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THE USE OF INTELLIGENCE TESTS AS A
BASIS OF SCHOOL ORGANIZATION
AND INSTRUCTION

by

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PREFACE

How to use most effectively the information yielded by general intelligence tests is one of the most important questions before the educational world at the present time. Many of our leading educational thinkers are urging that the children in our elementary schools be grouped into grades on the basis of their mental ages and divided into sections within the grade on the basis of intelligence quotients. Other educators maintain that this should not be done. In this monograph Dr. C. W. Odell presents the results of an investigation extending over nearly two years in which he has studied with unusual care certain of the questions involved in the proposal that we reorganize our schools on the basis of the results yielded by general intelligence tests. Because the questions studied are highly important it is felt that a somewhat detailed report is justified. In order to assist the reader in understanding the experiment the organization of the experimental schools has been described in detail.

This investigation was undertaken at the invitation of Superintendent Peter A. Mortenson of Chicago. Its execution was made possible by the cooperation of Assistant Superintendent A. B. Wight and of certain principals and teachers in the Chicago public schools. To all who have cooperated in the course of the investigation the Bureau of Educational Research desires to acknowledge its indebtedness.

WALTER S. MONROE, *Director.*

November 10, 1922.

THE USE OF INTELLIGENCE TESTS AS A BASIS OF SCHOOL ORGANIZATION AND INSTRUCTION

CHAPTER I

THE PLAN AND CONDUCT OF THE EXPERIMENT

The Problem. The experiment described in this bulletin was carried on in eight elementary schools in the city of Chicago. It was an attempt to answer the following question: What is the effect upon the efficiency of elementary schools of promoting and classifying pupils chiefly upon their mental ages and intelligence quotients as determined by group intelligence tests rather than according to the traditional method? It is recognized that this is really a double problem involving the question of a flexible system of promotion and classification upon any basis as compared with a non-flexible system, and also the question of using the results of group intelligence tests rather than some other basis for promotion and classification. The justification for combining these two questions is that the use of the results from group intelligence tests for the purposes mentioned above necessarily involves a flexible system and hence the two questions may be considered as one from the standpoint of practical school administration.

Definition of terms used in statement of problem. The "efficiency" of a school is the ratio of its output to the investment, or $\frac{\text{output}}{\text{investment}}$. The output or return upon the investment is measured in terms of the achievements of the pupils and their rates of progress through the school system. The investment, as the term is used above, includes not only what might strictly be called investment but also the factors which affect the manner in which the investment proper is used. The "promoting" of pupils refers to their advancement from one half-grade to another. The "classifying" of pupils refers to their placement in the fast, average and slow sections into which each half-grade in the experimental schools was divided. The word "chiefly" is used in the statement of the problem because the information derived from group intelligence tests was supple-

mented by other data. The "traditional method" refers to the method of placement used in the group of control schools. According to this method, promotion is determined by the pupil's final mark, which is usually a composite of the mark that he receives upon the final examination and that given by the teacher for his work during the term. In some cases the promotion indicated by the pupil's final mark is modified by the principal's opinion of his work or ability or by such considerations as chronological age, length of time already spent in the grade, number of pupils in the room, etc. This is the method which has been and still is the prevailing practice in the elementary schools of this country.

Scope of study. This study was confined to elementary schools having sixteen¹ or more teachers, which were organized in sixteen half-grades and in which pupils were promoted semi-annually. These schools were divided into an experimental and a control group of four each by Assistant Superintendent A. B. Wight. In making this selection, Mr. Wight endeavored to choose two groups of schools² in which the investment factors should be approximately equal at the beginning of the experiment.³ Except in the plan of organization of the experimental schools, nothing was done to cause any change.

This investigation was rather strictly limited to the study of the effect upon the "efficiency" of certain elementary schools of promoting and classifying pupils chiefly according to the data derived from the use of group tests of intelligence. There was no consideration of the desirability of discovering and segregating for instructional purposes pupils of varying degrees of ability, except from the standpoint of their rates of progress and achievements in school. Neither was there any assumption that the plan used, which provided that pupils of different degrees of ability should complete the same course of study at different rates of progress,

¹In one of the control schools there were only fourteen teachers in charge of pupils who actually participated in the project.

²The experimental schools were the Armour, Franklin, Holden and Moseley. In the control group were the Alcott, Greene, Mark Sheridan and Webster.

³A more complete comparison of the investment factors in the two groups of schools may be found in the dissertation of the same title and by the same writer as this bulletin. This dissertation is on file in the library of the University of Illinois.

was superior to a plan providing that the different groups of pupils should cover different courses of study.

In this experiment the measurement of the achievements of the pupils was, with certain minor exceptions, limited to arithmetic and reading. As these are two of the most fundamental subjects studied in the elementary school, they were considered a fairly good measure of total achievement.

The general plan of the experiment. The experiment began in the autumn of 1920 and continued until the summer of 1922. As Table I shows, both intelligence and subject-matter tests were administered to the pupils of both groups of schools once each semester except that at the last testing only subject-matter tests were used. Also certain other data that seemed pertinent to the investigation were collected at each time of testing. After the first testing period the pupils of the experimental schools were promoted and classified upon the basis of the test results and the other data which had been obtained. After each of the later testing periods such adjustments were made as seemed advisable. No direct use was made of the test results or other data in the control schools. There was some opportunity for the teachers of this group of schools to make a more or less indirect use of the test results but they did not do so to a degree sufficient to affect the results of the experiment. By thus measuring the abilities and achievements of the pupils of the two groups of schools near the beginning and end of each semester the resulting data afforded a basis for comparing the effect of promoting and classifying pupils chiefly upon the results obtained from the use of group tests of intelligence with that of promoting pupils according to the traditional method.

The first tests were given in November, 1920, and the results used in promoting and classifying the pupils for the second semester of 1920-21. The next testing occurred in May, 1921, and furnished the basis for the placement of the pupils for the following September. All new entrants were tested in September and assigned to their grades and sections as soon thereafter as possible. A general testing occurred again in December and was followed by the placement of the pupils for the second semester of 1921-22. The final testing was in May, 1922. In addition to these general testing

periods, small groups of absentees and new entrants were tested from time to time as seemed best.

The tests were in all cases given by the regular teachers who had been prepared for this work by a careful program of meetings with discussion. The teachers were also given very detailed directions. Rather extensive visiting by the writer while the tests were being administered showed that this program of preparation secured fairly uniform and correct procedure. Part of the scoring of the tests was done by the teachers and part by clerks in Assistant Superintendent Wight's office. The scoring was also checked sufficiently by the writer to warrant the belief that it was fairly accurate. Most of the errors which were found were so small that they had no effect upon the placement of pupils. In the tabulation of test and other data the positive and negative errors balanced each other so as to leave no sensible inaccuracy in the medians and other measures computed.

The data collected. Table I shows the intelligence and achievement tests used at each date of testing. The scores made upon these tests were translated into mental⁴ or achievement⁵ ages, as the case might be, and then further into intelligence⁶ and achievement⁷ quotients. The mental ages and intelligence quotients used

⁴Mental age is a term used to express the amount of intelligence possessed by an individual. The average score made upon an intelligence test by a large number of unselected children of any one given chronological age is said to be equal to a mental age of the given number of years. Thus, if on a given test the average score of six-year-olds is 25 points and that of seven-year-olds is 30 points, a score of 25 points may be transmuted into a mental age of six years and one of 30 points into one of seven years. It is abbreviated M.A.

⁵Achievement age is used to express the amount achieved by an individual on a subject-matter test. The average score made by the children of a single mental age is taken to equal an achievement age of the same number of years. Thus, if the average score of children of the mental age of ten years is 56 points, that score may be changed into an achievement age—abbreviated A.A.—of ten years.

⁶The intelligence quotient is the ratio of the mental age to the chronological age, or M.A. divided by C.A. It is conventionally carried to two places and written without the decimal point. Thus a child who has a mental age of ten years and is eight years old has an intelligence quotient of 10 divided by 8, or 125. It is abbreviated I.Q.

⁷The achievement quotient—abbreviated A.Q.—is the ratio of the achievement age to the mental age, or A.A. divided by M.A. It is written similarly to the I.Q. Thus a child whose achievement age is nine years and whose mental age is ten years has an achievement quotient of 9 divided by 10, or 90.

TABLE I. THE INTELLIGENCE AND ACHIEVEMENT TESTS USED IN THIS EXPERIMENT

Date of Testing	Grades	Intelligence Tests	Grades	Achievement Tests	
Nov. 1920	IB-IIIIB	Indiana University Primer Scale (Pressey Primer)	IA	Indiana University First Grade Reading Vocabulary Test, Form A	
	IB-IIIIB	Dearborn Group Tests of Intelligence	IIB-IIIIB	Indiana University Scale of Attainment No. 1, Form A	
	IIIA-VIIIA	National Intelligence Tests, Scale A, Form I	IIIA-VIB VIA-VIIIA	Monroe's Standardized Silent Reading Tests Form I, Test 1 Form I, Test 2	
	IIIA-VIIIA	Illinois General Intelligence Scale, Form I		Monroe's General Survey Scale in Arithmetic Form I, Scale 1 Form I, Scale 2	
May 1921	IB-IIIIB	Indiana University Primer Scale	IIIA-VIB VIA-VIIIA	The same tests were used as in November, 1920, except that Form B of the two Indiana Tests and Form II of the Monroe Tests were used.	
	IIIA-VIIIA	Illinois General Intelligence Scale, Form II			
Sept. 1921	IB	Kingsbury Primary Group Intelligence Scale, Form A		IIIA-VIB VIA-VIIIA	The same tests were used as in May, 1921
	IA-IIIIB	Indiana University Primer Scale			
	IIIA-VIIIA	Illinois General Intelligence Scale, Form II			
Dec. 1921	IB-IIIIB	Myers Mental Measure	IIIA-VIB VIA-VIIIA	The same tests were used as in November, 1920, except that Form III of the Monroe Tests was used.	
	IIIA-VIIIA	Illinois General Intelligence Scale, Form I			
May 1922		None used.	VIB-VIIIA	The same tests were used as in November, 1920, except that Form B of the Indiana Vocabulary Test and Revised Form A of the Scale of Attainment No. 1 were used.	
				Omnibus Test*	

*See Appendix C.

at the first time of testing were based upon the average of the two mental tests given at that time.

The other items of information called for by the individual record cards used in this project were as follows: name, building, date of birth, sex, date of testing, school grade, chronological age, teacher's estimate, average school mark, attendance, and health mark.

The teacher's estimate was an opinion as to the general capacity of the pupil regardless of whether this capacity was actually displayed in regular school work or not. This estimate was expressed

in terms of the following five marks and the teachers were instructed to make their distributions accord fairly closely with that given below:

S or 5=superior	—	5 to 10 percent
E or 4=excellent	—	20 percent
G or 3=good	—	40 to 50 percent
F or 2=fair	—	20 percent
P or 1=poor	—	5 to 10 percent

The average school mark was the average of the pupil's marks upon the seven most important subjects of the course of study. It was based upon the grades on the monthly reports issued during the current semester previous to the date of testing and was expressed in terms of the same five marks that were used for the teachers' estimates.

Attendance was given as the percent of school days from the beginning of the semester to the date of testing during which the pupil was present. The health mark was the teacher's opinion of the general health of the pupil and was expressed in terms of the same five marks that were used for teachers' estimates and average school marks.

At the time of the first testing, the published norms and data for the transmutation of point scores upon the tests used into mental and achievement ages were in most cases based on a number of pupils not much larger, or even actually smaller, than the number taking the tests in this experiment. Hence it was decided that in the case of most of the tests used, the norms and tables for transmutation should be based upon the data obtained in this project.⁸ The exceptions to this decision were the Illinois Examination, including the Illinois General Intelligence Scale and Monroe's Arithmetic and Reading Tests, and the Myers Mental Measure. These exceptions were made because in the case of the Illinois Examination scores from about fifty thousand pupils were available,⁹ and in that of the Myers Mental Measure scores from about fifteen thousand pupils.¹⁰

⁸See complete dissertation for these transmutation tables and their derivation.

⁹Monroe, W. S. A Report of the Use of the Illinois Examination, Form 1, with 49,500 Pupils. Insert of School and Home Education, March, 1921. 8p.

¹⁰Myers, C. E. and G. C. Measuring Minds. New York; Newson, 1921, p. 23-4.

Principles of promotion and classification used at the first placement of the pupils. It was necessary to lay down certain principles which should be followed in the placement of the pupils, with the understanding that there would be need for exceptions in the cases of certain individuals. The inadvisability of following set rules too closely was due to several facts. Such procedure would result in entirely too great a change in the placement of some pupils. Moreover, the data secured from the tests and from other sources could not be relied upon as being absolutely accurate, and in some cases were so conflicting that disagreements between any detailed principles laid down were sure to occur. In view of these facts it must be understood that the principles enumerated below were not adhered to absolutely and that there were exceptions of many sorts that it is impracticable to list. The principles formulated for the first placement of pupils, which was for February, 1921, are given below.

I. The use of the data derived from the intelligence tests.

1. The chief bases of placement were the mental ages and intelligence quotients. The mental ages were used to determine the half-grades in which the pupils should be placed, and the intelligence quotients to determine the sections, subject to such modifications as may be given in II.
2. In general, the mental age norm for each half-grade was the median mental age of this half-grade group for the experimental schools. If the median mental age of a particular half-grade group in any one school was distinctly above or below the median of the four schools, a rough average of the two medians was used. This was done because it was considered desirable to make some progress toward reducing the range of ability within a given half-grade group for the experimental schools, but not to do so without regard to the ability actually found in the half-grades of the several schools as they were at the beginning of the experiment. Rather wide mental age limits were used for each half-grade group, with the expectation that as the experiment progressed they would be narrowed.

3. In general, demotion was recommended only when a pupil's mental age was at least two years below the median of the grade in which he was found, and extra promotion only when it was at least several months higher than the median of the grade in which extra promotion would place him. In no case was a pupil recommended for skipping more than two semesters' work nor for being demoted more than one.
4. Pupils whose intelligence quotients were above 110 were usually placed in the fast sections, those with I. Q.'s below 85 in the slow sections and the remainder¹¹ regularly composed the average sections. However, in many cases pupils' mental ages were several months above the medians of the half-grades in which normal promotion would place them, while their I. Q.'s were below 85. In such cases they were usually given normal promotion to the average section of the next half-grade. Similar exceptions were made in connection with other ranges of mental ages and intelligence quotients.
5. In some cases where the mental ages and intelligence quotients were rather low, it appeared probable that the pupils had either misunderstood directions upon one of the two intelligence tests or, had not, through some other cause, done themselves justice upon one of them. In such cases their scores on the other test were given more than half weight in determining their placement.

II. The use of the other data obtained.

1. Most of the other items recorded upon the individual record cards were given consideration. Low teachers' estimates and average school marks rarely prevented promotion in cases where the mental ages seemed to warrant it. In doubtful cases the question of whether

¹¹Inasmuch as the intelligence quotients obtained in this project were derived from group intelligence tests they had a somewhat greater spread than those derived from individual tests. Therefore the percent of pupils with I.Q.'s from 85 to 110 was somewhat less than that usually found between 90 and 110 when individual tests are used.

a single or a double promotion should be given was, however, frequently decided by the teachers' estimates and average school marks.

