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A Study of the Relation Between Intelligence and Accomplishment as Shown by the Use of Standardized Tests in a "Main Street" School

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STUDY OF THE RELATIONSHIP BETWEEN INTELLIGENCE AND ACCOMPLISHMENT AS SHOWN BY THE USE OF STANDARD TESTS

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By
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INTRODUCTION.

The literature upon the subject of Standardized tests has dealt almost entirely with either city schools or rural school surveys. The Devil did not make the little towns, but they are made up of our great middle classes and are deserving of all that science discovers. Many teachers come from this class. They have received their public school education in the small town schools and are now teaching there. Give the children of these places the best and as our future leaders they will give their best to society.

This study is made with idea of benefiting not only the community studied, but of helping the thousands of similar communities. In order that the fathers and mothers, the grade and high school teachers who are not experts in educational measurements, may appreciate the uses to which standardized tests may be put, the discussion is as non-technical as is compatible with clearness and scientific accuracy.

This opportunity is taken to express appreciation of the cooperaiion of Superintendent C.C. Minatra of the Ozona, Texas Public Schools, in obtaining data for use in this problem.

C.N.F.

A Study of the Relation Between Intelligence and Accomplishment.

Problem.-It is the purpose of this study to show some definite facts in regard to the relation between intelligence and achievement in school work as revealed by the use of group intelligence scales and standardized accomplishment scales. It is further proposed to show that the use of these standardized tests is practical in relatively small communities as well as in larger towns and cities.

Historical.-The use of tests is as old as schools themselves, but the standardization of scientific scales for measuring either intelligence or accomplishment is recent. The Binet-Simon tests first published in 1905 with revisions in 1908 and 1911 were the first successful measures of intelligence. They were soon translated and adapted in Germany, England, and America. In America we have revisions by Goddard in 1910, Kuhlmann 1912 and 1922, Yerkes point scale 1915 and 1923, Terman 1916 (The stanford-Binet) and Herring 1922.

More recent still is the development of group tests. When the United States entered the world war a group of our psychologists devised two series of tests, known as the alpha and beta tests, the former for testing literates, the latter for illiterates. These were applied to 1,723,000 men and proved their worth in classifying soldiers according to ability. After the close of the war these tests came into quite general use in high schools, colleges and universities.

Although the list has grown rapidly since 1917, the number of reliable and valid intelligence scales is still very limited. For the primary grades The Otis Group Intelligence Scale (Primary Examination),Kingsbury's Primary Group Intelligence Scale and The Pintner-Cunningham Primary Mental Test are among the best. For the elementary grades The Otis Group Intelligence Scale (Advanced Examination), The National Intelligence Tests (Scale A and Scale B), and the Illinois General Intelligence Scale might be presented as a possible list from which to choose. For use in the high school Otis Group Intelligence Scale Terman's Group Test of Mental Ability and The Army Alpha are probably being most generally and successfully used, For college, The Otis Group Intelligence Scale, The Thurston Psychological Examination, and again the Army Alpha are being widely used.

Fifteen years ago educational measurements concerned chiefly time, money, numbers of teachers, children enrolled and their attendance. Achievement was "graded" by examinations, each teacher having a system of her own or none at all. E.J. Ashbaum (II2)[1], Ohio State University, writing on Reducing the Variability

1 The Roman numerals refer to the divisions of the bibliography, Arabic to the particular reference.

in Teachers' Marks, gives an account of an experiment in grading a type paper on the Stone reasoning test in arithmetic. Each of fifty-five seniors and graduate students in the Department of School Administration, at Ohio State University, marked the same paper three times at intervals of four weeks. The basis

of grading was a score of ten for each of ten problems. The total range of points for the first, second and third scorings was fifty-one, fifty, and thirty-nine respectively. These students had either had experience in teaching or were preparing to be taachers. Elliott and Starch(N-4) found one hundred teachers of mathematics assigned marks from twenty-eight to ninety to the same paper. In contrast to these subjective marks and guess work are the standardized tests used in our most progressive schools today.

Pioneers in this work were Rice and Thorndike. Rice investigated from the point of view of the school administrator in finding the best course of study, time allotment and methods of instruction. Thorndike's investigation combined psychological and statistical interest. His Mental and Social Measurements, 1904, contained many of the principles upon which the construction of later tests has been based. Thorndike's well known writing scale appeared in 1909. The principles underlying its construction were used by Hillegas in 1912 in his Composition Scale, and since by numbers of others. Stone's and Courtis' arithmetic tests, Ayres' writing and spelling scales and Buckingham's spelling scale were worthy contributions to educational measurement.

In order to interpret the scores yielded by these tests there must be some standard of comparison. The most common plan has been to group the scores by school grades. The standard, for example, for grade III, being the median attainment of all the pupils tested in the third grade. This median is

called the norm and is thought of as the degree of ability which a third grade pupil or group should have. It is now being generally recognized that mental age has more to do with achievement than placement in the grade. Monroe(IV-5) made a study of the relative influence of intelligence and school grade upon the achievement of pupils. The Illinois General Intelligence Scale and the Monroe Silent Reading Tests were given to about seven thousand pupils from grades three to eight. He found "The average increase for one year of mental growth is over three times as great for comprehension and nearly two times as great for rate as the corresponding increases from one school grade to the next." Investigations in other subjects would likely show, in varying degrees, the greater influence of mental age on achievment. Mental age norms are destined to supplement and to an extent to displace the older grade norms. This necessitates giving general intelligence tests to all pupils, but the extra work is well worth while.

It is significant to note that since 1914 our city and state school surveys have extensively used tests of achievment. Some examples of city surveys using achievment tests are: Gary 1914, Cleveland 1915, Salt Lake City, 1915, San Francisco 1917, and Columbia 1918. Pintner (IV-9) points out that the Cleveland survey as a type of the best recent school surveys, neglects the consideration of differences in mentality. In the Oklahoma state survey 1923, and the Texas survey 1924 the departments of tests and measurements have included both mental and accomplishment tests. These surveys were under the direc-

tion of Dr. G.A.Works, head of rural school education, Cornell University. That the ability of pupils must be taken into consideration before praise or blame of teacher or child is pronounced, is now more widely recognized than was formerly the case.

