

THE EFFECT OF CERTAIN MATERIALS ON
INTELLIGENCE AND ACHIEVEMENT

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TABLE OF CONTENTS

	Page
LIST OF TABLES	iv
Chapter	
I. INTRODUCTION	1
Statement of Problem	
Sources of Data	
Limitations of the Experiment	
Method of Collecting Data	
Review of Related Research	
Description of Experiment	
Means of Equating the Groups	
II. EFFECT OF CERTAIN MATERIALS ON INTELLIGENCE AND ACHIEVEMENT	14
Effect of Certain Materials on Intelligence	
Effect of Certain Materials on Achievement	
III. SUMMARY, CONCLUSIONS, AND SUGGESTIONS	47
Summary	
Conclusions	
Suggestions	
BIBLIOGRAPHY	50

LIST OF TABLES

Table	Page
1. Test Scores of the First Science Research Associates Primary Mental Abilities Tests Which were the Basis for Equating the Groups	9
2. Scores of Experimental and Control Groups on Metropolitan Reading Readiness Tests	11
3. Intelligence Quotients of Both Groups on First and Second Science Research Associates Primary Mental Abilities Tests	16
4. Reading Age Scores of Both Groups on First and Second Science Research Associates Primary Mental Abilities Tests	20
5. Scores of Both Groups in Quantitative Age on First and Second Science Research Associates Primary Mental Abilities Tests	24
6. Scores of Both Groups in Motor Age on First and Second Science Research Associates Primary Mental Abilities Tests	28
7. Scores of Both Groups in Space Age on First and Second Science Research Associates Primary Mental Abilities Tests	32
8. Scores of Both Groups on Metropolitan Achievement Tests	37
9. Scores of Both Groups in Reading Achievement on Metropolitan Achievement Tests	41
10. Scores of Both Groups in Number Achievement on Metropolitan Achievement Tests	44

CHAPTER I

INTRODUCTION

Statement of Problem

While some experiments indicate that the intelligence quotient does not vary much from time to time, other studies reveal that children with low intelligence quotients can be given special training that will cause their intelligence quotients to change as much as thirty points. Heredity determines the limit of achievement, but it is believed that few people approach the limits of their potentialities. Therefore, planned training could result in considerable improvement of many primary mental abilities of many children.¹

The problem in this experiment is to try to determine if the use of certain materials during the first semester of the first school year of a group of children will cause the intelligence quotients and achievements of these children to improve. The children used in this experiment were two first-grade groups in the Wichita Falls schools. The experimental group was a first-grade group in Franklin School, Wichita Falls, Texas. The parents in the Franklin School District are business and professional people with

¹Examiner Manual for the S.R.A. Primary Mental Abilities, Primary, Science Research Associates, Chicago, 1948.

middle to high incomes. In addition to regular first-year activities the experimental group was given material designed to give young children direct training in mental skills.

This material which will be described in more detail later in this study was a workbook of sixty lessons, each of which was planned to give specific training in one or more of the following abilities: verbal meaning, perception, space, reasoning, quantitative thinking, word fluency, memory, and eye-hand coordination.

The control group was a first-grade group in Alamo School, Wichita Falls, Texas. The children in Alamo School District have parents in the business and professional fields with middle to high incomes. Alamo School District is adjacent to Franklin District, and the school buildings are about fifteen blocks apart. The teachers of these two groups had approximately the same training and number of years teaching experience.

The purpose of this investigation is to measure the effects, if any, of this extra training and to interpret the data secured. The experiment is a comparative study of the intelligence and achievement of the two groups of first-grade children.

Sources of Data

The principal data for this study were obtained from the two groups of first-grade children upon whom the experiment

was made. Information from current publications supplied other valuable data for the study.

Limitations of the Experiment

This experiment is limited in that it was conducted with few children over a short period of time. Probably no definite conclusions can be reached from a study involving only two first-year groups over a period of four and one-half months.

Method of Collecting Data

On September 29, 1949, Science Research Associates Primary Mental Abilities Tests were given to both groups of first-grade children used in this study. The primary form for children from five to seven years of age was used. L. L. Thurstone, Professor of Psychology, the University of Chicago, and his wife, Thelma Gwinn Thurstone, Director, Bureau of Child Study, Chicago Public Schools, constructed these tests. On October 5, 1949, both groups were given The Metropolitan Reading Readiness Tests. On March 13, 1950, Science Research Associates Primary Mental Abilities Tests were given to both groups again. This was the same test that was used in September. On April 28, 1950, both groups were given The Metropolitan Achievement Tests, Primary 1 Battery: Form R. Each teacher administered all tests to her own pupils and all tests were scored by the teacher of the experimental group.

Review of Related Research

W. R. Van Voorhis found that the space ability factor, one of the primary mental abilities of the Thurstone tests, could be significantly improved by training. This experiment was conducted with college students.²

Agnes R. McElwell experimented with the Thurstone verbal factor, and reported that the verbal factor could be significantly improved with training. College students were used in this study.³

Mark Roser, Director of Child Welfare, Gary, Indiana, experimented with children in the Gary Schools and asserts that children with intelligence quotients between seventy and ninety raised their intelligence quotients to between one hundred and one hundred ten. This gain was accomplished by better teaching methods, smaller classes, individual attention, and consideration for pupils' needs.⁴

Agnes R. McElwell made a study of nursery school children from a Works Progress Administration nursery school in Pennsylvania. These children between three and five years of age with intelligence quotients below 100 came from environmentally deprived homes and were rated by teachers as

²W. R. Van Voorhis and Agnes R. McElwell, "Improving Functional Intelligence," Elementary School Journal, XXXV (December, 1944), 213.

³Ibid., p. 213.

⁴Benjamin Fine, "More and More the I. Q. Idea is Questioned," New York Times Magazine, September 18, 1949, p. 7.

slow and lacking in initiative. An analysis was made of functioning intelligence in young children, and nursery school activities to develop functioning intelligence were listed. After the children in the experimental group had been given training in these activities, they gained in mean score on all measures. Their gain in social quotients was highly significant statistically. There was a gain in intelligence and emotional quotients, though neither of these gains was significant statistically.⁵

Description of Experiment

The children in the control group engaged in regular first-year activities throughout the year. The experimental group was given instruction in The Blue Book for about thirty minutes each day over a period of four and one-half months. The Blue Book, the second book in the Learning to Think Series was written by Thelma Gwinn Thurstone, one of the authors of the Science Research Associates Primary Mental Abilities Tests. The Learning to Think Series consists of of three books, The Red Book for kindergarten, The Blue Book for first semester of first grade, and The Green Book for second semester of first grade. The American Council on Education sponsored the studies of Mrs. Thurstone. She spent fifteen years doing research at the University of

⁵Van Voorhis and McElwell, op. cit., pp. 213-219.

