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A Study to Determine How Much Correlation Exists between I.Q. and Academic Success in Mathematics, Science, English, and Social Studies

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Chapter I

Introduction

Recent years have witnessed a continued examination of our educational program. Under the microscope have been placed the curricula, personnel, methods, outcomes, and cost of public education. Never before has such a public and detailed investigation taken place.

Lay groups and educators alike are continuing the observation and evaluation of the current program. New ideas, methods, and materials are being considered and older practices are looked at in a new light. This has merit, for unless it is agreed that educational methods, "know how", and organization have reached perfection, efforts toward betterment and improvement must continue.

It is into this questioning, searching, atmosphere that this study between I.Q. and its relationship to academic success in mathematics, science, English, and social studies is suggested.

The value of I.Q. as a potent factor has long been recognized in educational circles. Administrators have long utilized I.Q. differences for grouping students of similar academic ability.

This study is a scientific analysis of the actual effect that I.Q. has on academic achievement which will tend to verify the present grouping or tend to suggest changes in our grouping procedure. One hundred 7th grade students have been selected for this study who have been grouped mainly by I.Q. alone.

The test used for determining the I.Q. of each of the 100 students was the SRA Verbal Formspublished by Science Research Associates. In a write-up of the SRA Verbal Form for the Fourth Mental Measurements Yearbook,[1] Willis C. Schaefer of the Institute for Research in Human Relations, Washington, D.C. stated:

> The SRA Verbal Form is a test designed "to furnish an objective index of student intelligence" which is "sometimes called the ability to learn, to solve problems, to foresee and plan, to use initiative, to think quickly and creatively."
>
> The excellent overall appearance of both test and manual in terms of content, typography, format, and usefulness is understandable in terms of the long experience of the Thurstones in test construction and the modern publishing standards of Science Research Associates. The page of fore-exercises presents adequate instruction and practice for self-administration.
>
> Score equivalents are presented separately for each chronological age group from 12 through 17 and over. This manner of presenting extensive standardiz ation data in a relative simple format for maximum usefulness is recommended as a model for test publishers.
>
> In general the SRA Verbal Form is an excellent test, well constructed, self-administering, simple scoring, and broadly useful. Where a short form of general intelligence is desired, the test can be highly recommended for general use.

1. Oscar Krisen Buros, The Fourth Mental Measurements Yearbook p. 319

In another write-up in the Fourth Mental Measurements Yearbook,[1] E. A. Peel, Professor of Education, University of Birmingham, Birmingham, England writes: "The tests as a whole should provide a useful single predictor of secondary school potentiality, both for research work and for routine guidance."

W. D. Commins,[2] Associate Professor of Psychology, Catholic University of America, Washington, D.C. is another reviewer of the SRA Verbal Form. He is in agreement with the previous reviewers and comments:

> This test has a number of features that would recommend its use for class sectioning, personnel selection, or other survey purposes when convenience and speed are desirable. It is self-administering, has a short time limit of 15 minutes, is easy to score, and the items are clearly phrased. For many group comparisons, it would seem adequate.

The above-mentioned reviewers seem to indicate that the SRA test is a good one. Still a big question remains on whether or not intelligence can be measured accurately by any test. Another question too is whether or not the marking procedures used by teachers to determine grades or amount of achievement is reliable. The pros and cons of these problems will be taken up in the next chapter.

1. Oscar Krisen Buros, op. cit., p. 319
2. W.D. Commins, in Oscar Krisen Buros book, The Fourth Mental Measurements Yearbook, p. 320.

Chapter II

Search of the Literature

The search of the literature in this study was mostly limited to determining just what has been written about what intelligence is, whether it can be measured accurately by tests, and whether or not the marking systems in use are reliable.

The first topic investigated is intelligence and intelligence tests.

The content of the I.Q. tests comes out of the experiences children normally have. It is based upon our culture, in the broadest sense of the word. More and more experts in this field are recognizing that children whose experiences and backgrounds differ do not have equal chances for success on I.Q. tests.

In recent years a number of psychologists have concentrated on developing what were first called "culture-free tests" and are now called "culture-fair tests". The aim of these tests is to minimize the influence of culture. Since it is not possible to construct tests that are "free" of cultural influences, the objective is to make them "fair" to children with different social, economic, and educational backgrounds.

Attempts to create such tests are an indication of the growing dissatisfaction among psychologists and educators with the limitations of all the standard I.Q. tests. However, these tests have had only a limited development up to now and are not in general use. Therefore it is advisable to use the tests we have available at present.

The term I.Q. has become a part of everyday speech. Many people even call all intelligence tests "I.Q. tests." In many ways the intelligence quotient has proved to be of great practical value. However, as we have learned more about the nature of intelligence, the limitations of the I.Q. have been recognized, and the possibility of devising even more useful indices has become clear. Many psychologists feel that a single index, such as the intelligence quotient, is inadequate to reflect the varieties of mental capacities we all have. It is in this vein that a new, long, hard look has been advised as to just what is intelligence.

Frank S. Freeman[1] realizes the complexity of intelligence when he states:

> If intelligence is to be measured and assessed, it is necessary to define it, at least tentatively. A variety of definitions have been given by psychologists. One group of definitions places the emphasis upon adjustment or adaptation of the individual to

1. Frank S. Freeman, Theory and Practice of Psychological Testing, p. 68

> his total environment, or to limited aspects thereof. A second type of definition states that intelligence is the ability to learn. Still others have defined intelligence as the ability to carry on abstract thinking. It should be apparent that the three foregoing categories of definitions are not and cannot be mutually exclusive.