2. On the other hand, even though their mental ages were low enough to merit demotion, very few pupils were failed whose teachers' estimates and average school marks were "good" or better, and not very many were failed if either one of the two was this high.
3. In making use of the teachers' estimates of capacity and the average school marks it was found that those of some teachers ran much higher than those of others in cases where the mental and achievement ages of the two groups of pupils showed little difference. That is, a teacher's estimate or school mark of "fair," for instance, given by one teacher might be fully equal to one of "good" given by another. In making use of these two items an allowance was made for this fact.
4. In cases of marked disagreement between the evidence afforded by the test data and that given by the teachers' estimates and school marks, the achievement test scores were frequently the deciding factor in placement.
5. In doubtful cases the teachers' estimates of health sometimes determined placement, but were not a major factor.

III. Pupils not classified.

1. Since all promoted VIIB and VIIIA pupils would leave the schools concerned before the close of the experiment, no recommendations were made in the case of any pupils of these grades.
2. Pupils in open-air and ungraded rooms were recommended for promotion and classification according to the same principles used for the other pupils, but it was not expected that they would actually be placed in exact agreement with the recommendations.

An illustration of the application of these principles of promotion and classification. In order to illustrate the actual application of these principles, the following sample taken from the

TABLE II. SAMPLE OF THE PROMOTION LISTS MADE OUT FOR THE BEGINNING OF THE SECOND SEMESTER OF 1920-21

Pupil Number	M.A.	I.Q.	A.A.	T.E.*	School Mark	Health Mark	Placement of Pupil
1	6.6	73	8-8	1	1.8	3	IIIA slow
2	7.7	66	7-10	2	1.7	3	IVB slow
3	11.3	110	10-8	4	3.8	3	VB average
4	8.0	85	9-6	2	2.7	4	IVB fast
5	11.3	100	11-10	3	3.0	4	VB average
6	9.1	106	9-8	3	3.5	3	IVA average
7	9.2	95	8-8	3	3.1	3	IVA average
8	10.2	105	9-8	3	3.0	3	IVA average
9	10.6	78	11-10	3	3.0	4	IVA slow
10	8.8	71	10-0	2	2.0	1	IVB slow
11	4.7	40	7-4	1	1.0	3	IIIA slow
12	10.0	72	8-10	2	2.0	3	IVA slow
13	12.3	109	11-6	3	3.0	3	VB fast
14	10.4	91	11-2	3	3.0	4	IVA average
15	10.4	80	8-0	3	2.8	2	IVA slow
16	8.7	106	9-0	2	2.7	4	IVA average
17	10.2	69	13-0	3	3.0	4	VB average
18	9.2	106	8-6	3	3.2	3	IVA average
19	8.6	85	8-4	2	1.5	1	IVB slow
20	11.2	100	11-10	4	4.0	4	VB average

*Teacher's Estimate.

lists actually made out is given and discussed. These lists were later submitted to the principals and teachers, as has been mentioned previously, and any changes that seemed best were made.

Since the sample in Table II is a portion of the list for the pupils who were in the IVB grade during the first semester of 1920-21, the median mental and achievement ages¹² for the half-grade groups into which IVB pupils were likely to be placed are given below.

Grade	IIIA	IVB	IVA	VB
Mental Age	8.1	9.6	9.8	10.8
Achievement Age	7-4	9-1	9-2	10-6

The mental ages of Nos. 1 and 11 were so low that it was evident they should be demoted. This was corroborated by the low teachers' estimates and average school marks given them. Their I. Q.'s clearly indicated that they belonged in the slow section. Nos. 2, 10 and 19 had mental ages considerably below the IVB median and I. Q.'s of 85 or below. As their teachers' estimates and school marks were also fairly low they were kept in their grade

¹²See Table III.

and placed in the slow section. No. 12 had a mental age above the IVB median, but an I. Q. of only 72, so he was recommended for the IVA slow section. Although No. 4's mental age and I. Q. were low enough to indicate that he belonged in the IVB slow section his fairly good achievement age and his school mark of 2.7 resulted in his being placed in the fast section of that grade. This was done to prevent him from having to repeat work during the whole of the next semester and with the expectation that he would soon drop back into an average or slow section. The mental ages of Nos. 9 and 15 seemed to entitle them to extra promotion but as their teachers' estimates and school marks were only about average they received merely normal promotion into the IVA grade. Because of their low I. Q.'s they were placed in the slow section. In the case of the six pupils placed in the average section of IVA there was little doubt as to where they belonged except that No. 16 had a mental age almost a year below the IVA median. His rather high I. Q. and average school mark led to the decision not to prevent his advancement. Nos. 8 and 14 might have been considered for extra promotion had their teachers' estimates and school marks been higher. Nos. 3 and 20 were clearly entitled to extra promotion on the basis of all the data and No. 5 was only slightly less deserving. The I.Q. of the first would have caused his placement in the fast section but it happened there were not enough pupils in the school of similar ability to justify the formation of a fast section in grade VB. Therefore all three were placed in the average section of that grade. No. 17 was also given extra promotion. In his case a chronological age of almost 16 years and a high score on the achievement tests were potent clauses. For the same reason he was placed in the average rather than the slow section, although his I. Q. was only 69. No. 13 would probably have been given two semesters of extra promotion instead of one except for the fact that his teacher's estimate and school mark were only 3. As it was he was given one extra promotion and placed in the fast section of the grade.

Supplementary principles of promotion and classification used at the second and third periods of placement of the pupils. At the second and third periods of placement—that is, for September, 1921, and February, 1922,—a majority of the pupils

placed at the beginning of the second semester of 1920-21 received normal promotion into the next half-grade and remained in the corresponding section. Unless the new data clearly indicated that the pupil had been placed improperly in February, 1921, this course was followed. Certain additional principles were adopted to care for those pupils who seemed to have been improperly placed. These principles were as follows:

1. In the cases of a number of the pupils given extra promotion at the beginning of the previous semester, their school marks and achievement ages following this promotion did not appear to justify it. If, however, their mental ages as shown by the later testing were high enough to justify their retaining the extra promotion given and also receiving normal promotion at the later date, such promotion was usually given. This was done on the assumption that after skipping the work of one or more semesters it might require more than one semester for them to "find themselves."
2. Pupils previously promoted or placed in fast sections despite their low school marks were failed if their school marks still continued to be unsatisfactory.¹³
3. Many pupils who had received only a part of the extra promotion that they seemed to deserve in February, 1921,¹⁴ were given further extra promotion, if their later scores justified so doing.
4. In cases where the test scores of pupils varied greatly from those made at the previous testing period or periods, and the other evidence did not agree with one score more than the other, the scores were roughly averaged to provide the basis for placement.

The final placement of the pupils. The writer made out his recommendations for placement, basing them upon the principles listed above, some two or three weeks before the end of the semester. The lists were then submitted to the principals and teachers concerned for their consideration, and finally put into

¹³Most of these seemed to be cases of laziness and lack of study.

¹⁴These pupils had received only a part of their extra promotion in order to lessen the amount of work skipped at one time and thus make their advance easier.

effect. In two of the four schools the recommendations were discussed individually, but in the other two this was not done, as the principals of those schools wished to make as complete a change as possible from the traditional method of procedure. The changes made as a result of this consideration amounted to about one percent of the total number of recommendations made. These changes were often due to the fact that a longer acquaintance with certain pupils caused the teachers to wish to revise the estimates of capacity or school marks which had been reported some time previously. Sometimes, however, the changes made represented a yielding on the part of the writer of his judgment, based largely upon the test results, to that of the principal or teacher, which was based upon the actual school work of the pupils and upon personal contact with them. In a few cases a change was made in order to place the pupil under a certain teacher so that he would be separated from a group of classmates.

In planning this whole experiment and in formulating and using the principles of promotion and classification those in charge of the experiment were guided by the desire to do a practicable piece of work. That is to say, they wished to use a procedure which the average school administrator or supervisor would be willing and able to make use of in his own school. It was partly because of this desire that more thoroughgoing changes were not made in the placement of the pupils, especially after the first period of testing. It is true that some public school superintendents have carried out considerably more radical plans of reclassification than the one used in this experiment but it was believed that a plan that might be followed by a more conservative educator would be more worth while.

CHAPTER II

CONDITIONS AT THE BEGINNING OF THE EXPERIMENT

Chronological age-grade placement in the two groups of schools. The chronological age-grade situation in November, 1920, showed that the retardation in the experimental schools was somewhat greater than that in the control schools. The median age of the pupils of the experimental schools averaged, grade for grade, two-tenths of a year more than that for the other group. In only two of the half-grades was it lower. The percents of pupils accelerated, normally placed, and retarded were 9, 18 and 73, respectively, in the experimental schools as compared with 10, 21 and 69 in the control schools. These figures are based upon the Chicago standard of normal progress, which is that a pupil should be from six to six and one-half years of age in grade IB, six and one-half to seven in grade IA and so on up. The average amount of retardation per pupil¹ was 1.14 years for the experimental schools and .96 year for the control schools. Assuming that pupils had entered the two groups of schools at the same average age, which the writer believes was the case, it is evident that the pupils in the control schools at the beginning of the experiment had made somewhat more rapid progress than had those in the experimental schools.

Mental age and school placement in the experimental and control schools. As may be seen from Table III, the median mental ages in all except three of the half-grades were higher in the control than in the experimental schools. The average difference was slightly over one-half year of mental age. This difference was found in spite of the fact just mentioned above that the pupils of the control schools were grade by grade about two-tenths of a year younger than those of the other group.

¹The average amount of retardation was computed as follows: The number of pupils accelerated one-half year was multiplied by one-half, the number accelerated one year by one, and so on. The same process was carried out for those retarded and the sum found for each group of pupils. As the total number of years of retardation was greater than the total of acceleration, the latter was subtracted to give the net total of retardation. This was divided by the total number of pupils.

TABLE III. GRADE MEDIAN MENTAL AND ACHIEVEMENT AGES, INTELLIGENCE AND ACHIEVEMENT QUOTIENTS OF THE EXPERIMENTAL AND CONTROL SCHOOLS, NOVEMBER, 1920

Grade	Mental Ages		Intelligence Quotients		Achievement Ages		Achievement Quotients	
	Exp.	Cont.	Exp.	Cont.	Exp.	Cont.	Exp.	Cont.
IB	6.0	6.4	88	98				
IA	7.5	7.7	100	105	7-3	7-8	97	103
IIB	7.7	8.7	95	110	6-9	7-8	89	87
IIA	8.2	9.1	92	107	8-5	9-0	104	102
IIIB	9.0	8.6	100	96	10-1	9-10	113	113
IIIA	8.1*	8.3*	77*	84*	7-4*	7-10*	110*	110*
IVB	9.6	10.0	92	102	9-1	9-0	110	102
IVA	9.8	10.4	92	100	9-2	9-6	104	105
VB	10.8	10.7	93	98	10-6	10-7	106	108
VA	10.0	11.2	85	100	10-1	11-4	112	106
VIB	11.8	11.8	97	96	10-9	11-8	100	105
VIA	12.6	13.2	101	103	11-3	12-1	105	104
VIIB	12.5	14.4	99	112	11-6	13-0	105	100
VIIA	13.2	14.0	102	106	11-11	13-2	107	109
VIIIB	14.2	14.8	104	110	12-2	14-4	99	109
VIIIA	15.4	15.8	111	114	13-7	14-7	99	105
All	9.1	9.7	94	103	10-0	10-8	104	103

*The low M. A.'s and I. Q.'s found in grade IIIA were doubtless due to the fact that the Illinois General Intelligence Scale requires a degree of reading ability somewhat above that possessed by most IIIA pupils.

**In grades IIIA to VIIIA a composite achievement age was obtained by averaging the achievement ages upon Monroe's arithmetic scale and in comprehension and rate upon his reading test. In obtaining this average each of the three was given equal weight. The same procedure was followed in the case of the achievement quotients.

The inter-quartile ranges of the various grades were also computed. These showed an average range of two and one-tenth years for the experimental schools and two and two-tenths years for the control schools. Thus it appears that the grade groups in the experimental schools were slightly more homogeneous than those in the control schools. Similarly, a slight advantage was shown by the coefficients of correlation of mental age and grade placement. These were $.84 \pm .01^2$ for the experimental schools and $.82 \pm .01$ for the control schools.

The intelligence quotients of the two groups of schools.

Probably the best basis of comparing the mentality of the pupils of the two groups of schools is that of their intelligence quotients. Table III shows the medians for the two groups of schools. In all grades except IIIB and VIB the median I. Q.'s of the experimental

²For convenience all probable errors smaller than .01 are given as .01

schools were lower than those of the control schools. The average difference was nine points, the medians for all grades combined being 94 and 103. This of course agrees with the fact just noted that the mental ages of the pupils of the experimental schools were lower, although their chronological ages were higher, than those of the other group.

The extent to which the data derived from the tests afforded a true comparison of the quality of the pupil material of the two groups of schools depends upon the reliability of the tests used and the similarity of testing conditions in the two groups of schools. As is shown in Appendix B, the reliability of the intelligence tests was only fairly high, but there is no reason to think that the degree of reliability was different in the two groups of schools. Moreover, as has been stated in Chapter I, the writer's rather extensive visiting while the tests were being given and his examination of the test booklets after they had been scored afforded fairly reliable grounds for believing that there were no essential differences in the administration of the tests in the experimental and in the control schools.

The use of the control schools as a check group upon the experimental schools. If we assume that the difference in the amount and degree of intelligence found by the use of the intelligence tests was reliable, the question remains as to whether this difference was so great that the control schools could not be used as a valid check upon the experimental schools. A definite answer to this question cannot be given. Such data as are available concerning the mentality of pupils of different school systems appear to show that an average difference of about seven months of mental age or nine points I. Q. is not unusual. Probably the most extensive data available upon this point are those obtained from the use of the Illinois General Intelligence Scale.³ This scale was given to the pupils of ten cities and nine counties in the autumn of 1920. It was found that the differences between the median mental ages of the various grades of the single cities and counties concerned and the general medians for the corresponding grades were four months or more in 50 percent of the cases. The largest difference was one year and three months. In terms of the I. Q. 50

³Monroe, W. S. A Report of the Use of the Illinois Examination, Form 1, with 49,500 Pupils. Insert of School and Home Education, March, 1921. 8p.

percent of the differences exceeded four points, the greatest being nineteen points. Differences as large as the average difference between the two groups of schools in this experiment were found in about one-sixth of the cases. Moreover, it must be remembered that differences between the individual members of a group and the group median are, on the average, much less than the differences between the individual members of the group. On the other hand, the differences in this experiment were based upon the average scores from two tests and therefore would probably tend to be smaller than those based upon a single score. This latter factor would not more than balance the one mentioned in the previous sentence, however, and probably would not even do that. Therefore the writer feels justified in the opinion that the difference in mentality found to exist between the two groups of schools was not so great but that the question referred to above can be answered affirmatively, provided that this difference was measured and taken account of in interpreting the results of the experiment.

The achievements of the two groups of schools. Table III also contains the median achievement ages for the various grades. It shows that the control schools were superior in all of the half-grades except IIIB and IVB. This average superiority was about eight months of achievement age, which is enough to indicate a decided superiority in pupil achievement on the part of the control schools.