Chicago and based her series of books on the results of her findings. The Blue Book was designed to give direct training in the following primary mental abilities; verbal meaning, space, reasoning, quantitative thinking, word fluency, memory, motor, and perception. The Blue Book is a workbook containing sixty lessons.

Thirteen of these lessons have as their purpose training in verbal meaning. Auditory discrimination or the ability to give close attention to the sounds of words is stressed in some lessons. There are pictures to stimulate story telling. Some lessons give training in the classification of objects. In some lessons the child is directed to choose the right object from four rather closely related alternatives, and there are problems of completion in other lessons of this section.

Eleven lessons are planned to develop perception. These include lessons in scanning a page quickly to find a specific picture. The child is led to distinguish between identical objects and objects that are nearly alike. There are pictures that contain hidden objects which can be discovered by turning the picture in different positions.

The five lessons to develop motor or eye-hand coordination give training in dot drawing, making dot pictures, and drawing a line between two closely spaced lines without touching them. The purpose of these lessons is to teach the child to use his pencil accurately and confidently.

There are eight lessons to help the children acquire skill in space relationships. This group of lessons includes problems in pattern completion, pattern copying, following a line through a field of confusing lines, recognizing reversals, determining if two nearly identical geometric figures are alike, and tracing mazes.

The purpose of twelve lessons in The Blue Book is to give instruction in quantitative thinking. Concepts of numbers and understandings of the order of numbers are developed. There are counting exercises, dot counting, and meaningful counting of objects.

The thirteen lessons planned to train children in the ability to reason include problems in classification which become progressively more difficult. There are exercises in logical association, recognizing the rule by which a series is constructed, and predicting on the basis of this principle what comes next. The other lessons of this division present work in grouping, part-whole relationships, and an elementary form of induction.

Each lesson based on the material in The Blue Book contains two parts, the group lesson and the individual lesson. The group lesson preceded the individual lesson each day and was developed by group discussion and participation in solving a problem presented on a chart seventeen by twenty-two inches in size. The chart problem for the day was similar to that of the corresponding lesson in the workbook.

Although the chart pictures and examples were different from those of the related exercise in the book, the same principles were used in solving both problems. After the teacher was convinced that the pupils understood the problem and its solution, the children solved similar problems in their workbooks. Individual help by the teacher was given if any of the children had difficulty. Check-up and discussion concluded each lesson.

Means of Equating the Groups

Table 1 presents the results of the first Science Research Associates Primary Mental Abilities Tests, which were used as a basis for equating the two groups used in this study. All the pupils of both groups were tested September 29, 1949, and two matched groups of twenty-three were selected according to ages and intelligence quotients. The pupils of each pair were within four months of each other in age and had intelligence quotients of not more than four points difference. Pupils in the experimental group ranged in age from six years to six years and nine months with intelligence quotients from seventy to one hundred twenty-seven. The median age was six years and six months and the median intelligence quotient was one hundred ten. In the control group the pupil's ages ranged from six years to six years and eleven months with intelligence quotients from sixty-seven to one hundred twenty-eight. The median age

TABLE 1

TEST SCORES OF THE FIRST SCIENCE RESEARCH ASSOCIATES
 PRIMARY MENTAL ABILITIES TESTS WHICH WERE
 THE BASIS FOR EQUATING THE GROUPS

Experimental Group			Control Group		
Pupil	Age	Score	Pupil	Age	Score
1	6-6	127	1	6-5	128
2	6-0	124	2	6-3	127
3	6-5	122	3	6-4	126
4	6-7	122	4	6-8	125
5	6-4	121	5	6-1	119
6	6-9	118	6	6-9	120
7	6-7	114	7	6-5	115
8	6-0	113	8	6-2	113
9	6-5	113	9	6-9	110
10	6-7	112	10	6-5	112
11	6-7	110	11	6-9	109
12	6-7	110	12	6-5	106
13	6-1	110	13	6-0	109
14	6-0	108	14	6-2	110
15	6-8	103	15	6-11	100
16	6-0	101	16	6-1	100
17	6-7	100	17	6-5	101
18	6-6	100	18	6-6	100
19	6-8	100	19	6-10	104

TABLE 1---Continued

Experimental Group			Control Group		
Pupil	Age	Score	Pupil	Age	Score
20	6-7	99	20	6-9	102
21	6-7	88	21	6-3	88
22	6-7	70	22	6-11	73
23	6-4	70	23	6-8	67
Median	6-6	110	...	6-5	106

in the control group was six years and five months, and the median intelligence quotient was one hundred six.

The scores of the Metropolitan Reading Readiness Tests of both groups are found in Table 2. The data from the scores of these tests were secured to help determine the abilities of the children in reading readiness and number readiness. The reading scores are as follows: eight A's from the experimental group, six A's from the control group; eight B's from the experimental group, nine B's from the control group; six C's from the experimental group, seven C's from the control group; one D from the experimental group and one D from the control group. The difference between the two groups in reading readiness though slightly in favor of the experimental group is so small that it might be called negligible.

TABLE 2

SCORES OF EXPERIMENTAL AND CONTROL GROUPS ON
METROPOLITAN READING READINESS TESTS*

Experimental Group						Control Group					
Pupil	Age	I. Q. on 1st Test	Reading Readiness	Number Readiness	Total Readiness	Pupil	Age	I. Q. on 1st Test	Reading Readiness	Number Readiness	Total Readiness
1	6-6	127	A	A	A	1	6-5	128	A	A	A
2	6-0	124	A	B	B	2	6-3	127	B	A	B
3	6-5	122	B	A	B	3	6-4	126	B	A	B
4	6-7	122	A	A	A	4	6-8	125	B	A	A
5	6-4	121	A	A	A	5	6-1	119	A	A	A
6	6-9	118	A	A	A	6	6-9	120	A	A	A
7	6-7	114	A	A	A	7	6-5	115	B	A	B
8	6-0	113	C	B	B	8	6-2	113	A	B	B
9	6-5	113	A	C	B	9	6-9	110	A	A	A
10	6-7	112	B	A	A	10	6-5	112	B	A	A
11	6-7	110	B	B	B	11	6-9	109	A	A	A
12	6-7	110	A	B	A	12	6-5	106	C	A	B
13	6-1	110	C	B	C	13	6-0	109	B	A	B
14	6-0	108	B	B	B	14	6-2	110	C	B	C
15	6-8	103	B	C	C	15	6-11	100	C	A	B
16	6-0	101	B	C	B	16	6-1	100	C	C	C