Because of the elusive means of defining intelligence, some people hint that maybe we should leave it undefined. George D. Stoddard[1] comments on this by saying:

> A definition of intelligence may be expressed independently of the way in which abilities are developed in the organism. It is all right if certain elements and factors lying in heredity, organic constitution, or environmental forces are recognized as crucial to mental ability. But to define intelligence as a composite of inherited factors, or as a derivative of environmental pressures, would beg the question. Some persons think it irrelevant or misleading to define intelligence; they say, "Intelligence is whatever the tests measure." This may be a good cliché now, but how could it be helpful to persons starting out to build tests? At that time a test measures nothing.

Since it seems imperative that we define intelligence, we must first agree that it is a stable trait. J. McV. Hunt[2] expresses his views on this when he relates:

> The view that intelligence is a capacity fixed once and for all by genetic inheritance has had wide currency. Although exceptions can easily be cited, most of the general textbooks written before World War II tended to present the view that the I.Q. is

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1. George D. Stoddard, The Meaning of Intelligence, p. 3.
2. J.McV. Hunt, Intelligence and Experience, p. 10.

> essentially constant because intelligence is fixed. Treatises on intelligence, moreover, appear to have been especially prone to accept this view.

Mr. Hunt[1] continues his comments by saying:

> The dissonant evidence came chiefly from three sources: (1) from the studies of identical twins reared apart, (2) from repeated testing of the same children in longitudinal studies, and (3) from studies of the effects of training.

As can be seen from the views expressed above, the unquestionable stableness of intelligence is in doubt. We, therefore, sometimes substitute the words "primary abilities" for intelligence. Edward B. Greene[2] expresses his ideas on primary abilities by quoting:

> Primary abilities are not defined as innate traits, but as traits which are primary in the sense that they are (a) statistically independent of each other; (b) psychologically basic to many types of academic and vocational success, and (c)stable over fairly long periods of time and not influenced greatly by practice or by recent formal training.

The above mentioned primary abilities are measured by I.Q. tests or by, as sometimes called, intelligence tests. The use of the "I.Q." term has been very advantageous as Lee J. Cronbach[3] agrees, when he says:

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1. Ibid, p. 19
2. Edward B. Greene, Measurements of Human Behavior, p. 122
3. Lee J. Cronbach, Essentials of Psychological Testing, p. 120

> The intelligence quotient is a convenient way of summarizing performance from the test. It is particularly helpful because mental age is constantly rising during the school years, whereas the I.Q. is more or less constant.

L. J. Bischof[1] explains to us just how the term came into being by stating:

> It was not Binet but Stern who thought up the idea of intelligence quotients - the now well-known initials I.Q. Stern reasoned that since the mental age and chronological age are equal for normal children, a ratio therefore exists. He expressed it as $\frac{MA}{CA}$, which would equal the intelligence quotient (I.Q.). Early work with this formula soon became bothersome because of the decimal point. To remove the necessity of dealing in decimals the result was multiplied by 100. Thus we now have the traditional formula, $\frac{MA}{CA} \times 100 = I.Q.$

Now that we have determined the formula for finding I.Q., the next step is to examine whether or not this I.Q. remains sufficiently stable enough to be of value. This is very important because unless it is stable, our whole study has little value. David Wechsler[2] makes some interesting points about this when he comments:

> The constancy of the I.Q. is the basic assumption of all scales where relative degrees of intelligence are defined in terms of it. It is not only basic, but absolutely necessary that I.Q.'s be independent of the age at which they are calculated, because unless the assumption holds, no permanent scheme of intelligence classification

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1. L.J. Bischof, Intelligence - Statistical Conceptions of Its Nature, p. 3.
2. David Wechsler, The Measurement of Adult Intelligence, p. 24.

> is possible. If an individual at one age attained a certain I.Q. and when examined a few years later another I.Q., or if a particular I.Q. meant one thing at one age and quite a different thing at another, the I.Q. would obviously have no practical significance. It is, therefore, highly important to ascertain whether I.Q.'s, as now calculated, do in fact remain constant.

The final very important points on intelligence and I.Q. interpretation are made by Lee J. Cronbach[1] when he states:

> . . Although we have so far assumed that an I.Q. of a given size always represents equally high standing, it is now necessary to consider two limitations to this assumption. The first is that to some extent, Stanford-Binet I.Q.'s are not comparable at different ages; the second, that I.Q.'s from different tests are not perfectly interchangeable. The most meaningful way to interpret a score is to study its relative position in the group.

The children used in this study were all given the same I.Q. test at the same time. This fact will help keep this study more meaningful and significant.

1. Lee J. Cronbach, Essentials of Psychological Testing, p. 120.

Now that we have discussed intelligence quotients and their various limitations, the other basic measure used in this study will be examined. That basic measure is marking and grading and its reliability and significance.

Assigning marks or grading, as it is sometimes called, is a very difficult and uncertain task for teachers. Thomas R. Murray[1] points this out when he says:

> In many schools there is widespread dissatisfaction with the currently-used grading and reporting methods. This dissatisfaction is experienced by both students and faculty. The students often feel that they have been misjudged. The teachers say, "I like teaching, but I hate to make out those report cards. The main trouble is that I'm never quite sure if I have been fair or accurate in marking. There are so many things to take into consideration."

C. C. Ross and Julian C. Stanley[2] say about the same thing as above when they state:

> In other words, school marks are highly subjective, the mark received often being more a function of the personality of the instructor than of the performance of the student. Further studies showed similar results elsewhere without exception. This was certainly disturbing.