The achievement quotients, however, are really more significant measures than are the achievement ages. It is evident from Table III that on the whole the relation of achievement to capacity, in so far as the tests used measured this relation, was practically the same in the two groups of schools. This would be inferred from a study of the mental and achievement ages. Such a comparison shows that the superiority of the control schools in achievement was just about the same as their superiority in intelligence. Thus from this standpoint the two groups of schools were capitalizing the capacities of their pupils almost equally in so far as the achievements measured were concerned.

The correlation of achievement with intelligence in the two groups of schools. It is a belief of many educators that the achievements of pupils should be as closely related to their capaci-

ties as possible and that the degree to which this relation holds is a measure of the success of the school in adapting its work to the individual pupils. The achievement quotient measures this from one standpoint, but it may also be measured by computing the correlation of achievement with intelligence. For all grades combined the coefficients of correlation between absolute achievement and intelligence scores was $.68 \pm .01$ for the experimental schools and $.60 \pm .01$ for the control schools. That is to say, the experimental schools were securing achievement more nearly in proportion to pupil capacity than were the control schools.

Another measure of the relation of achievement to intelligence may be obtained by computing the median achievement quotients for pupils of different levels of intelligence. This measure is based upon the assumption that the school should secure from all pupils the best work of which they are capable, and if it can not do this it should approach the standard as nearly for pupils of one level of intelligence as for those of another.

Table IV presents the median achievement quotients for the pupils of different levels of intelligence in the two groups of schools. A study of this table reveals the fact that in both groups of schools the inferior pupils were achieving more in relation to their capacity than were the superior pupils, but that this tendency was somewhat

TABLE IV. MEDIAN ACHIEVEMENT QUOTIENTS OF THE PUPILS OF DIFFERENT LEVELS OF INTELLIGENCE, NOVEMBER, 1920

Intelligence Quotient*	Achievement Quotients	
	Experimental	Control
150-59	104	98
140-	95	95
130-	102	98
120-	102	102
110-	101	101
100-	102	102
90-	104	104
80-	103	105
70-	107	110
60-	113	114
50-	109	125
All	105	104

*Only those levels of intelligence were included that had a sufficient number of cases to give fairly reliable medians.

less marked in the experimental schools. Further evidence to the same effect may be obtained from a comparison of the coefficients of correlation of the achievement and intelligence quotients. These were $-.16 \pm .01$ for the experimental schools and $-.28 \pm .01$ for the control schools.

Teachers' estimates of capacity, average school marks and estimates of health, in the two groups of schools. The pupil material of the two groups of schools may also be compared by means of the teachers' estimates, average school marks and health estimates. It is true that these measures are relatively subjective, but as there were almost one hundred teachers in each group of schools and as there was no apparent selection which would make one group of teachers more able to judge pupils than the other, these measures were probably fairly comparable for the two groups of schools. Taking the medians for all pupils, the teachers' estimates for the control group were two-tenths higher, the average school marks three-tenths higher, and the estimates of health two-tenths. Considering the three items together, the half-grade medians of the control schools were higher in about 50 percent of the cases, those of the experimental schools in only about 25 percent, and the two were equal in about 25 percent. The evidence afforded by these items is of value chiefly because it corroborates that obtained from the intelligence and achievement test results.

Summary. The differences found to exist between the experimental and the control schools in November, 1920, at the beginning of the experiment, were on the whole large enough not to be neglected as due to chance or as of no consequence, but were not large enough to invalidate the use of the two groups of schools in this experiment. When contrasted with the control schools the experimental schools exhibited the following differences:

1. .18 year greater retardation based on chronological age (1.14 years — .96 year)
2. .6 year lower median mental age (9.7 years — 9.1 years)
3. 9 points lower median I. Q. (103 — 94)

4. 8 months lower median achievement age in reading and arithmetic (10 years 8 months — 10 years)
5. 1 point higher achievement quotient in reading and arithmetic (104 — 103)
6. .08 higher correlation of achievement with intelligence. (.68 — .60)
7. .2 lower median teachers' estimate, school mark and estimate of health, averaged (3.3 — 3.1)

CHAPTER III

THE EFFICIENCY OF THE TWO GROUPS OF SCHOOLS AS MEASURED BY THE RATES OF PROGRESS OF THE PUPILS

In Chapter I "efficiency" was defined as the ratio of the output to the investment. The output to be measured was limited to the achievements of the pupils and their rates of progress. As was stated, the various factors constituting investment were all approximately constant except that of the mental abilities of the pupil material. Therefore, the "efficiency" of the experimental and the control schools might be measured in terms of the ratios of the achievements of the pupils and their rates of progress to their mental abilities. This chapter presents the data dealing with the rates of progress of the pupils, and the relation of these rates to their mental abilities.

The promotion and classification of the pupils for February, 1921. The information obtained from the testing in the four experimental schools in November, 1920, formed the chief basis for the placement of pupils for the succeeding semester, the second of 1920-21. This placement was made by the writer, following the principles of promotion and classification enumerated in Chapter I. The first half of Table V shows the percents of pupils in each grade of the experimental schools gaining or losing various amounts as a result of this placement. It is to be interpreted as follows, using grade IIB as an example: 7 percent of the pupils in grade IIB during the first semester of 1920-21 were demoted one semester, that is, were placed in IA; 26 percent were failed and remained in IIB; 64 percent received regular promotion of one semester into IIA and 2 percent received an extra promotion and thus entered IIIB. It will be seen that on the whole the placement of the pupils in the experimental schools involved many more demotions and failures than extra promotions and that the percent of the pupils given normal promotion was not as great as is usual in school systems. Only 58 percent of the pupils

TABLE V. PERCENTS OF THE PUPILS PROMOTED, FAILED OR DEMOTED THE GIVEN NUMBER OF SEMESTERS AT THE CLOSE OF THE FIRST SEMESTER OF 1920-21

First Semester Grade	Experimental Schools Semesters Gained or Lost					Control Schools Semesters Gained or Lost					
	-1*	0	+1	+2	+3	-1	0	+1	+2	+3	+4
IB		48	49	3	1		31	68	1		.2
IA	17	17	48	9	9		34	60	7		
IIB	7	26	64	2		2	9	80	9		
IIA	1	19	70	10		.4	16	83	.4		
IIIB	2	12	75	9	1		14	82	4	1	
IIIA	14	31	50	3	2		32	67	1		
IVB	4	19	57	13	8		10	82	7		
IVA	6	19	63	6	5	1	7	88	5		
VB	4	16	53	24	3		16	79	5		
VA	16	22	55	4	1		4	95	1		
VIB	10	28	43	15	4		11	87	2		
VIA	11	18	59	12			16	79	5		
VIIB	17	23	44	16			4	96	1		
VIIA	8	13	75	5			18	78	4		
All	6	26	58	8	2	.3	17	79	4	.03	.03

*-1 denotes one semester lost through demotion, 0 failure, +1 normal promotion, +2 one extra promotion, etc.

received normal promotion, 32 percent less, and 10 percent more. The average amount of promotion per pupil¹ was .74 semester. Probably the chief cause of the excess of demotions and failures and the low average promotion rate was the rather liberal promotion policy which had been pursued prior to the beginning of the project. Many decidedly inferior pupils were at the beginning of the experiment found to be almost up with normal pupils of the same chronological age, although they were unable to do satisfactory work as placed. Moreover, it had not been at all unusual to reward superior ability by allowing grades to be skipped.

The second half of Table V shows the changes made in the placement of the pupils in the control schools at this time. These changes were made by the teachers and principals according to the usual practice, which in Chapter I was called the "traditional method." A much larger percent of the pupils received normal promotion than in the experimental schools, but only about one-

¹The average amount of promotion per pupil was computed by finding the total number of semesters of promotion given, subtracting therefrom the total number of semesters of demotion and dividing by the total number of pupils concerned.

half as many were demoted or failed or given extra promotion. The average amount of promotion per pupil was .87 semester.

It is not fair, however, to compare the promotion rates of the two groups of schools directly according to the figures given above. The general assumption as to the promotion rate is that it should be one semester per semester for pupils of normal mentality who are properly classified and working to their full capacity with no hindering factors entering into the situation. For pupils whose mentalities are above or below normal and who are working under the same conditions as those mentioned for normal pupils the theoretical rates of progress are proportionately above or below one semester per semester. For example, a pupil with an I. Q. of 125 would be expected to advance one and one-fourth semesters per semester and one with an I. Q. of 80, four-fifths of a semester per semester. Thus to render the average promotion figures given in the preceding paragraphs strictly comparable each should be divided by the average or median I. Q. of the pupils concerned in order to bring both to the basis of what they would be for pupils of normal mentality, that is, pupils whose I. Q. is 100.

The measure of progress obtained by dividing the actual average rate of progress per pupil by the median intelligence quotient of the pupils contributing to this average will be called the "progress quotient." It will be used as the true measure of progress throughout this study. Making use of this measure we have as the "progress quotient" of the experimental schools .74 divided by .94, and for the control schools .87 divided by 1.03. Thus the "progress quotients" at this time were 79 for the experimental schools and 84 for the control schools. The true difference in the promotion rate at the beginning of the experiment is thus seen to have been only .05 rather than .13 semester. This difference cannot be attributed to the operation of the experimental plan of organization but rather to conditions in the two groups of schools previous to the beginning of the experiment and to the preparation necessary before the project could be begun.

The formation of the fast, average and slow sections. As a result of the placement in February, 1921, more pupils were placed in the slow sections and fewer in the fast sections than would usually be the case in most school systems. This was largely due

to the liberal promotion policy that had been pursued before the experiment was begun, and to the fact that the pupil material of the experimental schools was rather distinctly inferior—median I. Q. 94, first quartile 80, third quartile 107. The fast sections included 14 percent of the total number of pupils placed, the average sections 41 percent, and the slow sections 45 percent.

The promotion and classification of the pupils for September, 1921. It was to be expected that after the experiment was under way a majority of the pupils in the experimental schools would make normal progress in the sections to which they had been assigned. The extent to which this expectation was fulfilled provided a measure of the efficiency of the previous placement. The supplementary principles of promotion and classification given in Chapter I suggest various reasons for the failure of many pupils to make such progress.

Table VI, which is similar to the first part of Table V, shows the gains and losses resulting from the placement of the pupils in the experimental schools for September, 1921. For example, in the average section of grade VIA 5 percent of the pupils were placed back in the VIA slow section and thus lost one-third of a semester; 17 percent placed in the VIIB slow section gained two-thirds of a semester; 63 percent placed in the VIIB average section gained one semester; 11 percent placed in the VIIB fast section gained one and one-half semesters and 4 percent placed in the VIIIA average section gained two semesters.

At this time 64 percent of the pupils of the experimental schools were advanced to the corresponding section of the next grade, but as such advancement meant only two-thirds of a semester for the slow pupils and one and one-half semesters for the fast, there were only 41 percent of the pupils who gained just one semester. In addition to the 64 percent mentioned, 26 percent were placed in the next grade but in a different section, so that in all 90 percent of the pupils of the experimental schools were advanced to the next grade. The average progress earned by the pupils in the slow sections was .65 semester, that earned by those in the average sections was .94 semester, and that by the members of the fast sections 1.38 semesters. For all the pupils the average was .88 semester. Dividing by the median I. Q.'s obtained from the Novem-

TABLE VI. PERCENTS OF THE PUPILS OF THE EXPERIMENTAL SCHOOLS GAINING OR LOSING THE GIVEN NUMBER OF SEMESTERS DURING THE SECOND SEMESTER OF 1920-21

Grade	Section	Semesters Gained or Lost												
		-1½*	-1	-¾	0	+¼	+½	+1	+1½	+1¾	+2	+2½		
IB	Slow Average				14 21	22	60 57	226					.4	.4
IA	Slow Average Fast		1	4 1	4 7		46 12 4	43 58 22	2 18 65		1 1		1 1 7	
IIB	Slow Average Fast			6 7	5 4 3		62 18 7	23 69 24	3		1		3	
IIA	Slow Average Fast		1	5 2	2	1	70 7	25 73 20			10 76	1	2 4	
IIIB	Slow Average Fast	1		6	1	1	67 22 2	24 58 32	1 17 60		1 2		4	
IIIA	Slow Average Fast			14 5	2 3		68 21 1	14 63 42	1 6 51	1	1 4		1	
IVB	Slow Average Fast			10 3	2		68 23 7	22 61 21		5 71			7	
IVA	Slow Average Fast	2 1	1	7 5	6		60 12	23 59	1 13		4		5	
VB	Slow Average Fast			6 5			63 14	30 51 4	2 30 96					
VA	Slow Average Fast	1 1		15 6			80 17	3 52 16	1 24 84					
VIB	Slow Average Fast			13	2		70 25	10 54 20	7 16 73				2 7	
VIA	Slow Average Fast			4 5			78 17 5	19 63 20	11 75		4			
VIIB	Slow Average Fast			2 1			76 12	20 79	2 8 100					
VIIA	Slow Average Fast				8 1		40 4	52 76 6	19 94					
VIIIB	Slow Average			9			90 4	2 96						
All	All	.2	.1	4	4	1	36	41	13	.1	1		1	

*-1½ denotes a loss of one and one-third semesters, etc.

ber tests, the "progress quotients" were found to be 79, 92 and 118 for the slow, average and fast sections, respectively. For all the pupils of the experimental schools the quotient was 93.

Table VII shows the same data for the control schools as Table VI for the experimental. Of all the pupils in the control schools 80 percent were advanced just one semester. This percent is practically twice as large as that of the experimental schools, but is 10 smaller than the percent of pupils of those schools advanced to the same section of the next grade. Only 6 percent of the pupils of the control schools received extra promotion, as compared with the 15 percent in the experimental schools, but 14 percent were failed or demoted, as compared with only 8 percent in the latter group. The average progress in the control group was .92 semester. Dividing this by 1.02, a "progress quotient" of 90 was obtained. Thus, although the average progress of the pupils of the control schools was .04 semester greater, their "progress quotient" was three points smaller. To make the comparison upon a strictly valid basis, however, the effect of the pupils who left school and who entered school during the semester must be considered. Making the proper corrections for these pupils,² the average rate of progress

TABLE VII. PERCENTS OF THE PUPILS OF THE CONTROL SCHOOLS GAINING OR LOSING THE GIVEN NUMBER OF SEMESTERS DURING THE SECOND SEMESTER OF 1920-21

Grade	Semesters Gained or Lost							
	-2	-1	0	+1	+2	+3	+4	+5
IB			45	53	2			
IA		1	15	71	13	.4		
IIB			17	81	1			
IIA	1		10	88	1			
IIIB			12	87		.4	1	.4
IIIA		2	16	81	.4			
IVB			7	85	7	1		
IVA		2	9	88	1			
VB			11	87	2	1		
VA		1	4	83	12			
VIB			1	90	8	1		
VIA			9	75	16			
VIIIB			1	90	9			
VIIA		.5	2	86	11			
VIII B			4	96				
All	.1	1	13	80	6	.2	.1	.03

²See Appendix A.

of the pupils of the experimental schools was .02 semester less and their "progress quotient" four points larger than the corresponding figures for the pupils of the control schools. In other words, in so far as the progress of the pupils was concerned, the experimental schools were more efficient during the second semester of 1920-21 than were the control schools. The difference in the "progress quotient" was just about large enough to balance the difference at the beginning of the experiment.³ Since this was the case, it cannot be assumed that the increased efficiency of the experimental schools in the matter of progress was necessarily due to the plan of organization used.