TABLE 2 ---Continued

Experimental Group						Control Group					
Pupil	Age	I. Q. on 1st Test	Reading Readiness	Number Readiness	Total Readiness	Pupil	Age	I. Q. on 1st Test	Reading Readiness	Number Readiness	Total Readiness
17	6-7	100	B	B	B	17	6-5	101	B	B	B
18	6-6	100	B	B	B	18	6-6	100	C	B	C
19	6-8	100	C	C	C	19	6-10	104	B	A	B
20	6-7	99	C	B	B	20	6-9	102	B	C	B
21	6-7	88	C	C	C	21	6-3	88	C	C	C
22	6-7	70	C	E	D	22	6-11	73	C	C	C
23	6-4	70	D	B	C	23	6-8	67	D	D	D

*A - Superior
 B - High Normal
 C - Average
 D - Low Normal
 E - Poor Risk

The number-readiness scores show seven A's in the experimental group, fourteen A's in the control group; ten B's in the experimental group, four B's in the control group; five C's in the experimental group, four C's in the control group; one E in the experimental group and one D in the control group. The results of the number-readiness test indicate a greater difference between the groups in this ability than in reading readiness. The scores of the

control group were considerably higher than the scores of the experimental group: there were twice as many A's in the control group as there were in the experimental group, and there was no score in the control group as low as E, which was made by one pupil in the experimental group. The scores in total readiness are the same for the control group and the experimental group: seven A's, ten B's, five C's, and one D.

The scores of the readiness tests agree approximately with the scores of the first intelligence test in both groups. In Table 2 it is shown that both groups were ranked by means of first intelligence test scores. All of the A's in readiness in the experimental group were in the upper half of the class, while the B's were distributed throughout the entire class. All of the C's except two were in the lower half of the class, and all D's and E's were made by the two pupils who had ranked lowest on the first intelligence tests.

In the control group all except four A's were in the upper half of the class. The B's were distributed throughout the class. All C's were in the lower half of the class, and all D's were made by the pupil who scored lowest on the first intelligence test. The greatest difference which was found between the control group and the experimental group was in number readiness, but there was

there was little difference in this respect, as the readiness scores were approximately the same for both groups.

CHAPTER II

EFFECT OF CERTAIN MATERIAL ON INTELLIGENCE AND ON ACHIEVEMENT

Effect on Intelligence

After the children in the experimental group had completed The Blue Book both groups were given the Science Research Associates Primary Mental Abilities Tests again. This was the same test which was given in September. The purpose in giving this test was to get data to aid in determining if there was any difference in the improvement of the intelligence quotients of the experimental group and the control group after the experimental group had received direct training in the primary mental abilities for four and one-half months.

Table 3 shows the scores of the two intelligence tests and the improvement in the scores of the children used in this study. Some children showed a great deal of improvement while others showed very little. Only one child showed no improvement.

In the experimental group, although Pupil one showed the least improvement and Pupil twenty-three showed the most improvement, there appeared to be many deviations from any relationship between intelligence quotient and rate of improvement.

TABLE 3

INTELLIGENCE QUOTIENTS OF BOTH GROUPS ON FIRST
AND SECOND SCIENCE RESEARCH ASSOCIATES
PRIMARY MENTAL ABILITIES TESTS

Experimental Group				Control Group			
Pupil	1st I.Q. Test	2nd I.Q. Test	Improve- ment	Pupil	1st I.Q. Test	2nd I.Q. Test	Improve- ment
1	127	129	2	1	128	132	4
2	124	135	11	2	127	135	8
3	122	131	9	3	126	133	7
4	122	129	7	4	125	125	0
5	121	139	18	5	119	140	21
6	118	120	2	6	120	125	5
7	114	131	17	7	115	128	13
8	113	128	15	8	113	128	15
9	113	136	23	9	110	126	16
10	112	131	19	10	112	130	18
11	110	117	7	11	109	132	23
12	110	133	23	12	106	116	10
13	110	131	21	13	109	144	35
14	108	130	22	14	110	114	4
15	103	107	4	15	100	107	7
16	101	135	34	16	100	102	2
17	100	115	15	17	101	135	34
18	100	130	30	18	100	121	21
19	100	116	16	19	104	130	26

TABLE 3---Continued

Experimental Group				Control Group			
Pupil	1st I.Q. Test	2nd I.Q. Test	Improvement	Pupil	1st I.Q. Test	2nd I.Q. Test	Improvement
20	99	128	29	20	102	134	32
21	88	113	25	21	88	115	27
22	70	79	9	22	73	89	16
23	70	110	40	23	67	108	41
Total	...	...	388	...	...	...	385
Median	110	129	...	...	109	128	...
Mean	...	...	16.9	...	...	...	16.7

Pupil twenty-three moved from Alabama to Wichita Falls a short time before school started. His parents were divorced and his mother had recently remarried. At first he was infantile and aggressive, but during the school year he developed into a popular, happy child. This factor of his home life could have influenced the gain of forty points in his intelligence quotient. Pupil twenty-two, in the experimental group, seemed self-conscious about her extremely hoarse voice caused by a congenital throat condition. This physical factor and the poor economic status of her parents could have affected her development. Her score improved from seventy to seventy-nine. Pupil fifteen with a score of 103 improved only four points, while Pupil sixteen with a

score of 101 improved thirty-four points. Pupil eleven and Pupil twelve both made scores of 110. Pupil eleven improved seven points, and Pupil twelve improved twenty-three points. The score of Pupil one was improved two points, while that of Pupil two improved eleven points. Pupil eight and Pupil nine both scored 113. The score of Pupil eight improved fifteen points and that of Pupil nine improved twenty-three points. Pupils seventeen, eighteen, and nineteen all scored 100. Pupil seventeen improved fifteen points, Pupil eighteen improved thirty points, and Pupil nineteen improved sixteen points. Pupil five with a score of 121 improved eighteen points, and Pupil six with a score of 118 improved only two points.

The greatest improvement in the control group was made by Pupil twenty-three, who improved forty-one points, from sixty-seven to one hundred eight. Pupil four made no improvement, but scored 125 on both tests. Pupil five improved twenty-one points but Pupil six improved only five points. Pupil thirteen scored 109, and Pupil fourteen scored 110. Pupil thirteen improved thirty-five points, while Pupil fourteen improved only four points. Another contrast was shown by Pupils sixteen, seventeen, and eighteen. Pupil sixteen and Pupil eighteen scored 100, and Pupil seventeen scored 101. Pupil sixteen improved two points and Pupil eighteen improved twenty-one points. Pupil seventeen improved thirty-four points. Examples of diversity between

first intelligence quotient scores and improvement are evident throughout both groups. There seems to be slightly more improvement in low scores than high ones. The lower 52 per cent of the experimental group made 69 per cent of the total improvement and the lower 52 per cent of the control group made 66 per cent of the total improvement.