Colleges and universities have their bureaus of research, and departments for training experts for positions as heads of such departments in city schools. Such cities as Atlanta, Baltimore, Chicago, Cleveland, Los Angeles, New Orleans and many others have these departments well established. Something has been done in a few of our smaller schools. At Martn's Ferry, Ohio, Margaret S. Brainard (III-2) Director of Research, has seven, eight and nine. She says there were practically no complaints from pupils or parents and "Not a member of the staff has expressed desire to return to the old system."

Buckingham (III-3) answers very definitely some questions in regard to the use of a testing program in a small school system. He says in brief: (1) Standardized tests may be used to group pupils under one teacher, when there are not enough teachers to permit separation of the groups.(2) They help to show the teacher whether failure is caused by intellectual handicap or otherwise. (3) The project must be cooperative, the superintendent guiding and suggesting and the teachers using the results.

In "A Comparison of Intelligence and Training in a Massachusetts Town", the authors Shaw and Lincoln (III-8) compare the two schools of the town using the Dearborn Group Intelli-

gence Examinations, and accomplishment scales in reading, writing and arithmetic. They find in general a higher grade of work being done in the school which ranks higher in intelligence. But the literature dealing with the small town testing program is scarce. In this study an account is given of the work of a superintendent with the right training and the right spirit to "carry on" under the usual small town difficulties.

Method,- The intelligence scales selected for grades three to six in this study are the National Intelligence Tests, prepared by Haggerty, Terman, Thorndike, Whipple and Yerkes; and for grades seven to eleven, the Terman Group Tests of Mental Ability.

Of these two scales Van Wagenen(II-7) says, "these were used because of their wide recognition, because they were available in more than one form, and the Terman test especially because the score had been reduced to equivalent mental age norms on the individual mental examinations." Mrs. Brainard (III-2) says, "The National brings good results, especially through the preliminary practice exercises." She criticises the difficulty of finding final scores.

Whipple (II-8) gives a detailed description of the National Intelligence Tests. Summarizing in part from this paper we find the following facts in regard to this scale. (1) The General Educational Board acted on a suggestion to adapt the Alpha Army Tests to the examination of school children, the National Research council to take the responsibility, cooperating with a group of psychologists. A sum of money was appropriated and the above mentioned authors were made members of the committee. Preliminary trial tests

were made in the spring of 1919 and the final completed scale issued in the summer of 1920.

(2) The aim of the committee was to produce in a single pamphlet an arrangement of tests that could be applied to any child in the elementary school who could read well enough to participate in a group examination.

(3) Each test was so contrived that not more than ten percent of perfect scores should be made by an average eighth grade group, and not more than ten percent of zero scores by an average third grade group. The tests vary in difficulty and are arranged approximately in order from the least to the most difficult. This order was secured from actual test results.

(4) There are five forms, each form having scales A and B, either of which will serve well for an intelligence examination. At the offices of the National Research Council at Washington there is complete material for five other forms.

(5) The scale is brief enough to be given in a regular class room period, and is simple enough to be administered by almost any class room teacher. The instructions are simple, concrete and clear, and are followed by one minute fore-exercises for eachtest.

Terman's Group Test of Mental Ability is primarily for use in high schools (grades 7 to 11). This limitation makes possible the simplification of procedure, favors its accuracy, and shortens the time for administering. The scale is issued in two forms, each consisting of ten tests, with a total of 185 questions. These forms may be used alternately. Clear directions are given and the scoring keys are convenient to use.

were made in the spring of 1929 and the first scoring was
issued in the summer of 1929.

(2) The aim of the committee was to produce in a single
pamphlet an arrangement of tests which would be suitable to any
child in the elementary school who could read well enough to
participate in a group examination.

(3) Each test was so constructed that much more than 50 per-
cent of perfect pupils would be marked as average in the grade
group, and not more than 10 percent of zero papers in the average
third grade group. The tests were in difficulty and were arrange-
ed approximately in order from the least to the most difficult.
This order was secured from actual test results.

(4) There are five [illegible] tests, each of which is given
either or which will serve well for an intelligence examination.
At the offices of the National Research Council at Washington
there is complete material for five other forms.

(5) The series is intended to be given in a regular
class room period, and is simple enough to be administered by
almost any class room teacher. The instructions are simple,
concrete and clear, and are followed by an minute [illegible]-exam-
ples for each test.

Terman's Group Test of Mental Ability is primarily for use
in high schools (grades 9 to 12). Although intelligence ratio
is the significant of groups, [illegible] and
also [illegible] the time for [illegible]. The scale is [illegible]
two forms, each consisting of ten tests, with a total of 100
questions. These forms may be used alternately. Many [illegible]
[illegible] given and the [illegible] are numerous to [illegible].

Superintendent Ira J. Bright (II-3), Leavenworth, Kansas, who used this scale to determine its adaptability to first year high school pupils; found that success in the various courses could be predicted with a reasonably high degree of accuracy. Also that it clarifies the teacher's problems and offers the best criterion for organization of class groups.

The Stanford Achievement Test, by Truman L. Kelley, Giles M. Rush and Lewis M. Terman, Advanced Examination, form A, was prepared for grades 4 - 8, but was used in all grades above the third. The Primary Examination was used in the third grade. The primary scale consists of tests in reading, arithmetic and dictation exercise(spelling). The advanced wxamination is a battery of nine tests as follows.

1. Reading: Paragraph Meaning.
2. Reading: Sentence Meaning.
3. Reading: Word Meaning.
4. Arithmetic: Reasoning.
5. Arithmetic: Computation.
6. Nature Study and Science.
7. History and Literature.
8. Language Usage.
9. Dictation Exercise.

The composite scale from which educational age is taken is the sum of all these scores divided by ten. The first page gives all these data in compact form. The second page is an arrangement for an individual profile of subject ages. These first pages torn off and filed make a convenient record of achievement.