The unstableness of marking systems is further entrenched in our minds by Ernest W. Tiegs[3] when he comments:

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1. Thomas R. Murray, Judging Student Progress, p. 283.
2. C.C. Ross and Julian C. Stanley, Measurement in Today's Schools, p. 39.
3. Ernest W. Tiegs, Tests and Measurements in the Improvement of Learning, p. 13.

> Since teachers regularly award marks ranging from 40 or 50 to 90 on the same examination, it follows that the question of passing depends much more upon the teacher who happens to read a paper than upon the actual achievement of objectives which it may represent. From this it follows that the passing mark is not a stable point of reference, as usually conceived, with which actual achievement can be compared, but one which moves up and down in response to other factors.

As can be seen by the above reports, grades assigned students may not be truly indicative of the students' actual achievement. Robert M. W. Travers[1] further complicates the task of giving a representative grade of pupil-achievement by stating:

> A grade system is a measuring scale, but before it can be used as such, it is necessary to know what it is measuring. At the present time, student grades are used to measure at least, three different things. The grades given by one teacher may indicate the extent to which the goals of the course have been achieved in the students. The grades given by a second teacher may indicate the relative amount of progress made by a student. The grades given by a third may indicate the relative standing of the students (grading on the curve). According to the system of the second teacher, a student who starts a course with a poor background and finishes with average proficiency may deserve a better grade than one who starts out with a good background and finishes the course with a high level of achievement. A school should determine what is to be measured by grades so that those who use the cumulative records may know how to interpret them. Most cumulative records cannot be interpreted because the grades of different teachers mean different things.

William J. Michaels and M. Ray Karnes[2] also comment on the importance of establishing a uniform system of marking by saying:

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1. Robert M. W. Travers, How to Make Achievement Tests, p. 145.
2. William J. Michaels and M. Ray Karnes, Measuring Educational Achievement, p. 415.

> The need for uniformity with reference to the types of report to be used within a given school is obvious. Equally obvious is the necessity of having all teachers in the system base marks upon the same set of factors, in so far as differences in subject-matter areas will permit. Each factor to be considered should be given the same relative value by all teachers of a given course taught in the school system. Further, until schools of the same type throughout the country adopt uniform marking policies, the school mark is likely to remain relatively low in validity. The factors considered by instructors in assigning marks are as numerous and as varied as are the types of reports in current use.

Since no universally accepted practice has yet been devised, each local school system must plan its own reporting system. This should involve the cooperation of pupils, parents, teachers, and administrators. Through cooperative effort and consideration of the principles of objectivity and specificity in determining the marking and reporting system, a procedure can be worked out which will not only make marking and reporting more meaningful, but result in better educational practices.

In every school system it is important that some definition be given for each mark to facilitate uniformity in understanding. The particular final marks used in this study, for all four subjects, came from the same school with a mutual understanding by teachers of what each mark meant.

The preceding discussions on the intelligence quotient and on the different marking practices, will now put us in a better position to evaluate the gathered data in terms of correlations

between a person's intelligence or I.Q. and his academic achievement, as shown by grades.

Chapter III

Collection of Data

The first and most logical starting point would be to gather the data from the students' permanent record cards and tabulate it. This data will consist of each student's I.Q. together with the final marks he or she received in each of the four subjects mentioned.

There will be 100 students involved in this study. The four subject areas, as previously stated in this study, are mathematics, science, English, and social studies.

These 7th grade students, who are being studied, attended a junior high country school of about 450 students. The town area in which these students reside is located about 20 miles from a medium sized upstate New York city. The population of this town area is about 6000 people.

The following charts are used to determine the correlations of I.Q. with the different subjects.

Chart I - Distribution of I.Q.s and Final Grades in Mathematics

	Marking Ranges									
I.Q.	60-63	64-67	68-71	72-75	76-79	80-83	84-87	88-91	92-95	96-99
140 - 144							1			
135 - 139						1	11	11	11	
130 - 134				1	1	1	111	11	1	
125 - 129				1				1	11	
120 - 124			1		1		11	111		
115 - 119				1	1	11	1111	111	1	
110 - 114						1	111	1111	1111	
105 - 109					1111	11	111	11111111		
100 - 104		111			11		1	11111	1	
95 - 99	1			1	1		1		11	
90 - 94							11	111	11	1
85 - 89		1						1		
80 - 84	1			1			1			

Chart II - Distribution of I.Q.s and Final Grades in Science

	Marking Ranges									
I.Q.	60-63	64-67	68-71	72-75	76-79	80-83	84-87	88-91	92-95	96-99
140 - 144								1		
135 - 139							1	1111	11	
130 - 134				1	1	11	1	111	1	
125 - 129							11	11		
120 - 124				1	1	1	11	1	1	
115 - 119				11		1111	1111	1	1	
110 - 114					11	111	111	11	11	
105 - 109			11	1	11	11111	111	1	111	
100 - 104			1	1	1111	111		111		
95 - 99				1	1	1	11	1		
90 - 94					111	1	11		11	
85 - 89				1	1					
80 - 84	1			1		1				

Chart III - Distribution of I.Q.s and Final Grades in English

	Marking Ranges									
I.Q.	60-63	64-67	68-71	72-75	76-79	80-83	84-87	88-91	92-95	96-99
140 - 144							1			
135 - 139							111	1111		
130 - 134				11	1	11	11	11		
125 - 129				1			1	11		
120 - 124						1	1111	11		
115 - 119				1	11	111	111	111		
110 - 114				1		1	1111	1111	11	
105 - 109				1111	1	11111	1	11111		
100 - 104				1111	11	11111	1			
95 - 99		1		1	1	11	1			
90 - 94					11	11	11		11	
85 - 89				1			1			
80 - 84		1		1	1					