Although the experimental group tended to be slightly superior to the control group in improvement in intelligence quotients, the difference between the improvement of the two groups is negligible. The results indicate that in both groups more improvement was made by the lower half of the class than by the upper half.

Table 3 shows 388 total points improvement in intelligence quotient scores for the experimental group and 385 points improvement for the control group. The average improvement for the experimental group was 16.9, and the average improvement for the control group was 16.7. There was no appreciable difference between the improvement of the two groups.

Table 4 shows the improvement in reading ages of both groups. The total gain in reading age for the experimental group was 454 months and that for the control group was 472 months. The average gain for the experimental group was 19.7 months and that for the control group was 20.5 months. The lower 52 per cent of the experimental group made 309 months improvement or 65.8 per cent of the total improvement, and the lower 52 per cent of the control group made

TABLE 4

READING AGE SCORES OF BOTH GROUPS ON FIRST AND
SECOND SCIENCE RESEARCH ASSOCIATES
PRIMARY MENTAL ABILITIES TESTS

Experimental Group				Control Group			
Pupil	1st Test	2nd Test	Improvement in months	Pupil	1st Test	2nd Test	Improvement in months
1	8-5	9-2	9	1	8-5	9-2	9
2	7-4	8-8	16	2	7-9	9-1	16
3	7-1	8-5	16	3	8-6	9-2	8
4	7-9	8-7	10	4	7-11	9-1	14
5	7-9	9-7	22	5	8-5	9-3	10
6	7-6	8-1	7	6	8-5	9-2	9
7	7-5	9-3	22	7	8-4	9-2	10
8	6-6	8-1	19	8	8-1	9-2	13
9	7-11	9-7	20	9	8-1	9-6	17
10	6-9	8-9	24	10	8-7	9-2	7
11	7-0	8-1	13	11	6-10	9-7	33
12	6-10	9-5	31	12	7-1	9-5	28
13	7-8	7-8	...	13	7-0	9-5	29
14	6-2	7-11	21	14	7-3	7-11	8
15	7-7	7-9	2	15	7-4	7-5	1
16	6-0	8-6	30	16	6-7	8-11	28
17	7-6	8-2	8	17	7-3	9-8	29
18	6-10	9-3	29	18	6-7	9-3	32
19	8-0	8-5	5	19	6-9	9-10	37

TABLE 4---Continued

Experimental Group				Control Group			
Pupil	1st Test	2nd Test	Improvement in Months	Pupil	1st Test	2nd Test	Improvement in Months
20	6-6	8-10	28	20	6-5	8-10	29
21	6-7	8-11	28	21	5-4	9-1	45
22	4-10	7-0	26	22	5-3	6-9	18
23	4-9	8-5	44	23	5-3	7-11	32
Total	...	...	454	...	...	...	472
Mean	...	...	19.7	...	...	...	20.5

348 months improvement or 73.8 per cent of the total improvement. In both groups the lower 52 per cent made the most improvement, but the lower 52 per cent of the control group made more improvement than the corresponding pupils in the experimental group although the experimental group had been trained with material designed to improve reading age.

In the experimental group Pupil thirteen made no improvement in reading age although her intelligence quotient improved twenty-one points. Pupil fifteen, whose intelligence quotient gained four points, improved two months in reading age. Pupil twenty-three, who gained the most in total intelligence quotient, made the most improvement in reading age. Pupil twenty-two gained twenty-six months in reading age and nine points in intelligence quotient. In

the experimental group six children had a reading age of nine years or above on the second test, and in the control group seventeen children scored nine years or above. In the experimental group thirteen children had a reading age between eight years and eight years and eleven months, and in the control group two pupils had reading ages between eight years and eight years and eleven months. In the experimental group four pupils had reading ages between seven years and seven years and eleven months, and in the control group three pupils had reading ages between seven years and seven years and eleven months. The lowest reading age in the experimental group was seven years, and in the control group the lowest reading age was six years and nine months.

Pupil fifteen in the control group gained only one month in reading age. The greatest gain in reading age in the control group was made by Pupil twenty-one whose reading age improved from five years and four months to nine years and one month. Pupil four, whose intelligent quotient remained the same, improved fourteen months in reading age. Pupil sixteen made a gain of two points in intelligence quotient and twenty-eight months in reading age. The individual improvement for pupils in the experimental group ranged from zero to forty-four months, and that of the control group ranged from one to forty-five months.

In some cases there seemed to be a direct ratio between gain in intelligence quotient and in reading age, while in other cases pupils who made significant gains in intelligence quotient made little or no improvement in reading age, and conversely, some who made appreciable improvement in reading age made very slight improvement in intelligence quotient. The control group obtained slightly more improvement than the experimental group in reading age.

Table 5 shows the improvement in months of the quantitative or number ages of both groups. The greatest improvement in the experimental group was made by Pupil twenty-three who raised his number age thirty-six months. Pupil fifteen, whose number age remained eight years, made no gain. There is a wide range in the amount of improvement made by the different pupils. The pupils who scored lowest on the first number test made the greatest improvement. Pupil six improved two points in intelligence quotient and one month in quantitative age.

In the control group Pupil four made no improvement in intelligence quotient or quantitative age. Pupil fourteen gained four points in intelligence quotient and seven months in quantitative age. Pupil eight gained thirty-eight months in quantitative age.

Fourteen pupils in the experimental group had a quantitative age of nine years or better, and twelve pupils

TABLE 5
 SCORES OF BOTH GROUPS IN QUANTITATIVE AGE ON FIRST
 AND SECOND SCIENCE RESEARCH ASSOCIATES PRIMARY
 MENTAL ABILITIES TESTS

Experimental Group				Control Group			
Pupil	1st Test	2nd Test	Improvement in Months	Pup Pupil	1st Test	2nd Test	Improvement in Months
1	9-0	9-8	8	1	8-0	9-4	16
2	7-2	9-0	20	2	6-11	9-1	26
3	8-8	9-5	9	3	6-11	9-1	26
4	8-8	9-4	20	4	8-8	8-8	0
5	7-6	9-6	24	5	6-3	9-4	37
6	9-0	9-1	1	6	6-11	9-1	26
7	8-8	9-2	6	7	6-7	9-2	31
8	9-0	9-6	6	8	6-1	9-3	38
9	6-11	9-5	30	9	7-2	9-5	27
10	8-0	9-3	15	10	6-11	9-3	28
11	7-2	8-2	12	11	8-0	9-5	17
12	7-6	9-8	26	12	6-9	8-8	23
13	6-1	7-3	14	13	6-0	8-1	25
14	6-7	9-0	27	14	6-8	7-3	7
15	8-0	8-0	0	15	6-7	8-0	17
16	6-7	9-6	35	16	6-1	8-0	23
17	6-0	7-8	20	17	5-10	9-0	26
18	7-2	9-3	25	18	6-3	9-0	33
19	6-7	8-6	23	19	6-9	8-10	25