This scale is in compact form, easy to administer, and has a high degree of reliability. The mental age norms make it very desirable to use in connection with intelligent tests. This scale was administered instead of the old midyear examinations

as a basis of promotion in grades four to six and the primary examination in the third grade. Near the close of the second semester the "Advanced Examination" was given to grades seven to eleven inclusive. Although designed for grades four to eight there are norms for grade nine. The tenth and eleventh grades were included as an experiment, and because all being seated in an assembly hall, it was convenient to do this. The scale was administered by the superintendent with the help of the high school teachers. "There was no deviation whatever from the printed instructions and directions." The scoring and compilations of data were done entirely by the writer.

The tests (Stanford Achievement) in the elementary grades were also given by the superintendent. These were given in the regular class rooms with the teacher present. The scoring was done by the teachers in primary and intermediate groups. The teachers were first drilled on methods of scoring as the tests were new to them. The intelligence tests were administered and scored by the superintendent and work checked by the teachers.

Results.- The results are presented in tabular form. Table 1. gives for the third grade: (1) A pupil number which is maintained throughout the following discussions. (2) The mental age (M. A.) as found by the National Intelligence Tests, Primary Examination. (3) The reading score (R).(4). The Arithmetic score (A) . (5) Dictation exercise score (D). (6)The composite score (C.S.), which is the total of the Stanford achievement scores divided by ten.

Tables II. to IX. show the same items for grades four to eleven with the following differences: the Advanced Examination of The Stanford Achievement scale is used, which has in addition to the tests of the primary examination, Nature Study and Science(S), History and Literature (H) and Language Usage (L). The mental ages for grades seven to eleven were found by means of the Terman Group Tests.

In tables X. to XVIII. are presented the following items.

(1) C.A., chronological age in years and months.

(2) E.A., educational age as revealed by the age norms for the composite score of the Stanford achievement scale.

(3) M.A., mental age as in previous tables.

(4) I.Q., intelligence quotient, result of dividing the chronological age by the mental age.

(5) E.Q., educational quotient, result of dividing the educational age by the chronological age.

(6) A.Q., accomplishment quotient, result of dividing the mental age by the chronological age.

(7) The last line of each of the tables gives the medians for the respective columns.

Table I. Third Grade.

No.	M.A.	R.	A.	D.	C.S.
1		21	52	48	12
2	94	16	72	44	13
3	98	14	76	46	14
4	96	40	60	44	14
5	96	32	88	40	16
6	99	50	84	52	19
7	97	36	100	52	19
8	104	44	92	52	19
9	94	48	88	52	19
10	105	42	92	56	19
11	96	59	80	52	19
12	100	47	92	52	19
13	102	33	108	52	19
14	99	35	92	70	20
15	111	49	104	48	20
16	102	54	100	58	21
17	107	68	96	58	22
18	104	58	100	66	22
19	102	88	88	54	23
20	96	77	84	73	23
21	96	67	108	64	24
22	104	72	104	66	24
23	109	81	96	88	27
24	112	-	-	-	-
25	124	102	112	62	28
26	126	99	100	88	29
27	111	106	72	70	25
28	114	105	92	70	27

Table II. Fourth Grade

No.	M.A.	M.R.	A.	S.	H.	L.	D.	C.S.
29	104	63	104	12	6	19	80	28
30	111	57	116	0	0	0	50	22
31	112	-	-	-	-	-	-	-
32	112	73	88	15	15	10	50	25
33	114	-	-	-	-	-	-	-
34	116	84	140	10	7	3	60	22
35	118	100	120	28	13	15	74	35
36	119	126	108	38	12	21	106	41
37	120	100	152	31	0	0	74	36
38	122	93	112	18	2	14	64	30
39	122	90	136	25	12	20	70	35
40	124	130	132	37	17	21	90	43
41	127	105	136	34	15	13	88	39
42	128	119	112	36	11	23	90	39
43	130	114	128	33	10	5	86	38
44	135	95	148	28	14	7	98	39
45	135	130	132	41	12	23	126	46
46	137	114	124	40	11	13	106	41
47	144	145	132	52	11	14	104	46
48	144	121	152	28	22	6	110	43

No.	M.A.	R.	A.	S.	H.	L.	D.	C.S.
49	148	138	108	39	11	8	82	39
50	150	97	156	31	14	0	78	38
51		131	176	41	25	23	104	50
52		145	164	37	16	36	102	50
53		135	132	44	28	17	106	46
54		147	132	25	15	32	92	44
55		160	136	44	28	34	90	49
56		124	152	36	16	2	94	42

Table III. Fifth Grade.

No.	M.A.	R.	A.	S.	H.	L.	D.	C.S.
51	169	135	152	40	22	18	94	46
52	149	127	132	44	18	20	100	44
53	137	106	100	26	19	15	90	42
54	144	89	128	30	18	5	86	36
55	153	126	152	42	26	18	88	45
56	120	88	180	34	16	10	96	42
57	133	183	184	53	37	34	154	65
58	144	154	148	50	21	26	118	52
59	144	126	160	30	15	15	90	44
60	152	-	-	-	-	-	-	-
61	149	126	140	48	16	29	90	45
62	144	107	212	32	14	22	90	48
63	144	125	136	43	24	16	84	43
64	137	118	160	29	4	10	92	41
65	131							
66	120							
67	140							

Table IV. Sixth Grade.

No.	M.A.	R.	A.	S.	H.	L.	D.	C.S.
68	114	-	-	-	-	-	-	-
69	166	156	208	44	15	18	104	55
70	134	131	164	48	27	38	106	51
71	136	93	208	48	24	21	84	48
72	139	184	216	48	33	26	130	64
73	139	146	176	48	8	14	116	51
74	147	158	188	41	22	32	140	58
75	149	156	180	33	17	24	100	51
76	160	156	160	68	43	24	120	57
77	157	154	208	36	6	32	122	56
78	156	178	164	49	44	26	110	57
79	150	147	204	48	23	12	124	56
80	186	179	208	50	17	34	120	61
81	176	172	168	55	33	28	108	56
82	173	160	244	46	19	42	124	64
83	169	158	228	44	44	38	120	63
84	166	159	244	71	38	40	118	67
85	166	142	216	53	39	48	130	63
86	-	168	232	58	15	30	154	66

Table V. Seventh Grade.