Chart IV - Distribution of I.Q.s and Final Grades in Social Studies

Marking Ranges

I.Q.	60-63	64-67	68-71	72-75	76-79	80-83	84-87	88-91	92-95	96-99
140 - 144							1			
135 - 139							11	11	111	
130 - 134				1	1	111	1	111		
125 - 129			1				1		11	
120 - 124			1	1	1		1	11	1	
115 - 119				1	11	11111		111	1	
110 - 114					11	11111	1	1111		
105 - 109				1	11111	1111	1111	111		
100 - 104					1111	11	111	11	1	
95 - 99				11		1	1	11		
90 - 94			1		1	111	1	1	1	
85 - 89				11						
80 - 84	1			1			1			

	Marks															
I.Q.	60–63	64–67	68–71	72–75	76–79	80–83	84–87	88–91	92–95	96–99	f_y	y^1	fy^1	fy^{1^2}	Ex^1y	y^1Ex^1y
140–144							1				1	6	6	36	1	6
135–139						1	2	2	2		7	5	35	175	12	60
130–134				1	1	1	3	2	1		9	4	36	144	7	28
125–129				1				1	2		4	3	12	96	6	18
120–124			1		1		2	3			7	2	14	28	4	8
115–119				1	1	2	4	3	1		12	1	12	12	10	10
110–114						1	3	4	4		12	0	0	0	23	0
105–109					4	2	3	8			17	-1	-17	17	15	-15
100–104		3			2		1	5	1		12	-2	-24	48	0	0
95– 99	1			1	1		1		2		6	-3	-18	54	-1	3
90– 94							2	3	2	1	8	-4	-32	128	18	-72
85– 89		1						1			2	-5	-10	50	-2	10
80– 84	1			1			1				3	-6	-18	108	-6	36
fx	2	4	1	5	10	7	23	32	15	1	100		-4	836	87	92
x^1	-5	-4	-3	-2	-1	0	1	2	3	4						
fx^1	-10	-16	-3	-10	-10	0	23	64	45	4	87					
fx^{1^2}	50	64	9	20	10	0	23	128	135	16	455					
Ey^1x^1	-9	-11	2	-1	-4	9	14	-5	5	-4	-4					
x^1Ey^1x	45	44	-6	2	4	0	14	-10	15	-16	92					

Chart V – Correlation of I.Q.s with Final Grades in Mathematics

Chart V - Correlation of I.Q.s with Final Grades in Mathematics
(continued)

$$r_{xy} = \frac{N\Sigma x'y' - \Sigma x'\Sigma y'}{\sqrt{\left[N\Sigma x'^2 - (\Sigma x')^2\right]\left[N\Sigma y'^2 - (\Sigma y')^2\right]}}$$

$$r_{xy} = \frac{100 \cdot 92 - 87 \cdot (-4)}{\sqrt{\left[100 \cdot 455 - (87)^2\right]\left[100 \cdot 836 - (-4)^2\right]}}$$

$$r_{xy} = \frac{9200 + 348}{\sqrt{(45500 - 7569)(83600 - 16)}}$$

$$r_{xy} = \frac{9548}{\sqrt{37931 \cdot 83584}}$$

$$r_{xy} = \frac{9548}{\sqrt{3,170,424,704}}$$

$$r_{xy} = \frac{9548}{56,306}$$

$$r_{xy} = .16$$

	Marks															
I.Q.	60–63	64–67	68–71	72–75	76–79	80–83	84–87	88–91	92–95	96–99	f_y	y^1	fy^1	fy^{1^2}	Ex^1y	y^1Ex^1y
140–144								1			1	6	6	36	2	12
135–139							1	4	2		7	5	35	175	15	75
130–134				1	1	2	1	3	1		9	4	36	144	7	28
125–129							2	2			4	3	12	36	6	18
120–124				1	1	1	2	1	1		7	2	14	28	4	8
115–119				2		4	4	1	1		12	1	12	12	5	5
110–114					2	3	3	2	2		12	0	0	0	11	0
105–109			2	1	2	5	3	1	3		17	-1	-17	17	4	-4
100–104			1	1	4	3		3			12	-2	-24	48	-3	6
95– 99				1	1	1	2	1			6	-3	-18	54	1	-3
90– 94					3	1	2		2		8	-4	-32	128	5	-20
85– 89				1	1						2	-5	-10	50	-3	15
80– 84	1			1		1					3	-6	-18	108	-7	42
fx	1	0	3	9	15	21	20	19	12	0	100		-4	836	47	182
x^1	-5	-4	-3	-2	-1	0	1	2	3	4						
fx^1	-5	0	-9	-18	-15	0	20	38	36	0	47					
fx^{1^2}	25	0	27	36	15	0	20	76	108	0	307					
Fy^1x^1	-6	0	-4	-9	-24	-10	6	37	6	0	-4					
x^1Fy^1x	30	0	12	18	24	0	6	74	18	0	182					