The relative size of the fast, average and slow sections.

It was again deemed advisable to place many more pupils in the slow than in the fast sections. The facts that had made this necessary a semester earlier still exerted some influence upon the situation. The percent of the pupils placed in fast sections at this time was 15, and the remainder were equally divided between the average and the slow sections. Thus there was an increase of one percent in the number of pupils placed in the fast sections and also of those in the average sections over the percents for the previous semester.

The placement of the new entrants received by the experimental schools in September, 1921. The new entrants into the experimental schools in September, 1921, were tentatively placed in the average sections of the grades indicated by their previous school records, and later, after being tested, they were placed as the test results and the other data indicated. In the placement of pupils at this time no reclassification of the IB pupils was attempted, because the results obtained from the use of the Kingsbury Primary Group Intelligence Scale in that grade were so unsatisfactory that the writer deemed it unwise to make use of them. Table VIII shows that slightly over half of the pupils were not shifted at all, that 15 percent gained by the reclassification and 31 percent lost by it. The average change made amounted to a loss of .09 semester, or a promotion of .91 semester from the grades in which these pupils were the previous semester. As the median I. Q. of the new entrants was 85, their "progress quotient" was 107.

³See page 29.

TABLE VIII. PERCENTS OF THE NEW ENTRANTS INTO THE EXPERIMENTAL SCHOOLS GAINING OR LOSING THE GIVEN NUMBER OF SEMESTERS BY THEIR RECLASSIFICATION IN SEPTEMBER, 1921

Temporary Grade	Semesters Gained or Lost											
	-2½	-1½	-1	-½	0	+½	+¾	+1	+1½	+1¾	+2	+2½
IB*			27	13	53			7				
IA			2	14	52	11	2	10				
IIB		10		14	52	11	2	10				
IIA		8		35	42	8		4	4			
IIIB		7		7	51	21		14				
IIIA				23	77							
IVB		10	2	17	58	6		6	2			
IVA				38	52	5					5	
VB		7		25	53	2		14				
VA		19		21	47	8	4	2				
VIB		9		14	59			9	5			5
VIA		17	13	17	43			4	4			
VIIB	3			12	64	15		3		3		
VIIA		29	7	7	50				7			
VIIIB		12	31	15	42							
VIIIA					100							
All	.2	9	4	18	53	7	.2	6	1	.2	.2	.2

*As is explained in the text, the pupils in grade 1B were not reclassified at this time.

Only 9 percent of the new entrants at this time were placed in the fast sections. The average sections received 63 percent and the slow sections 28 percent. Combining the new entrants with the pupils who had been tested in the previous May the percent in the fast sections was 15, that in the average 45, and that in the slow 41.

The promotion and classification of the pupils for February, 1922. The data obtained in December, 1921, were used to determine the placement of the pupils for the second semester of the school year. Table IX, which is similar to Table VI, gives the percents of the pupils of the experimental schools gaining or losing various amounts during the first semester of 1921-22. There were 48 percent of the pupils advanced just one semester, as compared with 41 percent during the previous semester; 35 percent made less than one semester's progress and 17 percent made more, as compared with 44 and 15 percent previously. The percent of the pupils advanced to the corresponding section of the next higher grade was 79, whereas only 64 percent were so advanced a semester previously. The percent placed in some section of the next grade

TABLE IX. PERCENTS OF THE PUPILS OF THE EXPERIMENTAL SCHOOLS
GAINING OR LOSING THE GIVEN NUMBER OF SEMESTERS
DURING THE FIRST SEMESTER OF 1921-22

Grade	Section	Semesters Gained or Lost															
		-1½	-1	-¾	-½	-¼	0	+¼	+½	+¾	+1	+1½	+1¾	+2	+2½	+3	
IB	Slow Average						7 24			61 12		27 62				5 2	
IA	Slow Average Fast		1			3	14 6 2	8 7		65		76	12			7 41	
IIB	Slow Average Fast			2		12 4	9 4		58		86	16 2		1	2	4	
IIA	Slow Average Fast	1		4		12 4	8 4		73		89	8			2		
IIIB	Slow Average Fast			1		6 5	3 3		80		84	14			7		
IIIA	Slow Average Fast	1		1		6 7	2 8		82		83	10					
IVB	Slow Average Fast			3		4 3	2 7		79		84	16			3		
IVA	Slow Average Fast			4		1 3	1 3		76		78	22 5			10		
VB	Slow Average Fast		1	5		4	4		78		85	18			5		
VA	Slow Average Fast			1		6 3	3 2		92		85	7 1			4	1	
VIB	Slow Average Fast					1 6	7 7		63		87	36					
VIA	Slow Average Fast	1	2	5		9	5		59		75	37			2	4	
VIIIB	Slow Average Fast			1		3	4		87		94	10			1		
VIIA	Slow Average Fast			1		2			74		96	26					
VIIIIB	Slow Average Fast			4		2	7		83		80				8	17	
VIIIA	Slow Average						2		100		98						
All	All	.1	.1	1	.02	1 6	3	.2	23	.2	48	5	10	.02	2	.2	.02

was almost the same as before, being 89. The average progress per pupil was .72 semester for those in the slow sections, .87 semester for those in the average and 1.49 semesters for the members of the fast sections. The respective "progress quotients" were 84, 84 and 121. For all the pupils in the experimental schools the average progress was .90 semester and the "progress quotient" 91. The corresponding figures for the second semester of 1920-21 were .88 semester and 93, so it is apparent that the average progress was slightly greater and the "progress quotient" slightly less during the second semester of the experiment than during the first.

Table X, which is similar to Table VII, shows the gains and losses of the pupils of the control schools according to their placement at this time. A comparison of these data with those for the experimental schools shows that, as before, a larger percent of the pupils of the control schools received normal promotion. The difference, however, was not quite as great as the previous semester, the figures for this time being 82 and 48 percent as compared with 80 and 41 percent. The percent of the pupils receiving extra promotion in the control schools was only half as large as it had been a semester earlier, whereas in the experimental schools the corre-

TABLE X. PERCENTS OF THE PUPILS OF THE CONTROL SCHOOLS GAINING OR LOSING THE GIVEN NUMBER OF SEMESTERS DURING THE FIRST SEMESTER OF 1921-22

Grade	Semesters Gained or Lost						
	-3	-2	-1	0	+1	+2	+3
IB				33	64	2	.2
IA				19	80	.5	
IIB				14	82	3	
IIA				17	83	1	
IIIB	.3		.3	6	91	3	
IIIA				20	80		
IVB				10	83	7	
IVA				6	92	2	
VB				10	84	4	2
VA			1	6	91	3	
VIB		1		11	85	4	
VIA	1			13	82	4	1
VIIB				11	88	1	
VIIA			1	8	79	13	
VIIIB				9	91		
VIIIA	1		2	9	89		
All	.1	.03	.1	14	82	3	.2

sponding percent was slightly larger. The percent of failures and demotions in each group was practically the same as before. The average progress per pupil in the control schools was .88 semester and the "progress quotient" was likewise 88. Hence the average progress was .02 semester greater in the case of the experimental schools and the "progress quotient" three points greater. Had it not been for the new entrants and eliminees, the difference in average progress would have been .01 semester greater. Thus it can be said for the second semester of the experiment, as for the first, that in so far as the progress of the pupils was concerned, the experimental schools were somewhat more efficient than were the control schools.

The classification into fast, average and slow sections for the second semester of 1921-22. The percents of the pupils placed in the sections at this time differed rather markedly from those for previous semesters. The percent placed in the fast sections showed only a slight decrease, but that in the slow sections decreased about one-third. The percents were 13 in the fast sections, 57 in the average and 30 in the slow sections. These figures give evidence that as the experiment progressed it was possible to place pupils more nearly as would be expected from theoretical considerations.

The promotion and classification of the pupils for September, 1922. After the testing in May, 1922, which was the last during the experiment, the pupils of the experimental schools were placed for the first semester of 1922-23. Table XI, which is similar to Tables VI and IX, shows the gains and losses of the pupils of the experimental schools during the second semester of 1921-22. There were 55 percent of the pupils who gained just one semester as compared with 48 percent during the previous semester, 28 percent who made less than one semester's progress as compared with 35 percent, and 17 percent who made more, the same as the previous semester. Only 58 percent of the pupils were advanced to the corresponding section of the next higher grade as compared with 79 percent a semester previously. The percent placed in some section of the next grade was 89, just the same as it had been. The average progress per pupil was .62 semester for those in the slow section, .98 semester for those in the average, and 1.39 for

TABLE XI. PERCENTS OF THE PUPILS OF THE EXPERIMENTAL SCHOOLS GAINING OR LOSING THE GIVEN NUMBER OF SEMESTERS DURING THE SECOND SEMESTER OF 1921-22

Grade	Section	Semesters Gained or Lost													
		-1½	-1	-¾	-½	0	+½	+¾	+1	+1½	+2	+2½	+3		
IB	Slow Average					37 12			46 22	17 66					
IA	Slow Average Fast			1		30 20 3	33		36 69 5	11 21 66			5 .3		
IIB	Slow Average Fast				10	9		90	75 21	4 79		12			
IIA	Slow Average Fast				5	5		94	81 4	12 83	2	2 13			
IIIB	Slow Average Fast				19	12		81	81 16	7 65		18			
IIIA	Slow Average Fast				11	5		89	79	14 95		2		5	
IVB	Slow Average Fast				6	5		94	77 19	18 78		4			
IVA	Slow Average Fast		1		6	6		94	82	8 100		3			
VB	Slow Average Fast	1			3	2		96	93	4 100		1			
VA	Slow Average Fast					3		100	86	7		3			
VIB	Slow Average Fast					2		99	85 8	6 92		6	1		
VIA	Slow Average Fast					5		100	83 18	6 82					
VIIIB	Slow Average Fast				3	3		26	92 31	2 63	71	2 6			
VIIA	Slow Average Fast				6			94	89	8 100		3			
VIIIB	Slow Average Fast				3	4		97	96 38			63			
VIIIA	Slow Average					4			100 96						
All	All	.03	.03	.03	1	6	1	.2	20	55	14	1	2	.03	.03

members of the fast sections. The respective "progress quotients" were 76, 98 and 114. For all pupils of the experimental schools the average progress was .94 semester and the "progress quotient" 97. These figures show both greater actual progress and greater progress relative to ability than was made during either of the previous semesters.

Table XII, which is similar to Tables VII and X, shows the gains and losses of the pupils of the control schools for this semester. Again more pupils of the control schools received normal promotion than was the case in the experimental schools, the difference, however, being smaller than it was in either of the previous semesters. The percent of the pupils receiving extra promotion was only one-third as large as in February, 1922, whereas in the experimental schools it was the same. The percent of failures and demotions in the control schools was slightly less than in February, the decrease being in about the same ratio as that in the experimental schools. The average progress per pupil in the control schools was .89 semester and the "progress quotient" 86. Thus the average progress was .05 semester greater in the case of the experimental schools and the "progress quotient" eleven points greater.

TABLE XII. PERCENTS OF THE PUPILS OF THE CONTROL SCHOOLS GAINING OR LOSING THE GIVEN NUMBER OF SEMESTERS DURING THE SECOND SEMESTER OF 1921-22

Grade	Semesters Gained or Lost				
	-1	0	+1	+2	+3
IB		8	69	23	
IA	.4	18	81	1	
IIB		16	83	2	
IIA		10	90		
IIIB		8	91	1	
IIIA		24	75	1	
IVB		8	90	2	
IVA		10	90		
VB		13	86	1	1
VA		6	94		
VIB		8	92		
VIA		7	92	1	
VIIB	3	9	85	1	1
VIIA		16	83	1	
VIIIB		17	83		
VIIIA		5	95		
All	.2	12	87	1	.1

The new entrants and eliminees did not affect these differences.

The classification into fast, average and slow sections for the first semester of 1922-23. The percents of the pupils placed in the sections for September, 1922, again differed considerably from those for previous semesters. The percent in the fast sections was practically the same, 14, but that in the average sections rose to 68 and that in the slow sections dropped to 18. Thus the tendency already noted for the fast and slow sections to approximate each other in size was continued as the experiment progressed longer. Probably the distribution at this time was about what it should be, as there will always be more pupils belonging in slow sections because of not realizing their highest possible achievement than there will be pupils belonging in fast sections because of doing more than should be expected of them.

Summary. As a result of the placement of the pupils at the beginning of the experiment the "progress quotient" for the experimental schools was, at that time, five points smaller than that for the control group. During the course of the experiment this situation was reversed. Averaging the "progress quotients" for the three semesters, those for the experimental group were the larger by about six points. Thus the net result of the experimental plan of organization in so far as progress was concerned was favorable. The greater degree of efficiency of the experimental schools seems to have been due to the operation of this plan.

CHAPTER IV

THE EFFICIENCY OF THE TWO GROUPS OF SCHOOLS AS MEASURED BY THE ACHIEVEMENTS OF THE PUPILS

In Chapter III, one of the two factors which were taken as constituting output has been discussed. In this chapter the other factor, that of achievement, will be considered both absolutely and in its relation to capacity. It has been shown in the preceding chapter that there was an increase in the "progress quotient" of the experimental schools as compared with that of the control schools. Therefore if a study of the achievements of the pupils of the two groups of schools shows that those of the experimental schools were either equal to or greater than those of the control schools, it may be said that the experimental schools were more efficient than the other group during this experiment.