No.	M.A.	R.	A.	S.	H.	L.	D.	C.S.	E.A.
111	159	200	220	68	43	48	152	73	177
117	155	185	260	49	34	46	160	73	177
177	155	184	224	71	52	46	116	69	171
178	154	157	188	33	24	47	128	58	157
179	155	181	208	71	44	40	134	68	170
180	175	191	228	59	31	26	130	67	169
181	167	187	256	65	30	32	162	73	177
182	159	153	196	54	36	38	124	60	159
183	163	157	258	73	36	32	132	69	171
184	155	178	228	49	34	35	110	63	163
185	173	193	256	70	36	44	148	75	180
186	174	214	220	64	61	48	138	75	180
187	172	194	216	62	57	39	138	71	174
188	180	187	224	73	39	34	112	67	169
189	176	208	212	73	61	46	172	77	163
190	182	222	256	56	53	42	146	76	184
191	184	223	252	75	51	42	172	82	190
192	178	210	280	72	55	42	146	81	189

Table VI. Eighth Grade.

101	183	218	248	79	68	46	190	85	195
102	181								
103	180	220	256	70	55	54	144	80	180
104	174	211	244	73	68	39	158	79	186
105	172	208	228	58	28	30	180	73	177
106	171								
107	167	228	204	68	61	50	186	80	187
108	167								
109	163								
110	158	209	204	69	66	38	154	74	178
112	158	203	156	59	48	50	162	68	170
113	159	180	228	61	37	44	168	73	177
114	158	166	248	62	28	50	150	70	172
115	157	233	152	63	59	49	140	69	171
116	153								
118	153	172	220	77	52	42	156	72	175
119	150	192	192	66	40	46	144	68	170
120	151	169	216	57	30	26	142	64	165
121	149								
122	148	128	214	63	30	24	110	57	155
123	149	192	192	64	43	35	160	69	171
124	148								
125	148	173	216	61	28	34	116	63	163
126	146								
127	137	185	184	59	26	28	160	64	165
157	149	191	184	54	37	18	144	63	163
160	157	249	248	82	73	56	172	68	199

Table VII. Ninth Grade.

No.	M.A.	R.	A.	S.	H.	L.	D.	C.S.	E.A.
128	207	267	240	83	67	58	204	92	205
129	197								
130	189	220	260	61	39	48	164	79	180
131	178	224	244	89	71	41	170	84	193
132	170	233	208	64	46	38	180	76	181
134	161								
135	143	178	192	86	64	34	176	73	177
136	150								
161	153								
162	164	217	212	77	61	44	180	79	186
163	161	220	140	80	73	40	176	73	177
164	186	252	248	84	79	56	204	92	205
165	194	267	232	79	85	50	196	91	204
166	209	276	248	82	82	50	196	93	207
193		161	136	42	33	28	142	54	151

Table VIII. Tenth Grade.

137	212	269	240	85	89	58	206	95	210
138	211	248	260	8 6	73	58	208	93	207
139	209								
140	208	270	272	89	82	54	200	97	213
141	202	250	328	81	78	54	204	100	219
142	195	258	260	80	88	45	208	94	208
145	187	240	252	91	66	44	200	90	202
146	177	232	256	77	67	42	192	67	198
148	176	251	232	65	70	52	172	84	193
149	165	200	228	50	44	46	176	75	180
150	171	201	216	75	52	54	108	80	187
151	173	212	176	61	26	42	182	70	172
152	171	2 34	256	80	53	44	206	87	198
153	170	166	236	67	31	32	258	69	171
154	173	261	116	80	91	52	206	81	189
155	188	243	212	75	74	52	166	82	190

Table IX. Eleventh Grade.

167	196	238	212	71	46	54	208	93	207
168	224	264	296	83	79	58	212	99	217
169	207	246	276	77	74	50	190	91	204
173	241	264	328	91	92	52	206	103	224
174	238	270	328	89	84	50	210	103	224
175	190	199	268	76	62	34	154	79	186
176	210	255	324	82	85	54	200	100	219
177		199	244	62	53	42	186	79	186
178		236	292	87	85	50	208	96	212
179		241	240	77	82	52	206	89	198
180		239	312	74	57	46	206	93	207

Tables I to IX, above, show mental ages and achievement scores by grades.

Table X Third Grade

Pupil	C.A.	E.A.	M.A.	I.Q.	E.Q.	A.Q.
1.	13	8-6	---	--	65	---
2.	11	8-8	7-10	71	79	111
3.	8	8-8	8-2	102	103	101
4.	10-8	8-9	8	75	82	109
5.	10-1	9-0	8	79	89	113
6.	8	9-5	8-3	103	118	114
7.	9-7	9-5	8-1	84	98	116
8.	9	9-5	8-8	96	105	109
9.	9-1	9-5	7-10	86	104	120
10.	11	9-6	8-9	80	86	109
11.	11-11	9-6	8-0	67	80	119
12.	8-11	9-6	8-4	94	107	114
13.	10	9-6	8-6	85	95	112
14.	8-8	9-7	8-3	95	111	116
15.	9	9-7	9-3	103	106	104
16.	9-9	9-9	8-6	87	100	115
17.	9-10	9-10	8-11	100	109	110
18.	9	9-10	8-8	96	109	113
19.	9-6	10	8-6	89	105	118
20.	9-1	10	8	88	110	125
21.	12	10-1	8	67	84	126
22.	7	10-1	8-8	124	144	116
23.	9-4	10-5	9-1	97	112	116
24.	9-11	---	9-4	94	--	---
25.	8	10-6	10-4	130	131	101
26.	8-5	10-7	10-6	125	122	97
27.	8-10	10-3	9-3	105	115	110
28.	8-6	10-4	9-6	112	114	102
Median	9-8	9-2	8-6	93.8	107	113.1

Table XI. Fourth Grade.