Table 5---Continued

Experimental Group				Control Group			
Pupil	1st Test	2nd Test	Improvement in Months	Pupil	1st Test	2nd Test	Improvement in Months
20	6-3	7-4	15	20	6-1	8-8	31
21	6-9	7-6	9	21	4-7	6-11	28
22	4-3	6-5	21	22	6-5	6-7	2
23	4-11	7-11	30	23	5-2	7-0	20
Total	...	...	400	...	...	...	532
Mean	...	...	17.4	...	...	...	23.1

in the control group had a quantitative age of nine years or better. Three pupils in the experimental group had a quantitative age between eight years and eight years and eleven months, and seven pupils in the control group had a quantitative age between eight years and eight years and eleven months. Five pupils in the experimental group had a quantitative age between seven years and seven years and eleven months, and two pupils in the control group had a quantitative age between seven years and seven years and eleven months. Pupil twenty-two in the experimental group was the lowest with a quantitative age of six years and five months, and pupil twenty-one and twenty-two in the control group were low with quantitative ages of six years and eleven months and six years and seven months. Three pupils

in the experimental group and five pupils in the control group gained thirty months or more in quantitative age. Nine pupils in the experimental group and twelve pupils in the control group made gains of between twenty and twenty-nine months. Four pupils in the experimental group and three pupils in the control group gained between ten and nineteen months. Seven pupils in the experimental group and three pupils in the control group gained nine months or less.

The experimental group made a total gain of 400 months in quantitative age and the control group gained 532 months. The average improvement for the experimental group was 17.4 months and for the control group was 23.1 months. The average improvement per pupil in the control group was 5.7 months more than the average improvement in the experimental group.

The median quantitative age for the experimental group was seven years and two months on the first test and nine years and one month on the second test. The median quantitative age for the control group was six years and seven months on the first test and nine years on the second test.

The experimental group made less gain in quantitative than in any other mental ability and the control group made more gain in this ability than in any other. The lower 52 per cent of the experimental group made 58.4 per cent of

the total improvement for the experimental group, and the lower 52 per cent of the control group made 63.7 per cent of the total improvement for the control group.

The considerable difference between the two groups in improvement in quantitative age favored the control group, and there was less proportionate improvement made by the pupils in the lower half of both groups in quantitative age than there was in reading age.

Table 6 shows the scores and improvement of both groups in motor or eye-hand coordination. Both groups scored lower on motor ability on the first test than on any other ability. In the experimental group two pupils scored between three years and three years and eleven months, and in the control group three pupils scored between three years and three years and eleven months in motor age. Six pupils in the experimental group and five pupils in the control group scored between four years and four years and eleven months. Eleven pupils in the experimental group and ten pupils in the control group had motor ages between five years and five years and eleven months. Four pupils in the experimental group and three pupils in the control group had motor ages between six years and six years and eleven months. In the control group one pupil scored seven years and six months and one scored eight years and nine months. The highest was eight years and nine months. Nineteen pupils in the

TABLE 6

SCORES OF BOTH GROUPS IN MOTOR AGE ON FIRST AND
SECOND SCIENCE RESEARCH ASSOCIATES PRIMARY
MENTAL ABILITIES TESTS

Experimental Group				Control Group			
Pupil	Motor Score Test 1	Motor Score Test 2	Improve- ment	Pupil	Motor Score Test 1	Motor Score Test 2	Improve- ment
1	5-0	9-4	52	1	5-9	9-4	43
2	6-1	8-6	29	2	6-9	8-0	15
3	5-2	9-0	46	3	7-6	9-0	18
4	6-11	9-6	51	4	5-1	7-2	25
5	5-5	7-0	19	5	3-7	7-3	44
6	5-4	6-6	18	6	6-9	9-0	27
7	5-9	6-10	13	7	4-10	7-10	36
8	5-3	6-10	19	8	5-2	6-0	8
9	5-10	9-0	38	9	5-7	7-0	17
10	5-7	7-0	17	10	5-8	7-0	16
11	6-1	8-6	29	11	6-10	8-0	14
12	4-9	6-6	21	12	5-7	6-8	13
13	4-8	6-7	23	13	5-9	8-0	27
14	5-2	8-4	38	14	4-2	6-10	32
15	4-10	6-4	18	15	4-8	6-7	23
16	5-0	6-5	17	16	5-7	6-4	9
17	6-6	7-10	16	17	3-8	6-9	37
18	4-11	6-0	13	18	5-7	6-10	15
19	3-9	6-8	35	19	4-9	6-6	21

TABLE 6---Continued

Experimental Group				Control Group			
Pupil	Motor Score Test 1	Motor Score Test 2	Improvement	Pupil	Motor Score Test 1	Motor Score Test 2	Improvement
20	3-10	8-10	60	20	8-9	9-0	1
21	5-3	8-0	33	21	4-3	5-11	20
22	4-7	5-7	12	22	3-6	6-4	34
23	4-0	6-11	35	23	5-2	7-8	30
Total	...	...	652	...	...	...	525
Mean	...	...	27.5	...	...	...	22.8

experimental group and eighteen pupils in the control group scored below six years in motor age.

In the experimental group Pupil twenty made a gain of sixty months in motor age and Pupil one made a gain of fifty-two months. No pupils in the control group made this much gain. One pupil in the experimental group and two pupils in the control group made motor-age gains between forty and forty-nine months. Six pupils in the experimental group and five pupils in the control group made gains between thirty and thirty-nine months. Four pupils in the experimental group and six pupils in the control group made gains between twenty and twenty-nine months. Ten pupils in the experimental group and seven pupils in the control group

made gains between ten and twenty months. The lowest gain in the experimental group was twelve months. Three pupils in the control group made gains below ten months.

The experimental group improved a total of 632 months in motor age, and the control group improved a total of 525 months. The average improvement for the experimental group was 27.5 months and for the control group was 22.8 months. The average improvement for the experimental group was 4.7 months more than the average improvement for the control group.

The median motor age for the experimental group was five years and two months on the first test and seven years on the second test. The median motor age for the control group was five years and seven months on the first test and seven years on the second test. The experimental group made more total improvement and average improvement in this ability than in any other. The lower 52 per cent of the experimental group made 58.5 per cent of the total improvement for the experimental group and the lower 52 per cent of the control group made 51.7 per cent of the total improvement for the control group.