Chart VI – Correlation of I.Q.s with Final Grades in Science

Chart VI - Correlation of I.Q.s with Final Grades in Science
(continued)

$$r_{xy} = \frac{N\Sigma x'y' - \Sigma x'\Sigma y'}{\sqrt{\left[N\Sigma x'^2 - (\Sigma x')^2\right]\left[N\Sigma y'^2 - (\Sigma y')^2\right]}}$$

$$r_{xy} = \frac{100 \cdot 182 - 47 \cdot (-4)}{\sqrt{\left[100 \cdot 307 - (47)^2\right]\left[100 \cdot 836 - (-4)^2\right]}}$$

$$r_{xy} = \frac{18200 + 188}{\sqrt{(30700 - 2209)(83600 - 16)}}$$

$$r_{xy} = \frac{18388}{\sqrt{28491 \cdot 83584}}$$

$$r_{xy} = \frac{18388}{\sqrt{2,381,391,744}}$$

$$r_{xy} = \frac{18388}{48799}$$

$$r_{xy} = .37$$

	Marks															
I.Q.	60-63	64-67	68-71	72-75	76-79	80-83	84-87	88-91	92-95	96-99	f_y	y^1	fy^1	fy^{1^2}	Ex^1y	y^1Ex^1y
140-144							1				1	6	6	36	1	6
135-139							3	4			7	5	35	175	11	55
130-134				2	1	2	2	2			9	4	36	144	1	4
125-129				1			1	2			4	3	12	36	3	9
120-124						1	4	2			7	2	14	28	8	16
115-119				1	2	3	3	3			12	1	12	12	5	5
110-114				1		1	4	4	2		12	0	0	0	16	0
105-109				4	1	6	1	5			17	-1	-17	17	2	-2
100-104				4	2	5	1				12	-2	-24	48	-9	18
95- 99		1		1	1	2	1				6	-3	-18	54	-6	18
90- 94					2	2	2		2		8	-4	-32	128	6	-24
85- 89				1			1				2	-5	-10	50	-1	5
80- 84		1		1	1						3	-6	-18	108	-7	42
fx	0	2	0	16	10	22	24	22	4	0	100		-4	836	30	152
x^1	-5	-4	-3	-2	-1	0	1	2	3	4						
fx^1	0	-8	0	-32	10	0	24	44	12	0	30					
fx^{1^2}	0	32	0	64	10	0	24	88	36	0	254					
Ey^1x^1	0	-9	0	-14	-16	-17	24	36	-8	0	-4					
x^1Ey^1x	0	36	0	28	16	0	24	72	-24	0	152					

Chart VII – Correlation of I.Q.s with Final Grades in English

Chart VII - Correlation of I.Q.s with Final Grades in English
(continued)

$$r_{xy} = \frac{N\Sigma x'y' - \Sigma x'\Sigma y'}{\sqrt{\left[N\Sigma x'^2 - (\Sigma x')^2\right]\left[N\Sigma y'^2 - (\Sigma y')^2\right]}}$$

$$r_{xy} = \frac{100 \cdot 152 - 30 \cdot (-4)}{\sqrt{\left[100 \cdot 254 - (30)^2\right]\left[100 \cdot 836 - (-4)^2\right]}}$$

$$r_{xy} = \frac{15200 + 120}{\sqrt{(25400 - 900)(83600 - 16)}}$$

$$r_{xy} = \frac{15320}{\sqrt{24500 \cdot 83584}}$$

$$r_{xy} = \frac{15320}{\sqrt{2,047,808,000}}$$

$$r_{xy} = \frac{15320}{45252}$$

$$r_{xy} = .33$$

	Marks															
I.Q.	60-63	64-67	68-71	72-75	76-79	80-83	84-87	88-91	92-95	96-99	f_y	y^1	fy^1	fy^{1^2}	Ex^1y	y^1Ex^1y
140-144							1				1	6	6	36	1	6
135-139							2	2	3		7	5	35	175	15	75
130-134				1	1	3	1	3			9	4	36	144	4	16
125-129			1				1		2		4	3	12	36	4	12
120-124			1	1	1		1	2	1		7	2	14	28	2	4
115-119				1	2	5		3	1		12	1	12	12	5	5
110-114					2	5	1	4			12	0	0	0	7	0
105-109				1	5	4	4	3			17	-1	-17	17	3	-3
100-104					4	2	3	2	1		12	-2	-24	48	6	-12
95- 99				2		1	1	2			6	-3	-18	54	1	-3
90- 94			1		1	3	1	1	1		8	-4	-32	128	2	-8
85- 89				2							2	-5	-10	50	-4	20
80- 84	1			1			1				3	-6	-18	108	-6	36
fx	1	0	3	9	16	23	17	22	9	0	100		-4	836	40	148
x^1	-5	-4	-3	-2	-1	0	1	2	3	4						
fx^1	-5	0	-9	-18	-16	0	17	44	27	0	40					
fx^{1^2}	25	0	27	36	16	0	17	88	81	0	290					
Ey^1x^1	-6	0	1	-16	-9	-6	2	12	18	0	-4					
x^1Ey^1x	30	0	-3	32	9	0	2	24	54	0	148					

Chart VIII - Correlation of I.Q.s with Final Grades in Social Studies

Chart VIII – Correlation of I.Q.s with Final Grades in Social Studies
(continued)

$$r_{xy} = \frac{N\Sigma x'y' - \Sigma x'\Sigma y'}{\sqrt{\left[N\Sigma x'^2 - (\Sigma x')^2\right]\left[N\Sigma y'^2 - (\Sigma y')^2\right]}}$$

$$r_{xy} = \frac{100 \cdot 148 - 40 \cdot (-4)}{\sqrt{\left[100 \cdot 290 - (40)^2\right]\left[100 \cdot 836 - (-4)^2\right]}}$$

$$r_{xy} = \frac{14800 + 160}{\sqrt{(29000 - 1600)(83600 - 16)}}$$

$$r_{xy} = \frac{14960}{\sqrt{27400 \cdot 83584}}$$

$$r_{xy} = \frac{14960}{\sqrt{2,290,201,600}}$$

$$r_{xy} = \frac{14960}{47856}$$

$$r_{xy} = .31$$

Now that the correlations coefficients have been computed, we must determine if they are significantly different from zero. Tables by R. A. Fisher and F. Yates[1] show that for 98 degrees of freedom (N - 2), a correlation of .166 or more would be significant at the 5 % level and correlations of .232 or more would be significant at the 1 % level.