29.	11	10-1	8-8	79	92	116
30.	13	9-6	9-3	71	73	103
31.	8-½	--	9-4	103	--	--
32.	11-1	9-9	9-4	84	88	104
33.	11-5	---	9-6	83	--	--
34.	11-9	10-4	9-8	82	88	107
35.	10-0	10-8	9-10	98	106	109
36.	10-2	11-3	9-11	98	111	113
37.	12-1	10-10	10-0	83	90	108
38.	9.3	10-3	10-2	111	112	101
39.	10-3	10-8	10-2	99	104	105
40.	10-8	11-5	10-4	97	107	110
41.	11-8	11-1	10-7	91	95	103
42.	8-11	11-1	10-8	108	112	104
43.	10-1	11-1	10-10	107	110	102
44.	10-3	11-1	11-3	109	108	99
45.	10-1	11-8	11-3	112	116	104
46.	12-7	11-3	11-5	91	89	99
47.	12-9	11-8	12-0	94	92	97
48.	10-4	11-6	12-0	116	111	96
49.	9-6	10-11	12-4	130	117	90
50.	9-8	10-11	12-6	129	113	87
Median	10-1	10-11	10-4	96.9	106.9	102.9

Table XII. Fifth Grade.

51.	10-11	13-1	14-1	129	120	93
52.	10-11	11-11	12-5	114	109	96
53.	10-2	11-7	11-5	112	114	101
54.	11-3	11-8	12-0	107	104	97
55.	11-11	11-6	12-9	107	97	90
56.	9-7	11-4	10-0	104	118	113
57.	10-8	10-9	11-1	104	101	97
58.	11-7	11-7	12-0	104	100	97
59.	11-4	11-4	12-0	106	100	94
60.	12-5	13-10	12-8	101	111	109
61.	12-1	12-4	12-0	99	102	103
62.	12-2	11-6	12-0	99	95	96
63.	12-8	--	12-0	95	--	--
64.	12-8	11-7	11-5	90	91	101
65.	12-8	11-11	10-11	86	94	109
66.	11-8	11-5	10-0	86	98	114
67.	16-1	11-3	11-8	73	70	96
Median	11-8	11-7	11-10	101-9	102.5	99.1

Table XIII. Sixth Grade.

68	14.8	--	9.6	65		
69	12.10	12-9	13.10	108	99	92
70.	12-10	12-2	11-2	87	92	106
71.	16-7	11-11	11-4	68	72	105
72.	13-4	13-9	11-7	87	103	119
73.	11-7	12-2	11-7	100	105	105
74.	12-4	13-1	12-3	99	106	107
75.	13-9	12-2	12-5	90	88	98
76.	12-6	12-11	13-4	107	103	97
77.	14-1	12-10	13-1	93	91	98
78.	13-1	12-11	13-0	99	99	99
79.	11-11	12-10	12-6	105	108	103
80.	12-4	13-4	15-6	126	128	86
81.	10-7	10-10	14-8	139	102	74
82.	11-9	13-9	14-5	123	117	75
83.	11-10	13-7	14-1	119	115	96
84.	14-2	14-1	13-1	98	99	102
85.	12-1	13-7	13-1	114	112	98
86.	11-10	13-11	--	---	108	--
Median	12-6	13	13-1	100	103.3	98.8

Table XIV. Seventh Grade.

111.	14-5	14-9	13-3	91	102	111
117.	14-2	14-9	12-11	91	104	114
177.	15-7	14-3	12-11	79	91	110
178.	14-8	13-1	12-10	89	89	102
179.	14-1	14-2	12-11	86	101	110
180.	15-2	14-1	14-7	90	93	96
181.	14-3	14-9	13-11	91	104	106

No.	C.A.	E.A.	M.A.	I.Q.	E.Q.	A.Q.
182.	13-5	13-2	13-3	92	98	99
183.	13-9	14-3	13-7	92	104	105
184.	12-7	13-7	12-10	96	108	104
185.	13-4	15-0	14-5	100	113	104
186.	12-7	16.0	14-6	107	119	103
187.	12-1	14-6	14-4	110	120	101
188.	12-8	14-1	15-0	110	111	94
189.	12-3	15-3	14-8	111	124	104
190.	12-9	15-4	15-2	111	120	101
191.	12-4	15-10	15-4	115	128	103
192.	11-10	15-9	14-10	116	133	106
Median	14-2	15-9	14	95	105	104

Table XV. Eighth Grade.

101	13-1	16-3	15-3	117	124	107
102	14-9	---	15-1	104	---	---
103.	13-2	15-7	15-0	114	118	104
104.	13-5	15-6	14-6	108	116	107
105.	14-5	14-9	14-4	99	102	103
106.	13-11	---	14-3	103	---	---
107.	12-5	15-7	13-11	112	126	112
108.	12-2	---	13-11	113	---	---
109.	17-5	---	13-7	83	--	--
110.	15-7	14-10	13-2	86	95	113
112.	15-3	14-2	13-2	87	93	108
113.	13-2	14-9	13-3	96	107	111
114.	14-8	14-4	13-2	90	98	109
115.	13-1	14-3	13-1	100	109	109
116.	16-1	--	12-9	80	--	--
118.	16-0	14-7	12-9	79	91	114
119.	15-2	14-2	12-6	82	93	113
120.	14-10	13-9	12-7	85	93	109
121.	15-6	---	12-5	80	--	--
122.	15-11	12-11	12-4	78	81	105
123.	14-4	14-3	12-5	87	99	115
124.	14-10	--	12-4	83	--	--
125.	14-10	13-7	12-4	83	92	110
126.	14-2	---	12-2	86	--	--
127.	14-2	13-9	11-5	81	97	120
157.	15-0	13-7	12-5	83	91	109
160.	13-2	16-7	15-7	119	127	106
Median	14-10	14-0	13-6	89	98	109

Table XVI. Ninth Grade.

128	14-1	17-1	17-3	122	121	99
129	15-6	--	16-5	106	--	--
130	16-11	15-6	15-9	93	92	98
131	15-4	16-1	14-10	97	105	108
132	15-7	15-7	14-2	91	100	110
133	15-1	15-1	12-10	87	100	118
134	15-0	--	13-5	89	--	--

No.	C.A.	E.A.	M.A.	I.Q.	E.Q.	A.Q.
135	15-7	14-9	12-9	82	95	116
136	16-7	----	12-6	76	--	---
161	15-7	-----	12-9	82	---	---
162	15-11	15-6	13-8	86	97	113
163	16-0	14-9	13-5	87	92	110
164	15-7	17-1	15-6	100	110	109
165	15-4	17-0	16-2	106	111	105
166	13-7	17-3	17-5	129	125	100
193	16-5	12-7	---	--	--	--
Median	15-7	15-6	14-3	91	99	109

Table XVII. Tenth Grade.