The results of the motor test show significantly higher scores in improvement in the experimental group than in the control group. The improvement in the experimental group was practically the same for the upper and lower half of

the class while there was slightly more improvement in the lower half of the control group than in the upper half.

Table 7 shows the age scores of both groups in space or spatial relationships. In the experimental group the space ages on the first test ranged from four years and nine months to eight years, and in the control group from four years to eight years. Two pupils in each group had space ages between four years and four years and eleven months. Five pupils in the experimental group and ten pupils in the control group had space ages between five years and five years and eleven months. Ten pupils in the experimental group and seven pupils in the control group had space ages between six years and six years and eleven months. Four pupils in the experimental group and three pupils in the control group had space ages between seven years and seven years and eleven months. Two pupils in the experimental group and one pupil in the control group had space ages between eight years and eight years and eleven months. Seven pupils in the experimental group and twelve pupils in the control group scored below six years in space age. The median space age in the experimental group was six years and nine months on the first test and eight years on the second test. The median space age in the control group was five years and nine months on the first test and seven years on the second test.

TABLE 7

SCORES OF BOTH GROUPS IN SPACE AGE ON FIRST
AND SECOND SCIENCE RESEARCH ASSOCIATES
PRIMARY MENTAL ABILITIES TESTS

Experimental Group				Control Group			
Pupil	Space Score 1st Test	Space Score 2nd Test	Improve- ment in months	P Pupil	Space Score 1st Test	Space Score 2nd Test	Improve- ment in months
1	6-6	7-6	12	1	5-9	6-4	7
2	6-9	8-6	21	2	4-6	7-0	30
3	6-9	9-0	27	3	7-6	9-0	18
4	8-0	9-0	12	4	7-0	8-6	18
5	7-0	8-0	12	5	6-3	8-6	27
6	8-0	9-0	12	6	6-9	9-0	27
7	6-9	8-0	15	7	5-0	7-2	26
8	6-0	6-6	6	8	6-3	7-0	9
99	7-6	8-6	12	9	6-0	7-6	18
10	6-9	8-9	24	10	5-0	7-6	30
11	6-9	7-0	3	11	8-0	9-0	12
12	7-0	8-4	16	12	5-3	5-8	5
13	5-6	8-6	36	13	6-0	7-0	12
14	6-6	8-0	18	14	5-4	6-0	8
15	5-0	7-6	30	15	5-9	7-6	21
16	5-9	9-0	39	16	5-3	6-3	12
17	6-9	8-0	15	17	5-3	6-6	15
18	6-8	8-6	22	18	6-3	7-0	9

TABLE 7---Continued

Experimental Group				Control Group			
Pupil	Space Score 1st Test	Space Score 2nd Test	Improve- ment in Months	Pupil	Space Score 1st Test	Space Score 2nd Test	Improve- ment in Months
19	4-9	6-8	23	19	6-6	7-6	12
20	7-0	8-6	18	20	7-0	8-0	12
21	5-6	6-6	12	21	5-0	6-6	18
22	5-3	6-0	9	22	5-3	5-9	6
23	4-9	6-0	15	23	4-0	5-6	18
Total	...	...	409	...	...	...	370
Mean	...	...	17.7	...	...	...	16.0

Three pupils in the experimental group and two pupils in the control group improved between thirty and thirty-nine months in space age. Five pupils in the experimental group and four pupils in the control group improved between twenty and twenty-nine months. Twelve pupils in the experimental group and eleven pupils in the control group improved between ten and nineteen months. Three pupils in the experimental group and six pupils in the control group gained less than ten months in space age.

The total improvement in space age was 409 months for the experimental group and 370 months for the control group. The average improvement for the experimental group was 17.7

months and for the control group, 16.0 months. The control group improved less in this ability than in any other. The lower 52 per cent of the experimental group made 58.6 per cent of the total improvement for the experimental group. The lower 52 per cent of the control group made 52.9 per cent of the total improvement for the control group.

The negligible difference in improvement in space age between the experimental and control groups favored the experimental group. In each group the gain of the upper and lower half of the class was practically the same.

A comparative study of Tables 4, 5, 6, and 7 shows the following results from the first test: the pupils in the experimental group scored highest in number age, second in reading age, third in space age, and lowest in motor age. The median ages for the different abilities were as follows: number, seven years and two months; reading, seven years and one month; motor, six years and nine months; and space, five years and two months. In the control group the pupils scored highest in reading age, second in number age, third in space age, and fourth in motor age. The median scores for the control group were as follows: reading, seven years and three months; number, six years and seven months; space, five years and nine months; and motor, five years and seven months.

The median age scores on the second test for the experimental group were as follows: number, nine years and one

month; reading, eight years and six months; space, eight years; and motor, seven years. The median scores for the control group on this test were as follows: number, nine years and two months; reading, nine years; space, seven years; and motor, seven years.

The experimental group made the most improvement in motor age and the least improvement in number age. Improvement in reading age ranked second and improvement in space age ranked third. The average improvements for each ability were as follows: motor, 27.5 months; reading, 19.7 months; space, 17.7 months; and number, 17.4 months. The experimental group made more improvement than the control group on two abilities: an average of 4.7 months more improvement in motor age and an average of 1.7 months more improvement in space age.

The control group made the greatest improvement in number age with an average of 23.1 months; second, an average of 22.8 months improvement in motor age; third, an average improvement of 20.5 months in reading age; and fourth, an average improvement of 16.0 months in space age. The control group made more improvement than the experimental group on two abilities: an average of 5.7 months more in number age and an average of 0.8 month more in reading age.

The evidence indicates that the very slight difference between the gains of the two groups favored the control

group. The control group gained most in reading and numbers, the two abilities measured by the achievement tests, while the abilities in which the experimental group made the most improvement, motor and space, were not measured by the achievement tests. In all tests in both groups the lower half of the class improved more than the upper half.

Effect on Achievement

Table 8 presents the scores of the experimental and control groups on The Metropolitan Achievement Tests. The purpose in giving an achievement test to the children was to try to ascertain if the material designed to give direct training in mental abilities had any effect on the achievement of the experimental group. It is assumed that training which would affect intelligence would probably affect achievement. Twenty-four lessons of the planned material were designed to improve reading and twelve lessons had as their purpose training in quantitative thinking. Reading and numbers were the only two subjects measured by the achievement tests. A comparison of the scores of pupils who had been given this material (the experimental group) with pupils who had not been given the material (the control group) should give some data upon which to base an evaluation of the material. The scores in this test were grade placement scores instead of age scores.