The gains in absolute achievement during the second semester of 1920-21. Table XIII gives the median achievement ages of the grades and sections of the two groups of schools at the beginning and end of the second semester of 1920-21. A comparison of the first and fourth columns shows that at the beginning of this semester the median achievement age of the control schools was four months greater than that of the experimental schools, while at the end of this semester the median ages were the same. In other words, the gain in achievement age on the part of the experimental schools was four months more than that of the control schools. The cause of this increase cannot be stated with certainty. There are at least two explanations that may account for it. One of these is that it resulted from the same causes which accounted for a similar increase in the mental ages. The increase in the median mental age of the pupils of the experimental schools was five-tenths of a year greater during this semester than was that of the control schools. In the opinion of the writer the most potent cause of the greater increases in both mental and achievement ages on the part of the experimental schools was the fact that both the teachers and the pupils of those schools felt a very high degree of

TABLE XIII. MEDIAN GRADE AND SECTION ACHIEVEMENT AGES
OF THE PUPILS OF THE TWO GROUPS OF SCHOOLS AT THE
BEGINNING AND END OF THE SECOND SEMESTER
OF 1920-21

Grade	Section	Experimental			Control		
		Beginning	End	Gain*	Beginning	End	Gain
IA	Slow	6-4	10-5	49	6-2	10-0	46
	Average	6-8	10-4	44			
	Fast	5-6	10-10	64			
IIB	Slow	6-4	8-8	28	7-11	8-0	1
	Average	6-5	9-10	41			
	Fast	8-6	8-4	-2			
IIA	Slow	6-7	9-5	34	7-10	9-7	21
	Average	7-7	9-10	27			
	Fast	8-1	9-6	17			
IIIB	Slow	8-2	10-10	32	9-0	10-9	21
	Average	8-11	10-7	20			
	Fast	8-8	11-1	29			
IIIA	Slow	9-1	9-1	0	9-8	10-1	5
	Average	10-1	10-1	0			
	Fast	9-10	9-8	-2			
IVB	Slow	8-11	10-8	21	9-1	10-10	21
	Average	10-0	10-7	7			
	Fast	9-11	12-6	31			
IVA	Slow	9-5	11-7	26	10-0	10-0	0
	Average	10-7	14-0	41			
	Fast	.....	.....	...
VB	Slow	9-8	12-1	29	10-7	12-2	19
	Average	10-10	13-4	30			
	Fast	10-10	13-2	28			
VA	Slow	10-4	11-4	12	11-5	13-4	23
	Average	11-5	13-6	25			
	Fast	13-0	14-7	19			
VIB	Slow	10-0	12-1	25	12-0	13-8	20
	Average	11-10	12-10	12			
	Fast	13-6	15-1	19			
VIA	Slow	11-11	14-5	30	12-1	13-10	21
	Average	12-8	15-1	29			
	Fast	15-0	15-0	0			
VIIB	Slow	12-5	15-5	36	14-2	14-8	6
	Average	12-5	16-6	49			
	Fast	15-4	17-0	20			
VIIA	Slow	12-7	14-11	28	15-0	16-1	13
	Average	13-6	17-8	50			
	Fast	16-1	18-5	28			
VIII B	Slow	11-11	13-6	19	15-1	16-1	12
	Average	14-0	16-7	31			
All	All	10-0	11-6	18	10-4	11-6	14

*The gains are given in terms of months.

TABLE XIV. MEDIAN GRADE AND SECTION ACHIEVEMENT QUOTIENTS OF THE TWO GROUPS OF SCHOOLS AT THE BEGINNING AND END OF THE SECOND SEMESTER OF 1920-21

Grade	Section	Experimental			Control		
		Beginning	End	Gain	Beginning	End	Gain
IA	Slow	103	116	13	91	117	26
	Average	88	118	30			
	Fast	65	128	63			
IIB	Slow	93	100	7	99	95	-4
	Average	86	109	23			
	Fast	103	105	2			
IIA	Slow	89	112	23	90	111	21
	Average	92	111	19			
	Fast	88	110	22			
IIIB	Slow	111	120	9	103	118	15
	Average	106	111	5			
	Fast	103	112	9			
IIIA	Slow	114	104	-10	115	112	-3
	Average	114	115	1			
	Fast	108	104	-4			
IVB	Slow	111	106	-5	110	112	2
	Average	106	106	-0			
	Fast	106	108	2			
IVA	Slow	107	110	3	103	103	0
	Average	106	118	12			
	Fast	...	...	...
VB	Slow	109	112	3	105	110	5
	Average	108	109	1			
	Fast	98	108	10			
VA	Slow	106	108	2	106	112	6
	Average	110	116	6			
	Fast	105	118	13			
VIB	Slow	102	110	8	109	114	5
	Average	104	108	4			
	Fast	110	106	-4			
VIA	Slow	115	119	4	105	115	10
	Average	108	118	10			
	Fast	115	121	6			
VIIB	Slow	108	120	12	103	108	5
	Average	105	122	17			
	Fast	105	117	12			
VIIA	Slow	108	106	-2	101	113	12
	Average	103	119	16			
	Fast	105	122	17			
VIII B	Slow	99	104	5	105	111	6
	Average	93	113	20			
All	All	106	112	6	104	112	8

interest in the results of the tests because they knew that placement was largely dependent upon these results. On the other hand, the teachers and pupils of the control schools knew that no direct use would be made of the test results, hence naturally took less interest

in the testing. The other explanation is that the experimental plan of organization caused the increase. Inasmuch as there is generally a fairly high correlation between the scores made on intelligence tests and those on subject-matter tests, especially in the case of verbal intelligence and reading tests, the writer believes that the first explanation is the true one or at least more nearly so than the latter. It is not unlikely that both had a part in causing the relative increase.

The achievement quotients at the beginning and end of the second semester of 1920-21. Table XIV shows that at the beginning of this semester the median achievement quotient of the experimental schools was two points higher than that of the control schools. We have seen that both the intelligence and the achievement scores made at the end of the semester showed a greater increase in the case of the experimental schools than in that of the other group, but that the increase in intelligence on the part of the experimental schools was slightly greater than that in achievement. Moreover, both groups showed greater increases in achievement than in intelligence. Therefore we expect to find, as we do, that the median achievement quotients of both groups of schools increased during this semester, and that the increase in the case of the control schools was slightly greater. This difference was two points. Thus at the end of the semester the two medians were the same. The general import of this evidence is that in so far as achievement was concerned there was a slight relative increase in the efficiency of the control schools.

The correlation of intelligence and achievement at the beginning and end of the second semester of 1920-21. Although the achievement quotient measures the relation of intelligence and achievement in one way, this relation may also be measured by means of the coefficient of correlation. The following table shows the coefficients that were found at the beginning and end of the semester by correlating the mental and achievement ages for all grades combined:

Experimental			Control		
Beginning	End	Loss	Beginning	End	Loss
.68±.01	.56±.01	.12	.60±.01	.51±.01	.09

It is evident that in both groups there was a decrease in the

correlation of achievement with intelligence as measured by the tests used. This decrease was slightly greater in the case of the experimental schools, but the difference was not great enough to be significant. It may be that this decrease was due to a lessening of the degree to which instruction was adapted to the capacities of the pupils. It is likely, however, that much, if not all, of the decrease was caused by the fact that the mental ages calculated at the beginning of the semester were based upon the average scores made on two intelligence tests and hence were more reliable than those obtained at the end of the semester, which were based upon only one test score. This lower degree of reliability would naturally tend to reduce the correlation between the mental and the achievement ages.

The relation of the intelligence and achievement quotients at the beginning and end of the second semester of 1920-21. The median achievement quotients of the groups of different levels of intelligence as determined by the intelligence quotients were computed for the end of the semester as they had been at its beginning. Table XV presents a comparison of those found at the two periods. The achievement quotients of the different groups at the end of the semester showed that in the experimental schools instruction was adapted about equally well to the pupils of different

TABLE XV. MEDIAN ACHIEVEMENT QUOTIENTS OF THE PUPILS OF DIFFERENT LEVELS OF INTELLIGENCE AT THE BEGINNING AND END OF THE SECOND SEMESTER OF 1920-21

Intelligence Quotient	Achievement Quotients			
	Experimental		Control	
	Beginning	End	Beginning	End
150-59	104	117	98	103
140-	95	122	95	113
130-	102	113	98	107
120-	102	113	102	109
110-	101	112	101	109
100-	102	113	102	113
90-	104	111	104	113
80-	103	113	105	114
70-	107	115	110	117
60-	113	116	114	120
50-	109	128	125	120
All	105	112	104	112

levels of intelligence, whereas in the control schools the previous well-marked tendency to adapt instruction more nearly to the capacities of the inferior pupils remained. As this tendency was present in both groups of schools at the beginning of the semester it is evident that there was a relative improvement in the degree to which the instruction in the experimental schools was adapted to pupils of one level of intelligence as well as to those of another.

The coefficients of correlation of the intelligence and achievement quotients were also found and compared with those for the beginning of the semester. The following table presents this comparison:

Experimental			Control		
Beginning	End	Gain	Beginning	End	Gain
-.16±.01	-.12±.01	.04	-.28±.01	-.25±.01	.03

This comparison shows that at the close of the semester the negative correlations between the intelligence and achievement quotients were slightly smaller in the cases of both of the groups of schools. The difference in the gains was so small that it has no significance. This fact shows that the instruction given in the control schools was still somewhat less equally suited to pupils of all levels of intelligence than was that of the experimental schools. In the main this corroborates the evidence presented in the preceding paragraph.

The gains in absolute achievement during the first semester of 1921-22. Table XVI, which contains data corresponding to the third and sixth columns of Tables XIII and XIV, shows that the increase in absolute achievement during this semester was seven months of achievement age in the experimental schools and four months in the control schools. As during this same semester the median mental age of the experimental schools did not increase as much as did that of the control schools it seems fair to attribute the greater gain in achievement to an increase in the efficiency of the experimental schools. It was shown in the preceding chapter that during this same semester the "progress quotient" of this group of schools was greater than that of the control group, therefore this increase in efficiency in so far as achievement is concerned cannot be attributed to a slowing up of the progress of the pupils.

TABLE XVI. GRADE AND SECTION GAINS AND LOSSES IN ACHIEVEMENT AGES AND QUOTIENTS OF THE TWO GROUPS OF SCHOOLS FROM THE BEGINNING TO THE END OF THE FIRST SEMESTER OF 1921-22

Grade	Section	Achievement Ages		Achievement Quotients	
		Experimental	Control	Experimental	Control
IA	Slow	16		12	
	Average	23	-2	7	6
	Fast	8		-19	
IIB	Slow	-20		-11	
	Average	-14	-18	-19	-31
	Fast	-11		-13	
IIA	Slow	11		18	
	Average	7	6	-2	-21
	Fast	5		10	
IIIB	Slow	8		-1	
	Average	17	12	-11	-32
	Fast	16		-8	
IIIA	Slow	-15		-11	
	Average	-17	-16	-7	-12
	Fast	-10		-10	
IVB	Slow	10		-4	
	Average	15	4	-4	-9
	Fast	21		-5	
IVA	Slow	23		1	
	Average	22	-7	1	-18
	Fast	67		12	
VB	Slow	20		-11	
	Average	5	17	-10	-1
	Fast	-2		-25	
VA	Slow	12		-7	
	Average	-6	18	-15	2
	Fast	6		-9	
VIB	Slow	17		-8	
	Average	19	8	-3	-8
	Fast	-49		-12	
VIA	Slow	14		-13	
	Average	2	8	-11	-5
	Fast	-29		-2	
VIIB	Slow	19		-9	
	Average	18	0	-10	-12
	Fast	35		2	
VIIA	Slow	5		-13	
	Average	10	3	-3	-5
	Fast	27		-3	
VIIB	Slow	-19		-15	
	Average	-8	1	-13	-9
	Fast	-15		-18	
VIIB	Slow	7		-7	
	Average	12	-3	3	-17
All	All	7	4	-8	-13

The achievement quotients at the beginning and end of the first semester of 1921-22. The median achievement quotients of both groups of schools were smaller at the end of this semester than they were at its beginning. In other words, the average increase in the scores made upon the intelligence tests was considerably greater than that in those upon the achievement tests. This would seem to point to the fact that the practice effect upon the intelligence tests was greater than that upon the others. As Table XVI shows, the decrease in the median achievement quotient of the experimental schools was eight points, whereas that in the control schools was thirteen points. Thus the loss of the experimental schools was five points less than that of the other group, or, in other words, their relative gain was that large. This supports the conclusion reached above from the study of the mental and achievement ages, that the efficiency of the experimental schools during the semester was greater than that of the control schools.

The correlation of achievement and intelligence at the beginning and end of the first semester of 1921-22. The following table compares the coefficients of correlation found at the end of the semester with those at the beginning:

Experimental			Control		
Beginning	End	Loss	Beginning	End	Loss
.56±.01	.54±.01	.02	.51±.01	.51±.01	.00

Judging from these coefficients, it seems that there was practically no change in the relation of achievement to intelligence during this semester. The slight decrease of .02 on the part of the experimental schools was too small to have any significance.

The relation of the intelligence and achievement quotients at the beginning and the end of the first semester of 1921-22. Table XVII shows the same facts for this semester as Table XV for the previous semester. At the end of this semester there was a rather definite decrease in the achievement quotient medians of the experimental schools from the duller to the brighter pupils. This tendency was even more marked in the control schools. Inasmuch as at the beginning of the semester this tendency was not noticeable in the experimental schools but was present in the control schools the figures for the end of the semester indicate that relatively the condition which they measure became worse in the

TABLE XVII. MEDIAN ACHIEVEMENT QUOTIENTS OF THE PUPILS OF DIFFERENT LEVELS OF INTELLIGENCE AT THE BEGINNING AND END OF THE FIRST SEMESTER OF 1921-22

Intelligence Quotient	Achievement Quotients			
	Experimental		Control	
	Beginning	End	Beginning	End
150-59	117	98	103	85
140-	122	96	113	88
130-	113	102	107	95
120-	113	100	109	99
110-	112	102	109	104
100-	113	106	113	105
90-	111	106	113	105
80-	113	110	114	107
70-	115	111	117	113
60-	116	114	120	119
50-	128	125	120	132
All	112	105	112	104

experimental schools. That is to say, during this semester there was a relative loss in the degree to which instruction was equally well adapted to pupils of all levels of intelligence in the experimental schools. The writer is unable to suggest any probable explanation of this fact.

A comparison of the coefficients of correlation of the intelligence and achievement quotients at the end of the semester with those at the beginning supports the conclusion given above. These coefficients were as follows:

Experimental			Control		
Beginning	End	Loss	Beginning	End	Loss
$-.12 \pm .01$	$-.36 \pm .01$	.24	$-.25 \pm .01$	$-.39 \pm .01$	.14

This comparison shows that the correlation between the intelligence and achievement quotients became considerably greater, negatively, during the semester. The change was much larger in the experimental schools. This fact emphasizes the conclusions presented in the last two paragraphs to the effect that there was a relative decrease in the degree to which the experimental schools capitalized the capacities of their pupils into achievement. This decrease is even more definitely shown by these coefficients than by the data given previously.

The gains in absolute achievement during the second semester of 1921-22. Table XVIII, which is similar to Table XVI,

TABLE XVIII. GRADE AND SECTION GAINS AND LOSSES IN ACHIEVEMENT AGES AND QUOTIENTS OF THE TWO GROUPS OF SCHOOLS FROM THE BEGINNING TO THE END OF THE SECOND SEMESTER OF 1921-22

Grade	Section	Achievement Ages		Achievement Quotients	
		Experimental	Control	Experimental	Control
IA	Slow	35	18	25	4
	Average	40		45	
	Fast	47		16	
IIB	Slow	3	0	7	-4
	Average	7		12	
	Fast	-7		5	
IIA	Slow	11	15	7	17
	Average	10		10	
	Fast	6		25	
IIIB	Slow	1	16	-3	19
	Average	7		2	
	Fast	7		10	
IIIA	Slow	-16	-4	-6	13
	Average	-15		-9	
	Fast	-2		16	
IVB	Slow	6	16	1	12
	Average	4		9	
	Fast	15		3	
IVA	Slow	5	19	7	11
	Average	13		9	
	Fast	12		20	
VB	Slow	0	12	8	11
	Average	10		11	
	Fast	7		11	
VA	Slow	8	3	13	4
	Average	12		10	
	Fast	10		13	
VIB	Slow	20	5	23	5
	Average	17		13	
	Fast	16		17	
VIA	Slow	6	3	4	7
	Average	5		8	
	Fast	4		3	
VIIB	Slow	34	-12	17	-1
	Average	9		5	
	Fast	-9		10	
VIIA	Slow	-23	6	-5	2
	Average	2		8	
	Fast	9		9	
VIII B	Slow	18	25	14	17
	Average	-6		1	
	Fast	-19		-1	
VIII A	Slow	6	20	-16	11
	Average	-11		1	
All	All	7	4	7	6

shows that the increase in absolute achievement during the second semester of 1921-22 averaged seven months in the experimental schools and four months in the control schools. Thus again it appears that the experimental schools were more efficient as regards the achievement of their pupils. As their "progress quotient" was considerably greater during this semester the gain in absolute achievement can not be attributed to holding back the pupils.