137	15-11	17-6	18-8	117	110	94
138	15-3	17-3	17-7	115	113	98
139	17-1	--	17-5	103	--	--
140	15-0	17-9	17-4	108	111	103
141	15-8	18-3	16-10	107	116	108
142	17-9	17-4	16-3	92	98	107
145	17-8	16-10	15-7	83	95	108
146	18-9	16-6	14-9	82	88	112
147	16-2	--	15-7	96	--	--
148	15-3	16-1	14-8	96	105	110
149	16-0	15-0	13-9	86	94	109
150	16-7	15-7	14-3	86	94	109
151	14-10	14-4	14-5	97	97	99
152	18-3	16-6	14-3	78	86	111
153	18-3	14-3	14-2	78	78	101
154	16-0	15-9	14-5	90	98	92
155	16-0	15-10	15-8	98	99	101
Median	16-4	16-6	15-5	96	101	105

Table XVIII. Eleventh Grade.

167	17-9	17-3	16-4	92	98	105
168	17-5	18-1	18-8	107	104	92
169	18-2	17-0	17-3	95	93	98
173	18-4	18-8	20-0	109	102	93
174	17-5	18-8	19-9	113	107	94
175	18-1	15-6	15-10	88	81	98
176	17-5	18-3	17-8	101	105	103
177	18-6	15-6	--	--	85	--
178	17-7	17-8	--	--	100	--
179	17-7	16-6	--	--	94	--
180	17-6	17-3	--	--	99	--
Median	17-7	17-2	17-8	100	97	97

Tables X to XVIII, above, show chronological age, mental age, Educational, intelligence quotient, educational quotient and accomplishment, by grades.

~~Using the Results.- Figure I. gives a graphical representation of the relation of the I.Q., the E.Q. and the~~

Using the Results.- Figure I. gives a graphic representation of the relation of the I.Q., the E.Q. and the A.Q. The I.Q., solid line, represents what can reasonably be expected of the children. The E.Q., dash line, represents what they are doing in the subjects as a whole of the Stanford Achievement Tests. The A.Q., dotted line, shows what the children are doing compared with what they are capable of doing. By figure I. we see at a glance that in the lower end of the scale less is being accomplished than should be expected. The same is true with those of very high intelligence. But the great bulk of the children, those with intelligence quotients above ninety and below one hundred twenty, are doing as much or more than should reasonably be expected. It is at the two extremes that special attention is needed. The lower cases should be in special classes, where they can be given the minimum essentials, with such hand work as they will be able to do creditably. The upper cases could easily be given additional work in their present grades or extra promotions, so they will not waste their time nor form loose habits of study.

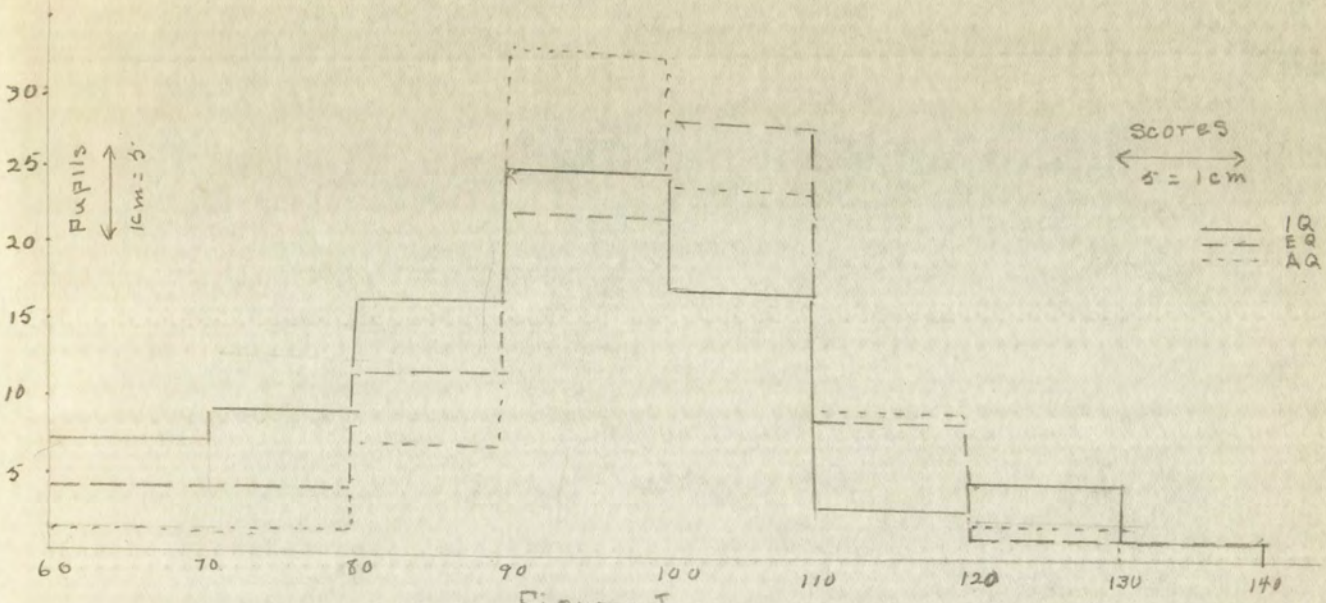

Figure I.

