38	-5	25	1	38	25
37	-6	36	5	185	180
36	-7	49	3	108	147
34	-9	81	2	68	162
32	-11	121	2	64	242
31	-12	144	1	31	144
30	-13	169	3	90	507
29	-14	196	5	145	980
28	-15	225	2	56	450
27	-16	256	1	27	256
25	-18	324	1	25	324
22	-21	441	1	22	441
21	-22	484	1	21	484
15	-28	784	1	15	784
14	-29	841	1	14	841
			N = 74	$\Sigma X = 3217$	$\Sigma(x^2) =$ 15007

EXPERIMENTAL SCHOOL POST-TEST

GRADE 3 RAW SCORES MEAN RAW SCORE 47

X	x	x^2	N	N(X)	$N(x^2)$
90	43	1849	1	90	1849
89	42	1764	1	89	1764
87	40	1600	2	174	3200
84	37	1369	1	84	1369
83	36	1296	1	83	1296
81	34	1156	1	81	1156
80	33	1089	1	80	1089
75	28	784	1	75	784
74	27	729	1	74	729
68	21	441	1	68	441
67	20	400	1	67	400
66	19	361	1	66	361
63	16	256	1	63	256
62	15	225	2	124	450
57	10	100	2	114	200
55	8	64	1	55	64
54	7	49	1	54	49
53	6	36	2	106	72
52	5	25	1	52	25
51	4	16	2	102	32
50	3	9	2	100	18
49	2	4	2	98	8
48	1	1	1	48	1
47	0	0	3	141	0
46	-1	1	2	92	2
45	-2	4	1	45	4
44	-3	9	1	44	9
43	-4	16	2	86	32
42	-5	25	4	168	100
41	-6	36	1	41	36
40	-7	49	2	80	98
39	-8	64	4	156	256
38	-9	81	2	76	162
37	-10	100	2	74	200
36	-11	121	1	36	121
35	-12	144	2	70	288
33	-14	196	7	231	1372
32	-15	225	2	64	450
31	-16	256	3	93	768
29	-18	324	1	29	324
27	-20	400	2	54	800
26	-21	441	2	52	882
25	-22	484	1	25	484
21	-26	676	1	21	676
20	-27	729	1	20	729
			N = 77	ΣX = 3645	$\Sigma(x^2)$ = 23406

CONTROL SCHOOL POST-TEST

GRADE 3 RAW SCORES MEAN RAW SCORE 62

X	x	x^2	N	N(X)	$N(x^2)$
109	47	2209	1	109	2209
106	44	1936	1	106	1936
99	37	1369	2	198	2738
91	29	841	1	91	841
90	28	784	1	90	784
89	27	729	1	89	729
85	23	529	1	85	529
82	20	400	2	164	800
81	19	361	2	162	722
80	18	324	2	160	648
79	17	289	1	79	289
78	16	256	2	156	512
77	15	225	2	154	450
76	14	196	1	76	196
75	13	169	1	75	169
74	12	144	1	74	144
72	10	100	2	144	200
71	9	81	1	71	81
70	8	64	1	70	64
69	7	49	1	69	49
68	6	36	1	68	36
65	3	9	2	130	18
64	2	4	2	128	8
62	0	0	2	124	0
61	-1	1	1	61	1
60	-2	4	4	240	16
58	-4	16	3	174	48
57	-5	25	1	57	25
56	-6	36	1	56	36
54	-8	64	2	108	128
53	-9	81	1	53	81
52	-10	100	3	156	300
51	-11	121	3	153	363
49	-13	169	2	98	338
48	-14	196	1	48	196
47	-15	225	3	141	675
44	-18	324	1	44	324
42	-20	400	1	42	400
41	-21	441	1	41	441
40	-22	484	1	40	484
39	-23	529	3	117	1587
38	-24	576	2	76	1152
35	-27	729	1	35	729
32	-30	900	3	96	2700
30	-32	1024	1	30	1024
24	-38	1444	1	24	1444
			N = 74	ΣX = 4562	$\Sigma(x^2)$ = 26644

EXPERIMENTAL SCHOOL PRE-TEST

GRADE 2 RAW SCORES MEAN RAW SCORE 20

X	x	x^2	N	N(X)	$N(x^2)$
38	18	324	1	38	324
37	17	289	2	74	578
36	16	256	1	36	256
34	14	196	1	34	196
33	13	169	2	66	338
32	12	144	2	64	432
31	11	121	3	93	363
30	10	100	1	30	100
29	9	81	1	29	81
28	8	64	2	56	128
27	7	49	5	135	245
26	6	36	2	52	72
25	5	25	1	25	25
24	4	16	5	120	80
23	3	9	3	69	27
22	2	4	1	22	4
21	1	1	5	105	5
20	0	0	4	80	0
19	-1	1	6	114	6
18	-2	4	2	36	8
17	-3	9	8	136	72
16	-4	16	10	160	160
15	-5	25	9	135	225
14	-6	36	5	70	180
13	-7	49	4	52	196
12	-8	64	1	12	64
11	-9	81	3	33	243
10	-10	100	2	20	200
9	-11	121	2	18	242
8	-12	144	1	8	144
6	-14	196	1	6	196
4	-16	256	1	4	256
3	-17	289	1	3	289
			N = 98	ΣX = 1935	$\Sigma(x^2)$ = 5735