The achievement quotients at the beginning and end of the second semester of 1921-22. Table XVIII likewise presents the gains of the two groups of schools in achievement quotients. According to these quotients the gain of the experimental schools was only one point greater than that of the control schools.

The correlation of achievement and intelligence at the beginning and end of the second semester of 1921-22. The coefficients of correlation between absolute achievement and intelligence at the beginning and end of this semester were as follows:

Experimental			Control		
Beginning	End	Gain	Beginning	End	Gain
.54±.01	.75±.01	.21	.51±.01	.53±.01	.02

Judging from these coefficients it seems that there was a very decided gain in the relation of achievement to intelligence on the part of the experimental schools, but practically no change in the control schools.

The relation of the intelligence and achievement quotients at the beginning and end of the second semester of 1921-22. Table XIX, which is similar to Tables XIII and XVII, presents the relation of the achievement and intelligence quotients for the second semester of 1921-22. Comparing the figures for the beginning and end of this semester there seems to have been no noticeable change in the situation.

A comparison of the coefficients of correlation of the intelligence and achievement quotients is more favorable to the experimental schools. These coefficients were as follows:

Experimental			Control		
Beginning	End	Gain	Beginning	End	Loss
-.36±.01	-.34±.01	.02	-.39±.01	-.52±.01	.13

The change in the coefficients of the control schools showed a decrease in the adaptation of instruction to pupils of all levels of

TABLE XIX. MEDIAN ACHIEVEMENT QUOTIENTS OF THE PUPILS OF DIFFERENT LEVELS OF INTELLIGENCE AT THE BEGINNING AND END OF THE SECOND SEMESTER OF 1921-22

Intelligence Quotient	Achievement Quotients			
	Experimental		Control	
	Beginning	End	Beginning	End
150-59	98	89	85	88
140-	96	99	88	92
130-	102	106	95	101
120-	100	109	99	104
110-	102	108	104	109
100-	106	112	105	111
90-	106	115	105	112
80-	110	114	107	118
70-	111	121	113	119
60-	114	131	119	128
50-	125	125	132	131
All	105	113	104	109

intelligence, but in the experimental schools such adaptation seems to have remained about the same.

The achievements of the two groups of schools during the second semester of 1921-22 as measured by the Omnibus Test.

In planning this experiment it was decided to make use of tests in reading and arithmetic because those are generally considered the two most important subjects of the elementary curriculum and further because it was believed that the results obtained would give a fairly reliable index of the achievements of the pupils in all subjects. In order to provide a partial check upon this latter assumption a test was devised by the writer and given to the pupils of grade VIB and above at the regular testing period in May, 1922. This test, which was called the Omnibus Test,¹ contained questions in geography, history, grammar, elementary science and certain phases of arithmetic not covered by the standardized tests used. The scores made on this test were translated into achievement ages and quotients in the same way as for the other tests of achievement.

Table XX presents the median ages and quotients for the various grades and sections of the two groups of schools. It may be seen from this table that the showing made upon this test by

¹See Appendix C.

TABLE XX. MEDIAN GRADE AND SECTION OMNIBUS ACHIEVEMENT AGES AND QUOTIENTS OF THE PUPILS OF THE TWO GROUPS OF SCHOOLS AT THE END OF THE SECOND SEMESTER OF 1921-22

Grade	Section	Ages		Quotients	
		Experimental	Control	Experimental	Control
VIB	Slow	10-8	10-10	97	88
	Average	12-3		102	
	Fast	10-8		90	
VIA	Slow	10-8	15-2	85	120
	Average	11-1		89	
	Fast	12-2		85	
VIIB	Slow	11-10	14-10	95	109
	Average	12-0		92	
	Fast	15-3		100	
VIIA	Slow	11-1	14-4	86	107
	Average	14-9		102	
	Fast	16-8		114	
VIIB	Slow	12-11	15-7	98	108
	Average	13-5		87	
	Fast	15-2		90	
VIIIA	Slow	11-7	17-3	88	111
	Average	14-11		96	
	All	12-8		94	
		14-11		107	

the control schools was very much better than that made by the experimental schools. The average difference was over two years of achievement age and thirteen points of achievement quotient. Inasmuch as the pupils were not given a similar test at any previous time the relative gain can not be computed. The difference between the two groups is so great, however, that it is evidently significant. A very probable conclusion is that in the experimental schools there was a tendency to emphasize the instruction in reading and arithmetic to the neglect of that in the other subjects. This tendency was probably not due to the fact that the teachers and pupils were consciously striving to prepare to make better scores upon the tests but that merely through the use of the tests in reading and arithmetic attention was called to pupils' weaknesses in these subjects and therefore unusual care was taken to correct these weaknesses.

Individual opinion as to the relative importance of arithmetic

and reading as compared with the elementary school subjects covered by the Omnibus Test will largely determine one's belief as to whether or not the experimental schools made a relative gain in achievement during the course of the experiment. Inasmuch as there was an average relative gain of only about one point per semester in the achievement quotient on the part of the experimental schools it is the opinion of the writer that there was not any greater efficiency in the achievement of this group of schools. On the other hand, he does not believe it should be asserted that in so far as achievement was concerned there was a decidedly smaller degree of efficiency.

Summary. The data presented in this chapter considering them from the standpoint of the experimental schools relative to the control schools may be briefly summarized as follows:

1. At the beginning of the experiment the median achievement age as measured by the tests used was four months lower. During the experiment slightly greater efficiency was shown, averaging about one month per semester, according to the reading and arithmetic test results. According to the results on the Omnibus Test, however, the median achievement age was twenty-seven months lower at the conclusion of the experiment.
2. The median achievement quotient derived from the arithmetic and reading tests was two points greater both at the beginning and end of the experiment. Allowing for the effect of the new entrants and eliminees, however, there was a relative gain of about one point per semester. The Omnibus Test achievement quotient was thirteen points lower.
3. The correlation of intelligence and achievement was .08 greater at the beginning and .25 greater at the close of the experiment.
4. At the beginning of the experiment instruction was somewhat better adapted to the inferior than to the superior pupils in both groups of schools. On the whole there was little change in this situation.

Considering these items together it seems that in so far as

achievement was concerned the efficiency of the experimental schools was no greater than that of the control schools. The slightly greater efficiency in reading and arithmetic was at least balanced by the results of the Omnibus Test. If we assume that the measurement of achievement shows no advantage for either group of schools it may be said that the experimental plan of organization was more efficient than the traditional plan because of the fact that the progress of the pupils was considerably greater in the experimental than in the control schools. If, on the other hand, it is considered that the Omnibus Test showed a distinctly greater degree of efficiency as regards the total achievement for the control schools, this must be balanced against the greater progress made in the other group and a less definite conclusion reached.

CHAPTER V

A STUDY OF THE PUPILS WHO REMAINED IN SCHOOL THROUGHOUT THE COURSE OF THE EXPERIMENT

Although there was no reason to suspect that a study of the records of the pupils who participated in this experiment throughout the three semesters that it continued would yield results and conclusions materially different from those presented in Chapters III and IV, yet it was thought desirable to make such a study. Therefore this chapter will present certain data concerning the pupils who were in the schools in February, 1921, and remained therein until the close of the experiment. These pupils did not compose as large a group as might be expected because the pupil population of both groups of schools was very unstable. Slightly less than 60 percent of the pupils tested at the beginning of the experiment were still in the schools at its conclusion. In making a study of these pupils the tabulations were not made by separate semesters but all three semesters were taken together.

The placement of the pupils and their progress throughout the grades. Tables XXI and XXII show the percents of pupils in the two groups of schools gaining or losing the given number of semesters during the three semesters that the experiment continued. From these tables it may be seen that only 34 percent of the pupils of the experimental schools made just three semesters of progress, whereas 62 percent of those of the control schools did so. The percents making more than this amount of progress were 26 and 7, respectively, and those making less, 40 and 32. The average amount of progress made was 2.79 semesters in the experimental schools but only 2.67 semesters in the control schools. Dividing these figures by three to reduce them to a semester basis and then by the median I. Q.'s gives "progress quotients" of 93 and 89, respectively. Therefore it appears that in so far as progress was concerned the experimental plan of organization was somewhat more efficient for those pupils remaining in school throughout the experiment than was the traditional plan. The

TABLE XXI. PERCENTS OF THE PUPILS OF THE EXPERIMENTAL SCHOOLS PRESENT THROUGHOUT THE EXPERIMENT THAT GAINED OR LOST THE GIVEN NUMBER OF SEMESTERS

Feb., 1921		Semesters Gained or Lost															
Grade	Section	-5	-1	0	+1	+2	+2½	+3	+3½	+4	+4½	+5	+5½	+6	+7	+10	+11
IB	Slow Average				22 11	52 28	5 1	20 33		2 25			2				
IA	Slow Average Fast	1	3		9 4 4	38 15	1	38 44 22	8 14 16	2 17 27		3 2	2		1	1	
IIB	Slow Average Fast				23 6	51 33 9	2 9 5	15 39 36	8 9	2 3 23							
IIA	Slow Average Fast		1 1		8 2	59 12 6		25 52 13	4 11 29	1 9 19	1 12 32						
IIIB	Slow Average Fast		1		8 6 3	59 27 6		19 47 34	12 8 9	2	17	17	1 4 6	3	4		2
IIIA	Slow Average Fast		1		17 7 2	47 20 3		23 39 32	7 16 13	2 10 22	3 4 22	3 2	5				
IVB	Slow Average Fast				7	46 19 2		31 36 1	7 8 1	7 25 3		6 2	1		6 1		
IVA	Slow Average Fast		1		8 2	44 16		42 41	4 2	20	11	5	2				
VB	Slow Average Fast	1			5	54 14 5		26 39 11	5 11	5 7 16	2 27 67	2					
VA	Slow Average Fast			2	10	54 22		28 44 20	1 13	6 11 60	8 13	7					
VIB	Slow Average Fast				13 3	20 14		55 57 13	3 3	5 7 12	5 12 77	2					
VIA	Slow Average Fast		2		9	61 20 10		20 46 10	7 18		16 80						
VIIB	Slow Average Fast				7	60 16		33 83	2								
VIIA	Slow Average Fast				8	100 92 100											
VIIIB	Slow Average				100												
VIIIA	Slow Average																
All	All	.04	.04	.4	7	32	1	34	7	10	7	1	.4	.2	.04	.04	.04

TABLE XXII. PERCENTS OF THE PUPILS OF THE CONTROL SCHOOLS PRESENT THROUGHOUT THE EXPERIMENT THAT GAINED OR LOST THE GIVEN NUMBER OF SEMESTERS

February 1921 Grade	-1	0	+1	+2	+3	+4	+5	+6
IB		1	16	51	30	3		
IA		1	7	24	55	13		
IIB			7	37	56	1		
IIA		1	4	31	60	3		
IIIB		1	6	25	64	2		3
IIIA		4	5	26	58	7		
IVB			3	16	76	3	2	
IVA			1	23	73	2		
VB			1	17	78	2		1
VA			3	17	62	17	1	
VIB				21	69	10		
VIA			2	22	64	12		
VII B			5	20	75			
VIIA	7		7	87				
VIII B								
All	.1	1	5	26	62	6	.2	.3

difference of four points in the "progress quotients," especially when it is remembered that this is an average difference for three semesters, is large enough to justify the above statement.

The achievements of the pupils. Table XXIII presents the median achievement ages and quotients for the two groups of schools at the beginning and end of the experiment. From these data it may be seen that the gain on the part of the pupils of the experimental schools was three months of achievement age greater than that for the other group of schools and that the gain in achievement quotient was one point greater. These figures show that for the pupils who remained throughout the course of the experiment the experimental schools were slightly more efficient in so far as achievement was concerned.

Summary. The evidence afforded by the study of the pupils who remained in school during the course of the experiment shows that for these pupils the experimental plan of procedure resulted in appreciably greater progress according to the ability of the children and in slightly greater achievement. The difference in the "progress quotients" was four points and that in the achievement quotients, one point. Thus the general conclusion to be drawn

TABLE XXIII. MEDIAN ACHIEVEMENT AGES AND QUOTIENTS OF PUPILS WHO WERE PRESENT THROUGHOUT THE EXPERIMENT IN FEBRUARY, 1921 AND MAY, 1922

1921		Achievement Age				Achievement Quotient			
Grade	Section	Experimental		Control		Experimental		Control	
		1921	1922	1921	1922	1921	1922	1921	1922
IA	Slow	6-5	7-7	6-6	9-2	101	113	91	108
	Average	5-10	9-7			88	132		
	Fast	5-6	11-6			70	125		
IIB	Slow	6-6	6-5	7-7	7-6	100	100	101	93
	Average	6-7	8-4			90	106		
	Fast	8-0	9-5			103	108		
IIA	Slow	6-7	8-11	8-1	9-6	90	112	93	105
	Average	7-6	9-8			93	111		
	Fast	8-1	9-6			91	102		
IIIB	Slow	8-2	9-5	9-1	10-8	109	118	105	104
	Average	8-10	10-0			106	107		
	Fast	8-10	8-11			98	109		
IIIA	Slow	8-11	8-8	9-8	10-0	115	105	115	98
	Average	10-1	9-5			113	99		
	Fast	9-10	10-6			107	92		
IVB	Slow	8-11	9-4	9-1	10-11	112	103	108	115
	Average	9-11	10-4			106	110		
	Fast	10-6	10-2			105	100		
IVA	Slow	9-7	10-7	10-3	12-3	107	111	102	124
	Average	10-11	11-10			111	117		
	Fast	10-6	12-10			100	111		
VB	Slow	9-7	11-8	10-7	11-11	107	116	104	114
	Average	11-0	12-8			110	115		
	Fast	10-5	12-10			98	114		
VA	Slow	10-2	12-0	11-4	12-1	106	117	107	111
	Average	11-8	13-8			108	118		
	Fast	11-11	16-10			103	137		
VIB	Slow	10-1	12-10	12-1	14-1	104	124	107	120
	Average	11-11	14-4			106	118		
	Fast	13-10	16-4			112	116		
VIA	Slow	11-7	13-2	12-1	14-5	112	111	107	112
	Average	12-6	14-0			104	114		
	Fast	15-0	14-6			112	110		
VIIB	Slow	12-5	15-2	13-11	14-4	108	123	105	108
	Average	12-4	13-7			103	117		
	Fast	14-6	15-10			103	118		
VIIA	Slow	12-6	13-7	14-7	14-9	110	110	101	113
	Average	13-7	16-1			103	114		
	Fast	15-6	18-2			102	124		
VIIB	Slow	16-5	16-5	16-7	125	118	120
	Average	12-0	17-0			100	114		
	Fast	....	19-8			....	120
VIIIA	Slow	14-0	17-4	95	112
	Average	....	17-10			....	113
All	All	9-10	11-6	10-2	11-7	106	112	104	109

from this study is the same as that drawn from the study of all the pupils, that the experimental plan of organization was somewhat more efficient than was the traditional plan.