TABLE 8
 SCORES OF BOTH GROUPS ON METROPOLITAN
 ACHIEVEMENT TESTS

Experimental Group			Control Group				
Pupil	Reading Achievement Grade Placement	Number Achievement Grade Placement	Average Achievement Grade Placement	Pupil	Reading Achievement Grade Placement	Number Achievement Grade Placement	Average Achievement Grade Placement
1	3.5	3.3	3.4	1	3.6	3.0	3.4
2	2.6	1.8	2.4	2	3.0	3.2	3.1
3	3.2	2.9	3.1	3	2.8	2.6	2.7
4	3.3	3.6	3.4	4	3.0	3.6	3.1
5	3.5	2.9	3.4	5	3.5	2.6	3.3
6	2.4	2.9	2.5	6	2.6	2.6	2.6
7	3.2	2.9	3.1	7	3.0	2.2	2.8
8	2.3	2.4	2.3	8	3.3	2.8	3.1
9	2.8	2.6	2.7	9	3.0	2.8	2.9
10	2.7	2.7	2.7	10	2.7	2.3	2.6
11	2.2	2.2	2.2	11	3.3	2.3	2.9
12	3.1	2.9	3.0	12	2.1	1.7	2.0
13	2.2	2.1	2.2	13	3.6	2.6	3.3
14	2.6	2.6	2.6	14	1.7	2.1	1.9
15	2.1	2.1	2.1	15	2.6	2.4	2.5

TABLE 8---Continued

EXPERIMENTAL GROUP				Control Group			
Pupil	Reading Achievement Grade Placement	Number Achievement Grade Placement	Average Achievement Grade Placement	Pupil	Reading Achievement Grade Placement	Number Achievement Grade Placement	Average Achievement Grade Placement
16	3.2	2.2	2.7	16	2.0	2.0	2.0
17	2.3	2.1	2.2	17	3.3	3.1	3.2
18	3.3	2.4	3.0	18	2.9	2.1	2.7
19	2.3	1.5	2.2	19	2.4	2.7	2.5
20	2.5	3.0	2.6	20	3.0	2.5	2.8
21	2.2	1.9	2.1	21	2.3	2.2	2.3
22	1.5	...	...	22	1.6	1.6	1.6
23	2.1	1.9	2.0	23	2.0	1.8	1.9
Median	2.6	2.4	2.6	...	2.9	2.5	2.7

The scores shown are reading achievement, number achievement, and average achievement. The scores in reading achievement and number achievement were combined to give the scores in average achievement. The median average achievement was 2.6 for the experimental group. One score was too low to measure. The highest achievement, 3.4, was scored by

Pupils one, four, and five. Seven pupils placed between 3.0 and 3.9. Six of these high seven were in the upper half of the class arranged on a basis of first intelligence test scores. Fifteen pupils in the experimental group scored between 2.0 and 2.9, and the only score below 2.0 in the experimental group was too low to measure. (Pupil twenty-two scored 1.5 in reading achievement and zero in number achievement which caused her score in average achievement to be too low to measure.)

The median average achievement for the control group was 2.7. The highest score was 3.4, and the lowest was 1.6. Seven pupils in the control group scored between 3.0 and 3.9. Five of these were in the upper half of the class arranged on a basis of first intelligence test scores. Thirteen scored between 2.0 and 2.9. Three pupils had achievement scores at first-grade level: Pupil twenty-two scored 1.6, and Pupils fourteen and twenty-three scored 1.9.

The highest average achievement grade in both groups was 3.4. Seven pupils in each group made achievement scores above 3.0. Fifteen pupils in the experimental group and thirteen pupils in the control group made achievement scores between 2.0 and 2.9. Three pupils in the control group made achievement scores at first-grade level: two pupils scored 1.9 and one pupil scored 1.6. One pupil in the experimental group had an average achievement too low to measure. The median average achievement grade for the

experimental group was 2.6 and for the control group was 2.7. The achievement outcomes favored the control group although the difference was negligible.

Table 9 presents the reading achievement of both groups. The highest achievement made in reading in the experimental group was made by Pupils one and five, who achieved a reading grade of 3.5. Other scores within third-grade achievement were Pupil three with a reading grade of 3.2, Pupil four with a reading grade of 3.3, Pupil seven with a grade of 3.2, Pupil twelve with a grade of 3.1, Pupil sixteen with a grade of 3.2, and Pupil eighteen with a grade of 3.3. Eight pupils in the experimental group scored 3.0 or above in reading achievement. Pupils who scored within second grade were Pupil two with a grade of 2.6, Pupil six with a grade of 2.4, Pupil eight with a grade of 2.3, Pupil nine with a grade of 2.8, Pupil ten with a grade of 2.7, Pupil eleven with a grade of 2.2, Pupil thirteen with a grade of 2.2, Pupil fourteen with a grade of 2.6, Pupil fifteen with a grade of 2.1, Pupil seventeen with a grade of 2.3, Pupil nineteen with a grade of 2.3, Pupil twenty with a grade of 2.5, Pupil twenty-one with a grade of 2.2, and Pupil twenty-three with a grade of 2.1. Fourteen pupils scored between 2.0 and 2.9 in reading achievement. Pupil twenty-two was the only pupil in the experimental group who scored a reading age below 2.0. Her score was 1.5. The median reading achievement in the experimental group was 2.6.

TABLE 9

SCORES OF BOTH GROUPS IN READING ACHIEVEMENT
ON METROPOLITAN ACHIEVEMENT TESTS

Experimental Group		Control Group	
Pupil	Reading Achievement	Pupil	Reading Achievement
1	3.5	1	3.6
2	2.6	2	3.0
3	3.2	3	2.8
4	3.3	4	3.0
5	3.5	5	3.5
6	2.4	6	2.6
7	3.2	7	3.0
8	2.3	8	3.3
9	2.8	9	3.0
10	2.7	10	2.7
11	2.2	11	3.3
12	3.1	12	2.1
13	2.2	13	3.6
14	2.6	14	1.7
15	2.1	15	2.6
16	3.2	16	2.0
17	2.3	17	3.3
18	3.3	18	2.9
19	2.3	19	2.4
20	2.5	20	3.0

TABLE 9---Continued

Experimental Group		Control Group	
Pupil	Reading Achievement	Pupil	Reading Achievement
21	2.2	21	2.3
22	1.5	22	1.6
23	2.1	23	2.0
Median	2.6	...	2.9

The highest reading achievement attained in the control group was made by Pupils one and thirteen, who achieved a reading grade of 3.6. Other scores within third-grade achievement were Pupil two with a score of 3.0, Pupil four with a score of 3.0, Pupil five with a score of 3.5, Pupil seven with a score of 3.0, Pupil eight with a score of 3.3, Pupil nine with a score of 3.0, Pupil eleven with a score of 3.3, Pupil seventeen with a score of 3.3, and Pupil twenty with a score of 3.0. Eleven pupils or nearly half of the twenty-three scored 3.0 or better in reading achievement. Pupils who scored within second grade were Pupil three with a score of 2.8, Pupil six with a score of 2.6, Pupil sixteen with a score of 2.0, Pupil eighteen with a score of 2.9, Pupil nineteen with a score of 2.4, Pupil twenty-one with a score of 2.3, and Pupil twenty-three with a score of 2.0. Ten pupils scored between 2.0 and 2.9. Pupil twenty-two

scored 1.6 and Pupil fourteen scored 1.7, the only scores in first-grade level of achievement. The median reading achievement for the control group was 2.9.