When analizing the correlation coefficients, the first thing we notice is that they are all positive and rather low. This would seem to indicate that there is a positive relationship between I.Q. and the different subjects mentioned. However, since all correlations are low, it indicates that a high-rated I.Q. does not necessarily guarantee a high grade in these subjects or that a low-rated I.Q. does not necessarily guarantee a low grade in these same subjects.

All of the correlations are significant at the 1 % level except mathematics.

If these same correlations hold true in other studies of the same nature, then it would seem insignificant to group students by I.Q. alone. This would be true since such results indicate very little certainty of grade-achievement based upon a given I.Q.

By examining the correlations again we notice that Science, English, and Social Studies each correlates with I.Q. very similarly

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1. George A. Ferguson, Statistical Analysis in Psychology and Education, p. 315

while correlation of mathematics and I.Q. is about half as much as any one of the others. This could be peculiar to this study alone or it might indicate a certain trend. Further studies of this nature would shed more light on this.

Now that we have made some generalizations from the collection of data, we must determine what is behind this data and how valid it is. The following chapter on further interpretations of this collected data will touch on the above points.

Chapter IV

Further Interpretation of the Data

Teacher Viewpoint

A questionnaire was distributed to the four teachers concerned to determine if their attitude affected the marks they gave. From the results of this questionnaire the following information was gained.

All teachers considered themselves as medium markers except the social studies teacher. He stated that he was a hard marker. Even though the teachers themselves had different opinions as to how they marked, the average mark for each subject was in the mid-eighties; showing that differences in marking practices was probably insignificant.

The teachers all agreed that they had complete marking liberties and that there could be any number of A's, B's, C's, D's, and E's in a class.

The four teachers were split on the question of whether or not a student should get a good grade if his conduct and attendance were unsatisfactory. The science and social studies teachers believe that if a student knows his subject well and has a high average, his mark should be correspondingly high. The mathematics and English teachers believe that even though a student's grades

on tests are high, he should not get a good mark if his conduct were not passing. Their reason is that the mark should be based partly on citizenship because if this were not the case, the student would not be well-rounded.

Because of the above disagreement in marks to be given, it seems that some of the marks that were given to students might have been higher or lower than they should have been because of misconduct of the students. A further detailed study would have to be made to determine just how much effect this had at the different I.Q. levels. It is very interesting to note, however, that even though there was a split on this marking procedure, the average grade given by all teachers in each subject was in the mid-eighties as stated before.

All of the teachers agreed that test marks should form the major portion of a student's mark in all subjects. When questioned further the above teachers admitted that it was only on rare occasions that other factors, besides tests, altered the final mark.

Three of the teachers concerned had less than 3 years teaching experience, while the social studies teacher had 5 years. This fact did not seem to affect the study.

All of the teachers believe in homogeneously grouping students. This is how the students in this particular school are now grouped. However, as previously pointed out, this study seemed to indicate that grouping students by I.Q. alone is really insignificant.

The teachers all gave between 31 and 45 tests during the year. This helped keep the study more stable and meaningful.

All of the teachers agreed that a student should be passed even though he has failing grades, provided he has been working up to capacity and has good attendance. The main reason for this, the teachers argued, is that if a student is doing the best he can, it is not the student's fault that he has been grouped erroneously.

Students Viewpoint

A questionnaire was also sent out to the students to determine if their interests, attitudes, etc. had any effect on the grade they received. The following is a summary of the results of six of the questions in table form.

Table I - Showing the Number of People Getting Their Top Grade in a Subject and the Different Factors Affecting It

Number of People Getting Their Highest Mark in This Subject	Number of People Enjoying This Subject Most and Getting Their Highest Grade in it	Number of People Most Interested in This Subject and Getting Their Highest Grade in it	Number of People Liking This Teacher the Most and Getting Their Highest Mark in the Subject This Teacher Teaches	Number of People Who Think This Teacher is the Easiest Marker and Getting Their Highest Grade in the Subject This Teacher Teaches	Number of People Who Think This Subject is Most Important for Getting Along in Life and Getting Their Highest Grade in it
Mathematics					
36	24	22	15	23	17
Science					
18	7	11	6	8	1
English					
22	13	8	11	8	7
Social Studies					
24	10	12	5	10	3

From the preceding table we can make another table showing the actual per cent of people in the same categories.

Table II - Per Cent of People Getting Their Top Grade in a Subject and the Different Factors Affecting it

Per Cent of People Enjoying This Subject Most and Getting Their Highest Grade in it	Per Cent of People Most Interested in This Subject and Getting Their Highest Grade in it	Per Cent of People Liking This Teacher the Most and Getting Their Highest Mark in the Subject This Teacher Teaches	Per Cent of People Who Think This Teacher is the Easiest Marker and Getting Their Highest Grade in the Subject This Teacher Teaches	Per Cent of People Who Think This Subject is Most Important for Getting Along in Life and Getting Their Highest Grade in it
		Mathematics		
66 %	61 %	41 %	63 %	47 %
		Science		
38 %	61 %	33 %	44 %	5 %
		English		
59 %	36 %	50 %	36 %	31 %
		Social Studies		
41 %	50 %	20 %	41 %	12 %

Since interest and enjoyment of subject matter so very highly affected the grade obtained in a subject, it was decided to search the literature once more and determine what others had to say about it.