CONTROL SCHOOL — PRE-TEST

GRADE 2 — RAW SCORES — MEAN RAW SCORE 24

X	x	x^2	N	N(X)	$N(x^2)$
40	16	256	1	40	256
38	14	196	2	76	392
37	13	169	2	74	338
35	11	121	1	35	121
34	10	100	1	34	100
33	9	81	1	33	81
32	8	64	1	32	64
31	7	49	2	62	98
30	6	36	2	60	72
29	5	25	2	58	50
28	4	16	5	140	80
27	3	9	2	54	18
25	1	1	4	100	4
24	0	0	6	144	0
23	-1	1	2	46	2
22	-2	4	3	66	12
21	-3	9	7	147	63
20	-4	16	4	80	64
19	-5	25	2	38	50
18	-6	36	5	90	180
17	-7	49	2	34	98
16	-8	64	3	48	192
15	-9	81	1	15	81
13	-11	121	2	26	242
12	-12	144	1	12	144
10	-14	196	2	20	392
			N = 66	$\Sigma X = 1564$	$\Sigma(x^2) = 3194$

EXPERIMENTAL SCHOOL POST-TEST

GRADE 2 RAW SCORES MEAN RAW SCORE 31

X	x	x^2	N	N(X)	$N(x^2)$
70	39	1521	1	70	1521
64	33	1089	1	64	1089
63	32	1024	1	63	1024
61	30	900	1	61	900
60	29	841	1	60	841
58	27	729	2	116	1458
57	26	676	1	57	676
56	25	625	1	56	625
55	24	576	2	110	1152
53	22	484	2	106	968
52	21	441	1	52	441
51	20	400	2	102	800
50	19	361	1	50	361
46	15	225	1	46	225
43	12	144	2	86	288
42	11	121	1	42	121
39	8	64	1	39	64
38	7	49	2	76	98
37	6	36	2	74	72
36	5	25	3	108	75
35	4	16	2	70	32
34	3	9	3	102	27
33	2	4	4	132	16
32	1	1	1	32	1
31	0	0	1	31	0
30	-1	1	4	120	4
29	-2	4	4	116	16
28	-3	9	4	112	36
27	-4	16	4	108	64
26	-5	25	1	26	25
25	-6	36	3	75	108
24	-7	49	2	48	98
23	-8	64	5	115	320
22	-9	81	6	132	486
21	-10	100	4	84	400
20	-11	121	3	60	363
19	-12	144	1	19	144
18	-13	169	4	72	676
17	-14	196	4	68	784
16	-15	225	1	16	225
15	-16	256	4	60	1024
11	-20	400	1	11	400
10	-21	441	1	10	441
9	-22	484	1	9	484
8	-23	529	1	8	529
			N = 98	ΣX = 3074	$\Sigma(x^2)$ = 19502

CONTROL SCHOOL POST-TEST

GRADE 2 RAW SCORES MEAN RAW SCORE 40

X	x	x^2	N	N(X)	$N(x^2)$
78	38	1444	1	78	1444
74	34	1156	1	74	1156
73	33	1089	1	73	1089
69	29	841	1	69	841
63	23	529	1	63	529
59	19	361	2	118	722
57	17	289	1	57	289
56	16	256	2	112	512
55	15	225	1	55	225
54	14	196	1	54	196
53	13	169	2	106	338
52	12	144	1	52	144
51	11	121	1	51	121
48	8	64	2	96	128
47	7	49	2	94	98
46	6	36	1	46	36
44	4	16	1	44	16
42	2	4	3	126	12
41	1	1	3	123	3
40	0	0	3	120	0
39	-1	1	1	39	1
38	-2	4	3	114	12
37	-3	9	1	37	9
36	-4	16	2	72	32
35	-5	25	2	70	50
32	-8	64	6	192	384
31	-9	81	1	31	81
30	-10	100	2	60	200
28	-12	144	2	56	288
26	-14	196	1	26	196
25	-15	225	3	75	675
24	-16	256	1	24	256
22	-18	324	5	110	1620
21	-19	361	2	42	722
17	-23	529	2	34	1058
14	-26	676	1	14	676
			N = 66	ΣX = 2607	$\Sigma(x^2)$ = 14159