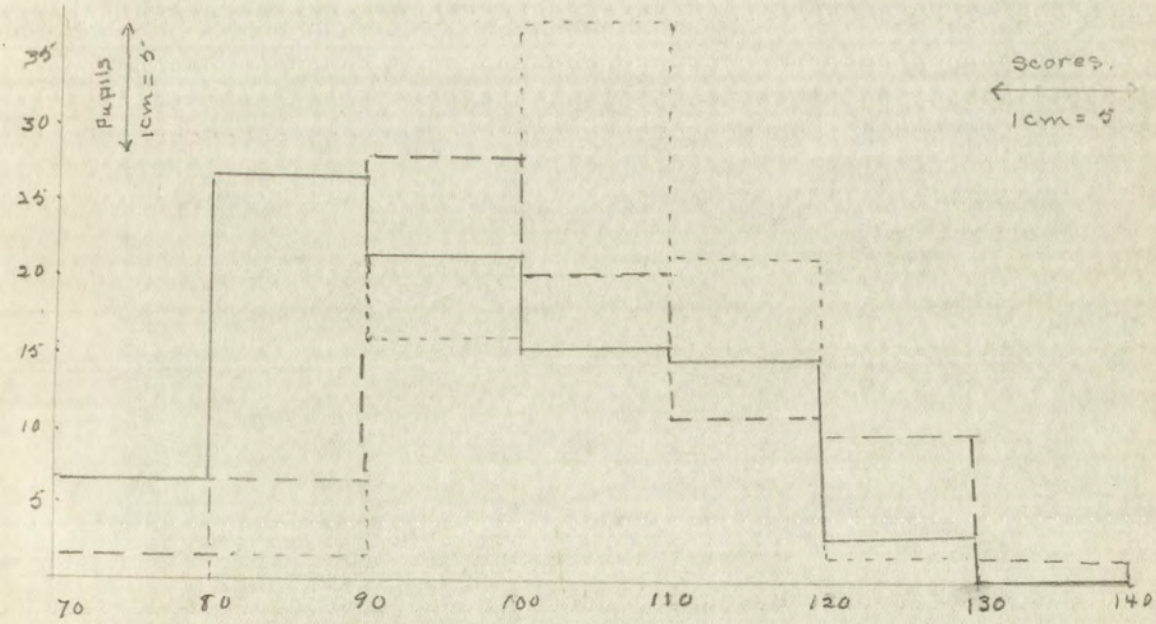

Figure II.

From figure II. which is drawn on the same scale as figure I., using data from grades 7 to 11, we again find the accomplishment quotients high for the pupils with intelligence quotients from 90 to 120. It is to be noted also that students with intelligence quotients ranging below 90 are doing very poor work. Referring to table XV. we find that fifteen of the thirty-two children, with the lower I.Q.'s are in grade 8, or first year high school. These pupils will no doubt drop out of school unless they can be given work suited to their capacities.

This is being done to an extent. Quoting from Superintendent Minatra: "Gifted pupils areadvised to take the more abstract difficult courses, such as Latin and Physics. Low grade intelligence is advised to steer around such courses, and to go strong on manual training and home economics." Each room is divided on the double track plan, into low and high intelligence groups. "Teachers are urged to differentiate in the matter of assignments, and in the amount of work required, between the two groups. In the case of each individual pupil teachers are stimulated to try to make the accomplishment quotients approximate 100."

In finding correlations the Thurstone correlation data sheets were used and the accompanying product-moment formula, with corrections, was followed exactly. The following correlations were found for the separate tests and for the total score, in the Stanford Achievement Tests, with the mental age, in the third grade.

From figure II, which is drawn on the same scale as figure I, using data from grades 7 to 12, we again find the accomplishment quotients high for the pupils with intelligence quotients from 95 to 120. It is to be noted also that students with intelligence quotients ranging below 90 are doing very poor work. Referring to table XV, we find that fifteen of the thirty-two children with the lower I.Q.'s are in grade 8, or first year high school. These pupils will no doubt drop out of school unless they can be given work suited to their capacities.

This is being done to an extent. Quoting from Superintendent Kinsler: "Gifted pupils are advised to take the more abstract difficult courses, such as Latin and Physics. Low grade intelligence is advised to steer around such courses, and to go strong on manual training and home economics." Each room is divided on the double track plan, into low and high intelligence groups. "Teachers are urged to differentiate in the matter of assignments, and in the amount of work required, between the two groups. In the case of each individual pupil teachers are stimulated to try to make the accomplishment quotients approximate 100."

In finding correlations the Thurstone correlation data sheets were used and the accompanying product-moment formula, with corrections, was followed exactly. The following correlations were found for the separate tests and for the total score, in the Stanford Achievement Tests, with the mental age, in the third grade.

For M.A. and	reading score	r=81
" " "	arithmetic	r=56
" " "	dictation	r=74
" " "		r=71

Here we find ahigh correlation between mental age and accomplishment in each of these subjects as well as between mental age and total accomplishment score.

It is convenient, in this way, to find the relatinn between mental and educational ages. Both were reduced to months, and intervals of five months were used in all cases. The coefficients of correlation as found were:-

For grades 3 and 4,	(46 cases)	r = 84
" " 5,6,and 7,	(51 ")	r = 72
" " 8 to 11 ,	(51 ")	r = 91
" " 3 to 11 ,	(148 ")	r = 92

These very high correlations between educational age and mental age indicate a decided relation between innate mental ability and what has been learned in the common school subjects. Marked correlations were found between some of the subject scores and the intelligence quotients. Monroe's Standardized Silent Reading Tests were given to fifty-two high school pupils. The resulting scores correlate with the I.Q. as follows.

I.Q. and reading rate score	36
" " comprehension "	62

As would be expected a closer relation is found to exist between intelligence and comprehension than between intelligence and reading rate.

Using Stanford Achievement Test scores the following relations were found when all scores for grades three to eleven were used.

Here we find a high correlation between mental age and accomplishment in each of the subjects as well as between mental age and total accomplishment score.

It is convenient, in this way, to find the relation between mental and educational ages. Both were reduced to months, and intervals of five months were used in all cases. The coefficients of correlation as found were:-

For grades 3 and 4, (46 cases) r = .84
" " 5,6, and 7, (51 ") r = .72
" " 8 to 11 , (51 ") r = .91
" " 3 to 11 , (146 ") r = .88

These very high correlations between educational age and mental age indicate a decided relation between innate mental ability and what has been learned in the common school subjects. Marked correlations were found between some of the subject scores and the intelligence quotients. Monroe's Standardized Silent Reading Tests were given to fifty-two high school pupils. The resulting scores correlate with the I.Q. as follows.

I.Q. and reading rate score .34
" " comprehension " .62

As would be expected a closer relation is found to exist between intelligence and comprehension than between intelligence and reading rate.

Using Stanford Achievement Test scores the following relations were found when all scores for grades three to eleven were used.