Readings in this area reveal that many educators share the opinion that interest is vital to the learning process and that education without interest leaves much to be desired. There is evidence also that others feel that education, to be of value, must be an unpleasant experience with the ability to persist in such a situation an indication of mental training. This controversial point of view is summarized by Lee and Lee[1] in their statement:

> The use of interest for education has been a controversy for many years. Before its introduction, educational leaders had selected subject-matter on the basis of what the child should know when he grew up. He was supposed to sit and learn this by direct effort and force of will, and the harder it was for him the better the training he received. The advocates of the use of interest believe that learning based on interest is more rapid, more efficient, and has valuable concomitants. These two viewpoints have persisted, with the doctrine of the use of interest gaining ground at an increasing rate.

Saucier[2] feels that the values of interest are not limited to creating a better learning situation and gaining improved academic results. He feels strongly that the child is aided in other ways as he indicates:

> Very important too, is the obvious relation between the pupil's attitude toward his subjects of study and all his conduct in school. A pupil who is so vitally interested

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1. Murray J. Lee and Doris May Lee, The Child and His Curriculum, p. 137
2. W. A. Saucier, Theory and Practice in the Elementary School, p. 112

> in his work that his mind is largely occupied with it is disinclined to become a behavior problem. The teacher should realize too, that whatever, the child's conduct may be in school, it indicates rather clearly what it will be outside school.

Fryer[1] feels that children's interests are most important for he concludes:

> If people show very great differences in their abilities they show even greater differences in their interests. A child grows up, it develops attitudes toward religion, politics, authority, and what not. He grows up into a conservative, a radical, a doctor, a plumber, an atheist, a Methodist, a cosmopolitan, and so on. The main difference between him and the other people is not necessarily a difference in abilities, but more often lies in another important aspect of human reaction; it is a difference of interests.

Although individual teacher abilities and outlook do influence the degree of utilizing interests toward academic success, there is indication that this is not the only reason. The lack of educational knowledge for modifying the school program to include interests may be a cause. Segal[2] decided after investigation that:

> Much has been written about adjustments of the curriculum to the varying capacities of children. As yet, however, practice lags behind the progressive thought of the day. Although this is partly due to natural intertia of human beings, it is also due to the fact that the methods of analyzing pupil abilities and interests are still imperfect and to the fact that not enough is known about adapting school curricula to discoverable abilities and interests.

Davis and Taylor[3] in their research on interest concluded that:

> The nature and extent of interest varies with the degree of intelligence. There is greater variation in the type of activity in children of high intelligence; but some prefer a

1. Douglas Fryer, The Measurement of Interests, p. 18
2. David Segal, "The Child's Capacities, Interests and Achievements", 19th Yearbook N.E.A. Dept. of Elementary School Principals.
3. Robert A. Davis and Hazel E. Taylor, "Significance of Research on Interests for the Classroom Teacher", Educational Administration and Supervision, p. 359.

type of play and certain activities involving thinking and reading.

From the preceding assessments of interests we can now better understand why it so highly affects a student's grade-achievement in a subject.

In questions 7 - 10 on the questionnaire an attempt was made to determine whether or not a student's attitude and belief about school had any relationship to his I.Q. level and thus, might possibly affect his grade-achievement.

To achieve the above result the students were divided into the top 50 % I.Q. level and the bottom 50 % I.Q. level. Then the results of the questions were tabulated in the following form.

Table III — Number and Per Cent Distribution of Student-Responses on the Questionnaire

What are your plans for the future?

Quit at 16		High School only		Further Schooling		4 year college	
Top 50%	Bottom 50%	Top 50%	Bottom 50%	Top 50%	Bottom 50%	Top 50%	Bottom 50%
0	2	6	13	17	17	26	19
0%	2%	6%	13%	17%	17%	26%	19%

What subject would you drop if you had your choice?

Mathematics		Science		English		Social Studies		Wouldn't drop any	
Top 50%	Bottom 50%	Top 50%	Bottom 50%	Top 50%	Bottom 50%	Top 50%	Bottom 50%	Top 50%	Bottom 50%
0	4	11	8	8	4	9	6	22	28
0%	4%	11%	8%	8%	4%	9%	6%	22%	28%

What is your attitude toward school?

Enjoy all		Like some parts		Don't care much		Hate it	
Top 50%	Bottom 50%	Top 50%	Bottom 50%	Top 50%	Bottom 50%	Top 50%	Bottom 50%
14	9	35	37	1	2	0	2
14%	9%	35%	37%	1%	2%	0%	2%

In what subject are you marked most unfairly?

Mathematics		Science		English		Social Studies		Marked fairly in all	
Top 50%	Bottom 50%	Top 50%	Bottom 50%	Top 50%	Bottom 50%	Top 50%	Bottom 50%	Top 50%	Bottom 50%
2	0	1	6	1	1	1	3	45	40
2%	0%	1%	6%	1%	1%	1%	3%	45%	40%

The whole numbers in this table refer to the number of students in each category while the per cent numbers refer to the per cent of students in each category.

From this table we can see that the top 50 % I.Q. level students had a greater inclination to continue their education and this almost requires them to achieve good grades. It is also noted, from the table, that fewer of the top 50 % I.Q. level students would not drop any subjects. This would seem to indicate a greater dissatisfaction with subjects at the top of the 50 % level of I.Q. One possible explanation is that the high I.Q. students are more apt to voice their disapproval of certain subjects.

A greater per cent of the top 50 % I.Q. level students enjoy all their subjects. This could help account for the higher achievement in the different subjects. The top 50 % I.Q. level students also more regularly agreed that they were marked fairly in all subjects.