CHAPTER VI

A SPECIAL STUDY OF THE BRIGHTER AND DULLER PUPILS

It is evident that such an experiment as the one described in this bulletin might not have the same effect upon the efficiency of the instruction of the brighter, the average and the duller pupils. In view of this fact a special study was made of the brighter and another of the duller pupils in order to discover the effect of the experimental plan of organization upon the efficiency of the instruction of these two groups. For the purpose of the two studies the records of those pupils whose I. Q.'s as found at the first testing period were 115 or higher and of those whose I. Q.'s were less than 80 were used. The former group included about one-sixth of the total number of pupils and the latter group about one-fifth. All records not complete for the duration of the experiment were rejected so that the number of pupils actually included in these studies was reduced to 199 brighter pupils and 514 duller pupils from the experimental schools and 396 brighter and 291 duller pupils from the control schools.

The placement of the brighter pupils and their progress through the grades. Of the 199 pupils of the experimental schools 2 percent were placed in the slow sections, 23 percent in the average sections and 75 percent in the fast sections at the beginning of the experiment. When it closed the respective percents were 1, 51 and 49. The marked reduction of the number in the fast sections was due to the fact that by the close of the experiment these pupils had gained one semester or more and in many cases were not quite bright enough to attempt to make further gain, at least immediately.

Table XXIV shows that the number of semesters gained by the brighter pupils of the experimental schools varied from two to six, and by those of the control schools from one to four. The percents of the brighter pupils of the experimental schools making less than regular, regular and more than regular progress, were 9, 23, and 68, respectively. In the control schools the corresponding

TABLE XXIV. PERCENTS OF THE BRIGHTER AND OF THE DULLER PUPILS OF THE TWO GROUPS OF SCHOOLS GAINING OR LOSING THE GIVEN NUMBER OF SEMESTERS DURING THE EXPERIMENT.

	-5	0	1	2	2½	3	3½	4	4½	5	5½	6	7	10	11	Average Progress	"Progress Quotient"
Brighter Pupils																	
Experimental																	
Slow.....						25	25	50								3.63	97
Average....				13		42	22	11	7	2	2					3.29	92
Fast.....				5	2	17	9	19	40	3	3	2				3.97	106
All.....				7	2	23	13	18	32	3	2	2				3.80	102
Control.....			2	15		72		11								2.92	77
Duller Pupils																	
Experimental																	
Slow.....	.2	2	14	57	.2	20	4	3	.5	.2						2.14	99
Average....			13	27	2	43	3	8	13			1*	1*	1*	1*	2.91	133
Fast.....			13	25			13	38	1							3.13	149
All.....	.2	1	14	54	.4	23	4	4		.2		.2*	.2*	.2*	.2*	2.26	105
Control.....		1	8	36		50		5		.3		1*				2.56	119

*These large amounts of progress were made by foreign-born pupils who, at the beginning of the experiment, were so handicapped by their inability to use the English language that they made low test scores and did poor school work. Many of these pupils were able to skip the work of several semesters as soon as the language difficulty was overcome.

figures were 17, 72 and 11. Table XXIV also shows that the average progress of the brighter pupils of the experimental schools was .88 of a semester greater than that of the pupils of the control schools and that their "progress quotient" was twenty-five points greater. These differences show that the experimental schools were much more effective in so far as the rate of progress of the brighter pupils was concerned.

The achievements of the brighter pupils. The table just below gives the median achievement ages and quotients of the brighter pupils of both groups of schools in February, 1921, and May, 1922.

	Experimental			Control		
	1921	1922	Gain	1921	1922	Gain
Achievement Age	11-4	12-11	19	11-2	12-7	17
Achievement Quotient	103	112	9	98	104	6

From these data it is evident that the more rapid progress of the pupils of the experimental schools did not result in a lessening of their relative achievement but was accompanied by a small gain. This gain in relative achievement amounted to two months in terms of achievement age or three points in terms of achievement quotient. Thus considering progress and achievement together, it may be said that for the brighter pupils the experimental plan of organization resulted in a marked increase of efficiency.

The placement of the duller pupils and their progress through the grades. Of the 514 duller pupils from the experimental schools, 86 percent were placed in the slow sections, 12 percent in the average and 2 percent in the fast sections at the beginning of the experiment. At the close of the experiment the respective percents were 85, 13 and 2. Thus it is apparent that there was practically no change in the number of pupils in each of the three sectional groups.

Table XXIV shows that the number of the duller pupils making more than normal progress was not very large in either group of schools. Slightly over one-half of the duller pupils of the experimental schools made regular progress in the slow sections, which resulted in their covering two semesters' work during the three semesters of the experiment. Slightly less than one-fourth of them made three semesters' progress by maintaining membership in the average sections. Ten percent managed to make more than normal progress, while 15 percent made less than two semesters. In the control schools 50 percent made normal progress, 45 percent less and 6 percent more. The average progress was three-tenths of a semester greater for the pupils of the control schools and the "progress quotient" fourteen points greater.

Analyzing the data presented above it is apparent that more of the duller pupils were failed in the control schools than in the experimental schools. Since, however, pupils were able to advance in the slow sections without failure while covering less than the normal amount of work the average progress was less in the experimental schools. As was true in the case of the brighter pupils more of the pupils from the experimental schools made extra progress.

The achievements of the duller pupils. The table just below gives the median achievement ages and quotients of the duller pupils of both groups of schools in February, 1921, and May, 1922.

	Experimental			Control		
	1921	1922	Gain	1921	1922	Gain
Achievement Age	8-10	10-6	20	9-3	10-9	18
Achievement Quotient	112	114	2	115	114	-1

These data show that the gain made by the duller pupils of the experimental schools was two months of achievement age greater

than that made by those of the control schools and that their gain in achievement quotient was three points greater. Therefore it can be said that in so far as achievement was concerned the experimental plan of procedure was slightly more efficient for the duller pupils than the traditional plan used in the control schools.

Summary. A special study of the brighter and duller pupils who were in school throughout the experiment yields the following results and conclusions:

1. The brighter pupils of the experimental schools had a "progress quotient" twenty-five points greater than did those of the control schools.
2. The relative gain of the brighter pupils of the experimental schools in median achievement quotient was three points.
3. The "progress quotient" of the duller pupils of the experimental schools was fourteen points less than that of the duller pupils of the control schools.
4. The duller pupils of the experimental schools made a relative gain of three points in their median achievement quotient.

A fair statement of the conclusions to be drawn would seem to be that the experimental plan of organization was considerably more efficient than the traditional plan in so far as it concerned the brighter pupils, but that in the case of the duller pupils it was somewhat less efficient.

CHAPTER VII

RESULTS AND CONCLUSIONS

A brief statement of the results of this experiment. The results actually obtained in this experiment may be listed as follows:

- I. At the beginning of the experiment the placement of the pupils involved a relative loss in placement of .05 semester on the part of the experimental schools. This and the other amounts of progress are computed relative to the capacity of the pupils.
- II. The main study, which included all the pupils of the two groups of schools, showed that:
 1. The average progress was .06 semester larger in the experimental schools than in the control schools.
 2. There was a relative gain for the experimental schools of about one point per semester in the achievement quotient as measured by the arithmetic and reading tests.
 3. The achievement quotient derived from the Omnibus Test was thirteen points less for the experimental schools.
- III. A special study of the pupils who remained in school throughout the experiment gave the following results:
 1. The average progress for the experimental schools was .04 semester greater than that for the other group.
 2. There was a relative gain for the experimental schools of one point in the achievement quotient.
- IV. A special study of the brighter pupils revealed the following facts:
 1. Those of the experimental schools progressed at a rate .25 semester greater than did those of the control schools.
 2. The relative gain in the achievement quotient on the part of the pupils of the experimental schools was three points.
- V. A special study of the duller pupils gave the following results:

1. Those of the experimental schools made, on the average, .14 semester less progress per semester than did those of the other group of schools.
2. There was a relative gain of three points in the median achievement quotient for the experimental schools.

It seems fair to summarize these results by saying that for pupils of all degrees of intelligence combined the experimental plan of organization was more efficient as regards progress and about the same as regards achievement, as compared with the traditional plan. The difference in progress was considerably more than enough to balance the relative loss caused by the placement of the pupils at the beginning of the experiment.

Conclusions to be drawn from these results and their application to school systems in general. The comparisons that were made between the schools taking part in this experiment and certain other city school systems seem to show that the results obtained in this experiment and the conclusions based thereon are fairly applicable to school systems in general. Assuming that this conclusion is warranted, the question remains as to whether or not the classification of pupils along lines similar to those followed in this experiment should be recommended to school administrators as a practical method of procedure. In considering this question it should be recognized that the public school superintendent or supervisor can ordinarily exercise a somewhat higher degree of supervision over the schools under his control than could the writer over the schools participating in this experiment. Therefore, it should be possible to secure somewhat more favorable conditions for carrying out the experimental plan of organization than were possible in this experiment.

In the second place, the question arises as to how large a gain in output, that is to say in progress and achievement, is required to justify a certain amount of additional investment. In this experiment the cost in both money and time was considerably larger per pupil than would be necessary in the usual public school situation. Ordinarily pupils would not need to be tested so often nor would it be necessary to use tests of achievement. Furthermore, there were many tabulations and computations made in this project that would not be necessary in the ordinary school situation. The cost

of group intelligence tests is only a few cents per pupil, in some cases being as low as one and one-half cents and in few more than ten cents. If the teachers scored the papers there would be no extra expense involved therein. Thus the cost of the tests and a rather small amount of clerk hire would be all the unusual outlay required to make use of group intelligence tests for purposes of placing pupils. Certain plans of doing this have involved a decrease in the average number of pupils per teacher or per room or some other element of additional investment. In this experiment there was no such expenditure, nor need there be in the usual situation. The desirability of reducing class size, whether in this or some other type of organization, is a separate problem. Therefore the total cost of the type of organization used in the experimental schools amounts to only a fraction of one percent of the total expenditure per pupil. As the gain in progress on the part of the experimental schools amounted to several percent of the total progress and as there was no loss in achievement, and, furthermore, as it is probable that under ordinary conditions the gain would be greater than it was in this project it would seem that an additional investment of a fraction of one percent would be entirely justifiable.

There remains, however, another point that must be considered in this connection. In Chapter I, output was defined as being composed of progress and achievement. There are undoubtedly other less tangible factors that constitute a part, and a rather important part, of the output of a school system. Such outcomes as industry, good citizenship, intellectual honesty, social development, etc., were either not measured in this experiment or measured so indirectly that no assumptions can be made concerning their presence and amount. This fact does not invalidate the conclusions reached, but merely signifies that these other outcomes of instruction must be considered in their interpretation. The fact that we cannot measure the total output should not bar us from measuring that which can be measured nor from proceeding according to what our measurements reveal until more complete measurements are possible.

It must also be remembered, as was stated in Chapter I, that there were really two problems involved in this experiment. It is possible that a portion or all of the results obtained in this experiment

might be secured in a somewhat similar experiment in which the pupils were classified according to teachers' judgments. Especially might this occur if the teachers participating were well-trained and experienced, and perhaps had given special study to the problem of classifying pupils according to their capacities. There were several reasons why the pupils in the control schools were not so classified, the chief one being that it was impracticable in the given situation. It may be suggested that since fast, average and slow sections were not formed in the control schools, they should not have been formed in the experimental schools. As was stated in Chapter I, the use of intelligence tests for the purpose of placing pupils implies that the pupils be placed according to their capacities and that it would not have been possible to arrange an experiment that would show the value of intelligence tests for the purpose mentioned unless such sections had been formed. Also the writer does not believe that the classification of the pupils of the experimental schools according to the teachers' judgments would have yielded as favorable results as did their classification according to the principles enumerated in Chapter I. This belief is based upon a study of the accounts of various experiments and of the teachers' estimates of capacity and the average school marks actually given in this experiment. These disagreed with the results of the intelligence tests in many cases and in most of these the latter appeared to furnish a more reliable means of predicting future progress and achievement than did the former.

In considering the conclusions reached from this study it should be borne in mind that the total time included was only three semesters. It is probable that if the experiment had continued for a longer time, say for eight or ten years, certain effects would have been noted that did not appear during the three semesters or effects that were present might have appeared in much more pronounced fashion. In general it seemed that as the experiment progressed from semester to semester the plan of organization being tried out gave better results. If the teachers had had several years' experience with such a plan the results might have been still more favorable. The plan was new to the teachers and hence they probably could not do their best work at first. On the other hand, it is possible that a division of the pupils into three groups

might tend to make the teachers feel less responsible for the achievements of the pupils, especially those of the duller ones. They might more or less unconsciously come to feel that the pupils placed in the slow sections could not be expected to do a very high quality of work and that therefore they were not worth much attention and effort. Such a result would, of course, be decidedly undesirable.

Considering the facts and possibilities mentioned above it is the opinion of the writer that the use of intelligence tests as the chief basis of classifying pupils increases the output of the school sufficiently to justify the additional expense involved. It is not, however, a panacea for all inefficient schools nor a method of organization that should be rushed into by every school administrator before he has made a careful study of its installation and operation.

APPENDIX A

A COMPARISON OF THE PUPILS ENTERING AND LEAVING SCHOOL DURING THE EXPERIMENT WITH THE TOTAL NUMBER OF PUPILS

Necessity for this comparison. Inasmuch as the shifting of membership within both groups of schools was so large, it seemed wise to take definite account of its effect upon the results and conclusions reached. In Chapters III and IV, where these results and conclusions are given, this effect has been considered. It was more or less probable that the number or mental capacities of the pupils eliminated from the experimental schools might be considerably influenced by the conditions of the experiment. For example, the recognition of the ability of the brighter pupils might tend to hold a larger percent of them in school and the placing of the duller pupils in slow sections might cause more of them to leave school than would normally be the case. This would, of course, materially raise the general mental level of the pupil material. On the other hand, it is possible that by placing many duller pupils, who would otherwise be failed, in the slow sections more of them would be held in school and that by allowing the brighter pupils to progress more rapidly they would be encouraged to leave school sooner than would otherwise be the case. Such results as these would lower the general mental level. Or perhaps some other combination of the four possible results just mentioned took place, so that more pupils of all degrees of ability were held in school, or more eliminated. Or again, other effects than those mentioned might have resulted. In regard to the new entrants, a priori reasoning would lead to the conclusion that they would have no effect upon the outcome of the experiment, since its operation would not in any way cause them to enter or not to enter school. However, it was thought best to make a study of them as well as one of the eliminees.

The effect of the pupils entering and leaving school during the experiment upon the total school population. It was found that during each of the three semesters of the experiment

the percent of pupils eliminated from the experimental schools was much greater than that from the control schools, the averages being about 12 and 7 percent, respectively. It might seem, therefore, that the experimental plan of organization resulted in increasing the amount of elimination. The writer does not believe, however, that this was the case. If it had been, the elimination rate for the pupils in the different sectional groups probably would have varied considerably. A study of this phase of the question shows that for each of the semesters the percents of all the pupils belonging to the fast, average and slow sections that were eliminated were practically the same. To word it differently, the percent of all pupils eliminated that had been in the fast sections was almost exactly the same as the percent of all pupils placed therein. A similar condition held for the other sections. Furthermore, the principals of the experimental schools stated that the elimination was no greater than was usual.