For M.A.	and	Total	Arithmetic score	r = 96
"	"	"	" Reading score	r = 87
"	"	"	" Nature Study and Science	r = 81
"	"	"	History and Literature	r = 78
"	"	"	Language Usage	r = 67
"	"	"	Dictation Exercise	r = 87
"	"	"	Composite Score	r = 92

These coefficients of correlation show in most cases a very high relation existing between accomplishment in the special subjects and mental age. Even the lowest, that of language usage, is designated by Rugg (II,10) as a high correlation.

Discussion.- If the Stanford Achievement Scale is really a measure of what a child has learned; if the Terman Group Test and the National Intelligence Tests give us intelligence quotients which indicate what children are capable of doing, then our study means something. It clearly means that there is a close relation between native intelligence and school achievement. This being true, when mental tests have been given, the school teacher and officer can know what may be expected. They can know that some children will not be able to do certain things, nor go far along some lines. They can direct the very bright child into work that will keep him busy and happy and growing.

Children of like ability may be classified so that they may work together. The brighter pupils will be discovered and will not be held back. The less bright will be given work suited to their ability and will not be discouraged with, to them, impossible tasks. The achievement tests will be used as measure of progress using duplicate forms at beginning and end of the year or semester. They

will be used to identify pupils needing special help and to reduce the range of educational ages in a given class, by demotion or by extra promotions.

Theaccomplishment quotient is useful for diagnosis. It is not only taking achievement into account but ability as well. The brighter pupil may be required to bring his achievement up to his ability, while the less gifted may be given credit for work which comes up to his capacity.

Referring to table XVIII, take the two sixth grade pupils No. 76 with an educational quotient of 103 and No. 81 with an educational quotient of 102. These two pupils have accomplished practically the same as measured by the Stanford Achievement scale. But ability considered No. 76 has done just about what he is able to do, his accomplishment quotient being 97. No. 81 who has a brilliant mind has an accomplishment quotient of 74, showing that he is putting forth little effort. Pressure should be brought to bear on the latter pupil, the former needs commendation for the effort he has put forth. Similarly teachers in each grade may find examples of pupils working at, above or below what, from their intelligence quotients, they might be judged capable of doing.

The teacher may also gauge her own work by the study of the accomplishment quotients of her room. If they go far below the 100 mark she may judge that there is something wrong with her teaching methods. The superintendent

may also apply this test to his faculty. The median accomplishment quotients, tables X to SVIII, range from 97 to 113. This indicates that the teachers in this school are securing excellent results. In fact, in some cases, the children may have been pushed too much. The extreme is shown in grade three, where every child except one has an accomplishment quotient above 100. This condition might be explained, however, by the intelligence tests giving too low a score with third grade children, who had not been accustomed to following printed directions nor to taking any kind of written tests.

Suggested Problems.- In investigating the relation between intelligence and school accomplishment, a number of other questions has arisen. Some of these are:-

1. The effect of intelligence on retardation and elimination.

2. The mental age at which elimination is greatest.

3. The mental age best adapted to the study of various subjects and phases of subjects.

4. The relation between school success and future success.

5. Advantages and disadvantages of placing the seventh grade with the high school.

6. Comparative study of eleven year and twelve year school systems.

The last question received some attention. The following table shows the results of the present study of an eleven year system compared with the standard grade norms,

may also apply this test to his family. The median accomplishment quotients, ranging from X to XVIII, range from 97 to 112. This indicates that the teachers in this school are securing excellent results. In fact, in some cases, the children may have been pushed too much. The extreme is shown in grade three, where every child scored one had an accomplishment quotient above 100. This condition might be explained, however, by the intelligence tests giving too low a score which third grade children, who had not been accustomed to following printed directions not to taking any kind of written tests.

Suggested problems.- In investigating the relation between intelligence and school accomplishment, a number of other questions have arisen. Some of these are:-

1. The effect of intelligence on retardation and elimination.

2. The social age at which elimination occurs.

3. The mental age that is limited to the study of various subjects and groups of subjects.

4. The relation between school success and family occupation.

5. Advantages and disadvantages of placing the seventh grade with the high school.

6. Comparative study of eleven year and twelve year school systems.

The last question received some attention. The following table shows the results of the present study of an eleven year system compared with the standard grade norms.

which were based on twleve year systems. Only total scores are recorded for each subject and fractions are omitted.

Table XIX.

Grade	Reading	Arithmetic	Science	History	Language	Spelling
	46	66				48
3	57	94				62
	96	109	19	6	12	72
4	113	132	31	13	15	91
5	125	142	34	19	17	97
5	124	152	39	19	18	98
	154	172	46	31	24	118
66	151	201	49	26	29	116
	175	194	58	41	29	139
7	190	231	63	43	40	140
8	199	221	67	54	35	160
	208	212	66	46	40	154
	288	226	73	61	39	172
9	229	215	75	64	44	181

Actual Grade Averages for Separate Tests.

The upper row for Each Grade gives the Standard Score, derived from Twelve Year School Systems. The lower row shows the score found in the Present Study of an eleven year System.

Judging a-priori, we would expect corresponding grades to have higher average scores in the eleven year system than in the twelve year system, since the entrance age is one year later. The data show this to be true. More extensive investigation would be enlightening.

Summary.- 1. In this small school system a close correlation exists between mental ability and achievement in school subjects.

2. This correlation is similar to that found in larger systems.

3. Intelligence tests form a basis for the prediction of school success.

4. In general the children in this school are above the standard grade norms of the Stanford achievement scale.

5. Achievement tests are of value in reclassifying pupils.

6. The accomplishment quotient is a diagnostic measure for both pupils and teachers.

Suggestions.-1. The administrative and teaching force being on the ground, with first hand knowledge and opportunity for studying the situation can best use the material herein set forth. Study and discussion in teachers' meetings will clear up many questions.

2. Special attention should be given the very bright pupils, by the room teahhers.

3. If possible a special teacher should be employed for subnormals, thus relieving the regular teacher and benefiting the bright as well as the dull pupil.

4. Effort should be made to enlighten the parents in regard to the new methods of measurement.

5. Each teacher would do well to make a thorough study of the uses of standardized tests, in summer school or elsewhere.

6. A good testing program has been launched. Following up the present lead will be necessary to insure continued benefits therefrom.

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