A comparison of reading achievement scores shows that eight pupils in the experimental group and eleven pupils in the control group scored 3.0 or above, fourteen pupils in the experimental group and ten pupils in the control group scored between 2.0 and 2.9, and one pupil in the experimental group and two pupils in the control group scored below 2.0. Twenty-two pupils in the experimental group and twenty-one pupils in the control group scored 2.0 or above. The median in reading achievement of the experimental group was 2.6 and that of the control group was 2.9.

The scores in reading achievement favored the control group. About half the control group obtained scores at the third-grade level of achievement while only a third of the experimental group scored that high. Most of the scores of the experimental group were at the second-grade level.

Table 10 shows the scores in number achievement in both groups. Pupil four in the experimental group made the highest number achievement, 3.6. Other pupils who scored 3.0 or better were Pupil one who scored 3.3 and Pupil twenty who scored 3.0. Three pupils in the experimental group scored 3.0 or better in number achievement. Pupils three, five, six, and seven scored 2.9, Pupil fourteen scored 2.6, Pupils eight and eighteen scored 2.4, Pupils eleven

TABLE 10

SCORES OF BOTH GROUPS IN NUMBER ACHIEVEMENT
ON METROPOLITAN ACHIEVEMENT TESTS

Experimental Group		Control Group	
Pupil	Number Achievement	Pupil	Number Achievement
1	3.3	1	3.0
2	1.8	2	3.2
3	2.9	3	2.6
4	3.6	4	3.6
5	2.9	5	2.6
6	2.9	6	2.6
7	2.9	7	2.2
8	2.4	8	2.8
9	2.6	9	2.8
10	2.7	10	2.3
11	2.2	11	2.3
12	2.9	12	1.7
13	2.1	13	2.6
14	2.6	14	2.1
15	2.1	15	2.4
16	2.2	16	2.0
17	2.1	17	3.1
18	2.4	18	2.1
19	1.5	19	2.7
20	3.0	20	2.5

TABLE 10---Continued

Experimental Group		Control Group	
Pupil	Number Achievement	Pupil	Number Achievement
21	1.9	21	2.2
22	...	22	1.6
23	1.9	23	1.8
Median	2.4	...	2.6

and sixteen scored 2.2, and Pupils thirteen, fifteen, and seventeen scored 2.1. Fifteen pupils scored between 2.0 and 2.9. Pupils twenty-one and twenty-three scored 1.9, Pupil two scored 1.8, Pupil nineteen scored 1.5, and the score of Pupil twenty-two was too low to measure. Five pupils in the experimental group scored below 2.0 in number achievement. The median number achievement for the experimental group was 2.4.

In the control group Pupil four made the highest number achievement, 3.6. Other pupils who scored 3.0 or better were Pupil two who scored 3.2, Pupil seventeen who scored 3.1, and Pupil one who scored 3.0. Four pupils in the control group scored 3.0 or above in number achievement. Pupils eight and nine scored 2.8, Pupil nineteen scored 2.7, Pupils three, five, six, and thirteen scored 2.8, Pupil nineteen scored 2.7, Pupils three, five, six, and thirteen scored

2.6, Pupil twenty scored 2.5, Pupil fifteen scored 2.4, Pupils ten and eleven scored 2.3, Pupils seven and twenty-one scored 2.2, Pupils fourteen and eighteen scored 2.1, and Pupil sixteen scored 2.0. Sixteen pupils in the control group scored between 2.0 and 2.9 in number achievement. Pupil twenty-three scored 1.8, Pupil twelve scored 1.7, and Pupil twenty-two scored 1.6. Three pupils in the control group scored below 2.0 in number achievement. The median number achievement for the control group was 2.6.

In comparing the number-achievement scores of the two groups we find that three pupils in the experimental group and four pupils in the control group scored above 3.0, fifteen pupils in the experimental group and sixteen pupils in the control group scored between 2.0 and 2.9, and five pupils in the experimental group and three pupils in the control group scored below 2.0. In the experimental group eighteen pupils scored 2.0 or above, and in the control group twenty pupils scored 2.0 or above. The median number achievement for the experimental group was 2.4 and for the control group was 2.6. The control group tended to be slightly superior to the experimental group in number achievement although the difference was not particularly significant.

CHAPTER III

SUMMARY, CONCLUSIONS, AND SUGGESTIONS

Summary

Although both groups showed gains in intelligence and achievement, there is very little difference in the amount of improvement of the two groups. The experimental group made slightly more improvement than the control group on intelligence quotient and space age. The control group made slightly more improvement than the experimental group on reading age. The difference in improvement in quantitative age and motor age is more significant. The pupils in the control group made an average improvement of 23.1 months in quantitative age, and the pupils in the experimental group an average improvement of 17.4 months in quantitative age. In motor age the average improvement for the experimental group was 27.5 months and for the control group was 22.8 months.

The control group made higher scores in all achievement tests: reading, numbers, and average achievement. There was very little difference in the achievement scores of the two groups.

Conclusions

The results of this study indicate that the material planned to improve the intelligence and achievement of the children was of little or no value. It is possible that the material was too easy for children who have the environmental advantages that children in Franklin School have. Children from a poor environment would possibly gain from the training provided by the material. The children in the experimental group might have been helped by training in the third book in the series, which is more difficult than the material that was given to them.

Fewer first-grade experiences provide training in spatial relationships and in motor abilities than in reading and in numbers. The experimental group gained more than the control group in spatial relationships and motor abilities. Training in the planned material could have accounted for this gain. Neither of these abilities was measured in the achievement tests. Most first-grade teaching is concerned with reading and numbers. As the control group gained more than the experimental group in these two subjects, it can be assumed that the planned material was of no value in reading and numbers.

Suggestions

1. A similar experiment could be conducted with children from environmentally deprived homes, using the

material throughout the first year, The Blue Book during the first semester and The Green Book the second semester.

2. The material could be used as remedial work for children who need extra help.

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