Table XXV shows the effects of the entrance and the elimination of pupils upon the total school population. It is to be read as follows, taking the first double column of the row of entries following "Med. Chron. Age" as an example: the elimination of pupils during the second semester of 1920-21 caused a decrease of one-tenth of a year more in the median chronological age of the pupils of the experimental schools than in that of the control schools. The entrance of new pupils during this time had no effect.

TABLE XXV. THE EFFECTS OF THE ENTRANCE AND ELIMINATION OF PUPILS UPON THE TOTAL PUPIL POPULATION

	Second Semester of 1920-21		Summer of 1921		First Semester of 1921-22		Second Semester of 1921-22	
	Elim.	NewE.	Elim.	NewE.	Elim.	NewE.	Elim.	NewE.
Med. Chron. Age.....	-.1		-.2		-.1	-.1	-.2	
Percent Accelerated.....	-1.		-1.	+1.			-1.	
Percent Retarded.....	+1.		+1.				+1.	
Aver. Retardation.....	-.03	+.03	-.04		-.02	+.02	-.04	
Aver. Progress.....		-.01		-.01		-.01		
Prog. Quotient.....		-1.						
Median M. A.....			-.1			-.2	-.1	
Median I. Q.....						-1.	+1.	
Median A. A.....			-2.	-1.		-1.		
Median A. Q.....				-1.				

In making use of the data in this table it must be borne in mind that all of the eliminated pupils were not included in the tabulations from which the data were derived. In a rather large number of cases the individual record cards of pupils who had left school were not returned to the writer along with the cards of those still in school. Practically all of these cases were in the control schools. In other cases the pupils were absent at the time of testing but did not actually withdraw from school until later, not returning to be tested in the meantime, so that another possible source of discrepancy was introduced. In view of these facts it was not certain that the effects listed in the table were all of the effects or were the true effects produced upon the pupil material by the pupils who left during the experiment. In the case of the new entrants there were no such opportunities for records to be lost unless the pupils concerned not only entered but left during the same semester, in which case they would not have been included in the tabulation.

The effect of the differences between the new entrants and eliminees and the total pupil population in so far as they relate to progress were considered in Chapter III. On the whole these effects were comparatively small. Those having to do with achievement were not used in Chapter IV or elsewhere. The reason for this was that all the tabulations in that chapter were made for the pupils who were present throughout the semester and hence did not need to be included for the pupils entering or leaving during the given semester. They are merely presented here as a matter of interest.

APPENDIX B

THE RELIABILITY AND CORRELATION OF THE TESTS USED IN THIS EXPERIMENT

In considering the results of such an experiment as the one described in the body of this report the question of the reliability of the tests used at once arises. The writer will not go into the matter in a detailed way but will merely present such coefficients of correlation and other measures of the reliability of the tests as were obtained and comment briefly thereon. No attempt was made to compute all the possible correlations between the tests used.

Constant and variable errors. Before proceeding to give the data referred to in the preceding paragraph, a brief discussion of the errors present in test scores seems appropriate. These errors may be classified as constant and variable.

Constant errors are those which are the same or approximately so for the group being tested. If, for example, the person giving the test allows less time than the directions call for a constant error is introduced, the effect of which is to lower the scores of all pupils taking the test. On the other hand, if too much time is allowed the scores are too large. Probably the most frequent constant errors are those due to what is often called "practice effect." If a duplicate form of a test is given the scores made thereon are ordinarily somewhat higher than those made at the first trial. Such constant errors were, of course, present in this experiment but as they were equally present for the two groups of schools it was not necessary to make any allowance for them.

Variable errors are those which differ for the different individuals taking the test. They are due to a number of causes. On any given day certain pupils are below par physically or mentally and therefore are likely to make a lower score than they would ordinarily. Such happenings as the breaking of a pencil point, the dropping of a test paper upon the floor or some occurrence distracting an individual's attention cause variable errors. All of these

mentioned so far result in lower scores. On the other hand, it may be that the particular form of a test used contains items which happen to be well known by a few members of the group taking the test. Such a condition results in an increased score. Scores may also be increased if a pupil turns the page and starts before the signal is given, if he does not know the correct answer but gets it by looking at someone else's paper, and by various other causes. It is usually impossible to determine the variable errors present in the scores of the individual pupils, although this can sometimes be done by a more or less detailed investigation. The effect of these errors is that the scores of many of the pupils are slightly too large or too small and those of a few are very much in error. On the other hand, the variable errors cause very little or no change in the average. In the long run they are as often positive as negative and therefore offset each other in the computation of averages.

The reliability of the Pressey Primer and the Illinois General Intelligence Scales. As the two scales named were the only ones used more than once in this experiment, they are the only ones for which the reliability can be calculated. The coefficients of correlation or of reliability,¹ the indices of reliability,² the probable errors of measurement,³ and the percents these probable errors were of the respective medians were calculated.⁴ Throughout the discussion of these measures of reliability it should be remembered that they were all computed from the use of tests at intervals of about six months and one year and therefore should not be expected to show as high a degree of reliability as if the time intervals had been shorter. In most studies of the reliability of tests the

¹The coefficient of correlation between repetitions or duplicate forms of the same test is called the coefficient of reliability.

²The index of reliability is the square root of the coefficient of reliability. It measures the correlation between the score on one trial of a test and the true score. This true score is the average of the scores made upon an infinite number of trials of the test after these have been corrected for any constant errors.

³The term "probable error of measurement" bears the same relation to the index of reliability that the probable error of estimate bears to the coefficient of reliability. It is a measure of the variable error by which a pupil's score upon one trial of a test deviates from his true score. The formula is $.6745\sigma\sqrt{1-r}$. For σ the average of the standard deviations obtained from the scores made on each of two trials is used.

⁴The complete tables are to be found in the dissertation by the same title and author.

interval between the periods at which the tests were given has not exceeded a few days.

Table XXVI, Part A, shows that there was in general little difference in degree of reliability between the Pressey Primer and the Illinois General Intelligence Scale, that of the former being slightly higher. The average coefficient of reliability was in each case about four-tenths for the single half-grade groups and not far from seven-tenths for all grades combined. The average indices of reliability were somewhat greater than six-tenths and eight-tenths, respectively. The probable error of measurement averaged about nine points, or 15 percent of the median, in both cases. In the case of the Illinois Scale this amounts to almost one year of mental age, whereas in that of the Pressey it is somewhat less.

TABLE XXVI. DATA CONCERNING THE INTELLIGENCE TESTS USED IN THIS PROJECT

A. Reliability				
	Coefficient of Reliability	Index of Reliability	Probable Error of Measurement	P.E. Meas. Median
Pressey (Nov., 1920 and May, 1921)				
Grade Average.....	.46 ± .02	.67 ± .02	8	.16
Grades Combined.....	.65 ± .01	.81 ± .01	9	.15
Illinois (Form 1 in Nov., 1920 and Form 2 in May, 1921)				
Grade Average.....	.38 ± .03	.62 ± .03	9	.15
Grades Combined.....	.69 ± .01	.83 ± .01	9	.15
(Form 2 in May, 1921 and Form 1 in Dec., 1921)				
Grade Average.....	.46 ± .04	.67 ± .02	8	.14
Grades Combined.....	.73 ± .01	.85 ± .01	9	.13
(Form 1 in Nov., 1920 and in Dec., 1921)				
Grade Average.....	.32 ± .04	.55 ± .03	9	.14
Grades Combined.....	.62 ± .01	.79 ± .01	10	.15

B. Correlations Between the Different Tests Used.

	Grade Average	Grades Combined
Pressey and Dearborn (Used at Same Time).....	.59 ± .02	.78 ± .01
Illinois and National (" " " ").....	.63 ± .02	.81 ± .01
Pressey and Myers (" " one semester apart).....	.29 ± .03	.39 ± .01
Kingsbury and Myers (" " " ").....	.47 ± .01	*.....
Pressey and Illinois (" " " ").....	.20 ± .03	*.....
Dearborn and Illinois (" " " ").....	.23 ± .03	*.....
Pressey-Dearborn and Illinois (Used one semester apart).....	.36 ± .03	*.....
Dearborn and Myers (Used one year apart).....	.38 ± .04	.52 ± .01
Pressey and Myers (" " " ").....	.32 ± .04	.46 ± .01

*In these cases the correlations from only one grade are available.

In other words, the mental ages derived from a single application of the tests would be within that distance of the true mental ages in only about 50 percent of the cases.

Certain data as to the reliability of these two scales have been given by their authors. The administration of the Pressey scale to 365 first, second and third grade pupils gave an average coefficient of reliability of .92 between the first and second halves of the scale.⁵ With two other groups of pupils numbering slightly over 100 each, coefficients of .89 and .92 were obtained.⁶ The probable error of measurement was found to be between two and three points on the scale. These coefficients are naturally much higher and the probable errors much less than those obtained in this experiment because of the difference in the intervals between testing. The coefficients of reliability for Forms 1 and 2 of the Illinois scale are not quite as high as those between the two halves of the Pressey scale. Results based upon about 1000 children gave an average coefficient of .83 for grades III to VIII and one of .92 for the grades combined.⁷ The probable error of measurement was between five and six points on the scale. These figures also show a considerably higher degree of reliability than do those obtained by testing at intervals of six months and one year. Inasmuch as the scale of the Illinois is finer than that of the Pressey, the probable errors are not far from the same when converted into mental ages.

The coefficients of reliability that are given for two or three other group intelligence tests run from about .75 up.⁸ They tend

⁵Pressey, L. W. "A Group Scale of Intelligence for Use in the First Three Grades." *Journal of Educational Psychology*, 10, 297-308, September, 1919.

⁶Pressey, L. W. "A Group Scale of Intelligence for Use in the First Three Grades." *Journal of Educational Research*, 1, 285-94, April, 1920.

⁷Monroe, W. S. "The Illinois Examination." *University of Illinois Bulletin*, Vol. 19, No. 9, Bureau of Educational Research Bulletin No. 6. Urbana: University of Illinois, 1921. p. 47-49.

Monroe, W. S. and Buckingham, B. R. "The Illinois Examination I and II. Teacher's Handbook." Bloomington: Public School Publishing Company, 1920, p. 31.

⁸Colvin, S. S. "Educational Tests at Brown University." *School and Society*, 10, 27, July 5, 1919.

Colvin, S. S. "Some Recent Results Obtained from the Otis Group Intelligence Scale." *Journal of Educational Research*, 3, 1-12, January, 1921.

Otis, A. S. "An Absolute Point Scale for the Group Measurement of Intel-

to average about .80. Therefore, if these few are typical of similar tests in general, it would seem that the Pressey and Illinois scales are more reliable than are most group intelligence tests. From such a comparative standpoint coefficients of reliability around .90 and probable errors of measurement of two and five points may be said to be rather satisfactory. The differences between these figures and those obtained in this project may be largely, if not entirely, attributed to the difference in the time elapsing between the giving of the tests.

The correlations between the different group intelligence tests used in this experiment. Part B of Table XXVI presents the correlations obtained between the different tests used. It will be seen that the correlation between the Pressey scale and the Dearborn tests and that between the Illinois scale and the National tests are fairly high. An average correlation of about .60 when pupils are taken by half-grade groups and of about .80 for all grades combined is higher than is usually found between group intelligence tests.

The correlations between the results of the tests used at intervals of six months and one year are considerably lower. This would, of course, be expected as they take account not only of the differences between the tests but also of changes in the true mental abilities of the pupils during the period elapsing between the giving of the tests and of differences in the general conditions of testing at the two times. On the whole, these correlations do not compare unfavorably with similar correlations obtained elsewhere.

The writer collected data concerning the correlations found between different intelligence tests in some fifty cases. In practically all of these the different tests were given within a comparatively short time of each other, usually within the same week. The unweighted average of the coefficients of correlation was .62, which is only slightly higher than the average correlation by half-grade groups given in Part B of Table XXVI and much lower than that

ligence." *Journal of Educational Psychology*, 9, 333-47, and 237-61 May, 1918, and June, 1918.

Snarr, O. W. "Reliability of General Intelligence Tests in Classifying High School Pupils." Unpublished Thesis, University of Chicago, Chicago, June, 1919.

obtained for the grades combined. This is true although in a number of cases the coefficients were based upon several grades combined. Only about a dozen of the fifty are as high or higher than those of .78 and .81 which were obtained in this experiment when the grades were combined. In only one case was there a coefficient found higher than .90. Thus it may be said that the correlation between the Pressey scale and the Dearborn tests and that between the Illinois scale and the National tests were rather satisfactory as compared with similar correlations obtained in other experiments.

Although the coefficients given in Part B of Table XXVI were obtained from testing at intervals of one and two semesters, yet some of them compare favorably with a number of those given in the accounts of other experiments. When several half-grade groups were combined the coefficients averaged about .46.

The degree of reliability of single test scores was of concern in placing the individual pupils, but in measuring the results of the experiment this was not a matter of importance. The average used in most cases was the median, and for this the probable error is 1.25 (approx.) times the probable error of the distribution divided by the square root of the number of cases.⁹ As the number of pupils included in this experiment was so large, the distribution would have had to be very scattering and the probable errors very large to cause the medians to be unreliable to any considerable degree. The distribution of the 3615 November, 1920, scores upon the Illinois scale, for example, had a probable error of 41 points, or 4.1 years of mental age. The probable error of the median was therefore about .85 point or one month.

⁹Yule, G. U. "An Introduction to the Theory of Statistics," London: Charles Griffin and Company, 1919, p. 338.

APPENDIX C

THE OMNIBUS TEST

As was mentioned in Chapter IV, a test called the Omnibus Test was devised by the writer to measure certain achievements of the pupils in the upper grades that were not covered by the reading and arithmetic tests used. This test was of the true-false type. It included seventy-five statements of which approximately half were correct and half incorrect. The following gives the first ten statements of the test:

- | | |
|--|-------|
| 1. Russia produces a large amount of wheat..... | ..... |
| 2. The ancient Greeks were famous for their art..... | ..... |
| 3. Charcoal is made from wood..... | ..... |
| 4. 4.6 is 100 times .46..... | ..... |
| 5. A paragraph should be indented..... | ..... |
| 6. Italy raises a great deal of flax..... | ..... |
| 7. The Roman Empire was not as powerful
as Greece..... | |
| 8. Digestion begins in the mouth..... | ..... |
| 9. $41/1000 = .41$..... | ..... |
| 10. A compound sentence has at least two in-
dependent clauses..... | |

Every fifth statement had to do with the same subject, the five subjects included being geography, history, elementary science, arithmetic and grammar. The fifteen statements dealing with each subject were divided approximately equally between the six semesters of work covered and were in all cases based upon material mentioned in the outline of the Chicago course of study. The seventy-five statements were preceded by explicit directions and preliminary practise statements. The pupils were instructed to place a plus mark after those statements that were correct and a minus sign after those that were incorrect. A time limit of four minutes was placed upon the test.





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