APPENDIX C

SUMMARY OF RESPONSES TO TEACHER QUESTIONNAIRES AT THE EXPERIMENTAL SCHOOL MAY - 1969

PRIMARY TEACHER QUESTIONNAIRE
(grades 2 & 3) 8 teachers responding

1. Considering learning in Arithmetic only, I feel the Ungraded Mathematics Program---
   benefited (range 0% to 100%) average 45%
   made no difference to (range 0% to 95%) average 36%
   was detrimental to (range 0% to 100%) average 18%

2. Did you notice any adverse psychological effects due to the ungraded program? 6 Yes, 2 No. If yes, what % of the students were thus affected?
   (range 10% to 100%) average 30%
   COMMENTS: "Most children didn't want to go to math classes. They would get upset and cry." (2)
   "A very small percent resented being with smaller children." One teacher answered 100%,but made no comment.

3. Which of the instructional aids did you use?
   3 manipulative materials
   5 film strips
   5 flannel board materials
   5 games
   worksheets;*
   5 developmental
   4 remedial
   5 enrichment
   *Both commercially produced and those designed by the math specialist.

4. Which of the items checked in item #3 were most beneficial (list 3 in order)?
   First: Worksheets 4, Manip. devices 1, Filmstrips 1, Flannel board 1
   Second: Worksheets 2, Manip. devices 2, Filmstrips 2
   Third: Manip. devices 1, Games 2

   Least beneficial: Games 2, Filmstrips 1, Flannel board 1

5. Did you find the services of the math specialist
   3 very useful, 2 useful, 3 of no use.
   a) Would you like the services of a math specialist available again next year? 5 Yes, 3 No. If no, why not? (The 3 no votes are the three who found no use for the math specialist, and disliked the entire program.)

6. The greatest advantage of the ungraded program is -
   The "yes votes" above agreed that the greatest advantage is in each child working at his own developmental level in math without overburdening the teacher. The "no votes" above could see no "great" advantage.

The greatest disadvantage was -- substitute teachers and impossibility of assigning home work and "enforcing" it. (Project Director's comment -- How beneficial and necessary is homework for these children????)

7. Would you recommend the continuation of the ungraded program in mathematics? 4 Yes, 4 No. Qualifications of the teachers - Yes, if the teachers are all willing to cooperate. No, not in the primary grades.

INTERMEDIATE TEACHER QUESTIONNAIRE
(grades 4, 5 & 6) 6 responding

1. Considering learning in Arithmetic only, I feel that the Ungraded Mathematics Program has:
   been highly beneficial to (range 0% to 80%) ave. 19%
   been of some benefit to (range 0% to 80%) ave. 60%
   made no difference to (range 10% to 30%) ave. 21%
   been detrimental to 0%
   been very detrimental to 0% of the students.

2. Did you notice any adverse psychological effects due to the ungraded program? 1 Yes, 5 No. If yes, what % of the students you worked with were thus affected? 90%. (The teacher who answered yes, felt that the movement of students to another class room was too disruptive.)

3. Of the various instructional aids purchased for the arithmetic program, check those listed below that you used.

3 manipulative materials	6 worksheets (developmental)*
3 film strips	2 worksheets (remedial)*
5 games	4 worksheets (enrichment)*
0 flannel board materials	1 other (name) transparencies for overhead

4. Which of the items checked in #4, did you find most beneficial, list in order. (BE SPECIFIC Ex: Manip. mat. - open-ended abacus.)
   First: Worksheets 2, manip. mat. 2, transparencies for overhead 1.
   Second: Worksheets 3, manip. mat. 1, film strips 1
   Third: Worksheets 1, games 3

   Least beneficial (No answers)

5. Did you find the services of the mathematics specialist 6 very useful, 0 useful, 0 of no use.

   Would you like to have the services of a math specialist available again next year? 6 Yes, 0 No. If no, why not?

6. What do you consider the greatest advantage of the ungraded program in mathematics? Understanding of concepts "missed" in lower grades. Working with groups of students at same level (beneficial to both students and teachers).

The greatest disadvantage? None - 3 votes, 1 - too disruptive. 1 - Sixth graders "resent" not working in 6th grade text. 1 - The great gap that appears in what the student has learned. (Project Director's comment: I don't understand what he means.)

7. Would you recommend the continuation of the ungraded program in mathematics? Briefly discuss the reasons for your answer.
5 yes, 1 no. The no because of the "disruptive" aspect of the program. 2 of the yes votes, qualified by wanting smaller classes.

ATTACHMENT I

EXAMINER'S MANUALS AND ANSWER KEYS FOR MATHEMATICS CONCEPT TEST
BASIC LEVELS 1-6

(Since these Examiner's Manuals and Answer Keys contain more than twenty pages each, they are bound in a separate packet accompanying this report. This was done to prevent the size of this manuscript from becoming unwieldy.)