The last question on the student questionnaire was used to determine whether or not the students themselves believed that an achievement-grade should reflect just test results or other factors also. Ten per cent of the top 50 % I.Q. level students agreed that an achievement-grade should be based on tests alone while 90 % disagreed. In the bottom 50 % I.Q. level, there were 14 % of the students agreeing, while 86 % disagreed. This small disagreement between the top 50 % I.Q. level students and the bottom 50 % I.Q. level students would undoubtedly have little effect, if any, on the student's grade-achievement.

Chapter V

Summary

Within the limitations of this study we can summarize what was found. Before we begin it would be proper to once more stress that the I.Q. test that was used was a good one, but like all tests of I.Q., it does not guarantee an absolute value for I.Q. that will not vary. However, for our purposes, the arrived-at I.Q. was adequate.

Another point that should be restated is the variability of the marking practices of different teachers. These marking practices were found to be rather stable among the teachers used in this study. This fact helps make the study more accurate.

The correlations arrived at would seem to bring out the idea that a person of high I.Q. would have a very slight edge on a person of low I.Q. in achieving a high grade in the different subjects. This fact alone is not sufficient to adopt grouping procedures on I.Q. alone.

The mathematics correlation, in particular, indicates a person of average I.Q. has an almost equal chance to achieve a high grade, as a person of high I.Q. ability has. Science, English, and Social Studies correlations with I.Q. seem to be strikingly similar.

Interest and enjoyment of the subject have been shown to influence achievement even more than I.Q. This fact would seem to indicate that more research should be done on these topics. Results of this research could then be applied toward the grouping of students by interest

categories or other motivational factors.

This study has also brought out the fact that may be more time should be spent on developing positive attitudes toward school on the part of low I.Q. students. The improved positive attitude might make for higher achievement.

The preceding summary stresses some of the more important points found in this study. It is hoped that the results will benefit those educators interested in bettering the educational process of developing children to their fullest ability. Only by experimenting and by research can progress be made.

Appendix A

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Appendix B

Teacher Questionnaire

We are making a study to determine the effects certain qualities and attitudes have toward high student achievement in the different subjects. The results of this questionnaire will in no way effect your standing and will only be used in a statistic type of way. Please feel free to answer the questions honestly and to the best of your ability. Thank you.

1. What subject do you teach?

_____ Mathematics _____ English

_____ Science _____ Social Studies

2. Do you consider yourself a hard, medium, or easy marker?

_____ Hard _____ Easy

_____ Medium

3. Do you agree or disagree with the assumption that in any class, regardless of how it is grouped, there should be some A's and some E's.

_____ Agree _____ Disagree

4. Do you agree or disagree with the assumption that if a student has been doing "A" work in all your tests he should get an "A" in the course, regardless of the fact that he was always late to class, had very poor attendance, annoyed you and other students in class, did practically no homework, and put a thumbtack on your seat when you weren't looking?

_____ Agree _____ Disagree

5. Do you feel that there are circumstances which dictate how you should mark or do you have complete marking liberties as to what mark you give?

_____ Circumstances dictate

_____ Complete marking liberties

6. Does your final marking consist of averaging test marks only or is it shaded by other factors?

_____ Test marks only

_____ Shaded by other factors

7. How long have you been teaching?

_____ 0 - 3 years _____ 8 - 11 years

_____ 4 - 7 years _____ over 11 years

8. Do you believe in grouping homogenously or hetergenously according to I.Q.?

_____ Homogenously _____ Hetergenously

9. About how many tests, including the final, do you give each year?

_____ 0 - 15 _____ 31 - 45

_____ 16 - 30 _____ over 45

10. Suppose a student was failing miserably in your class but did all his homework, was very understanding and polite, had near perfect attendance, tried the best he could in everything, etc; would you pass him?

_____ Yes, comment

_____ No, comment

Appendix C

Student Questionnaire

We are making a study to determine the effects certain qualities and attitudes have toward high achievement in the different subjects. Your name on this questionnaire will only be used to put you in a certain category and will in no way be made public to any other teacher except as a statistic without your name. So feel free to answer these questions honestly and to the best of your ability. Thank you.

In questions 1 - 6 list your order of preference as follows: (1) for most, (2) for next most, (3) for third most, and (4) for least.

1. List in order of preference your enjoyment of these subjects.

_____ Mathematics _____ English

_____ Science _____ Social Studies

2. List in order of preference your interest in these subjects.

_____ Mathematics _____ English

_____ Science _____ Social Studies

3. List in order of highest to lowest your final mark obtained in these subjects. (1) for highest, (2) for next highest, (3) for third highest, and (4) for lowest.

_____ Mathematics _____ English

_____ Science _____ Social Studies

4. The teacher you like the most teaches which of these subjects? List from most liked to least liked.

_____ Mathematics _____ English

_____ Science _____ Social Studies

5. The teacher who marks the easiest teaches which of these subjects? List from easiest to hardest.

_____ Mathematics _____ English

_____ Science _____ Social Studies

6. Which subject do you think is most important for getting along in life? List from most important to least.

_____ Mathematics _____ English

_____ Science _____ Social Studies

7. What are your plans for the future?

_____ I plan to quit school when I am 16 years old.

_____ I plan to graduate from high school and then get a job or go into the service.

_____ I plan to graduate from high school and then take some further schooling.

_____ I plan to go to a four-year full-time college.

8. If you had your choice of dropping one of these subjects, which one would you eliminate?

_____ Mathematics _____ English

_____ Science _____ Social Studies

_____ Wouldn't drop any

9. What is your attitude toward school?

_____ Enjoy it all very much.

_____ Like some parts of great deal and dislike others.

_____ Don't care for it too much.

_____ Hate it.

10. In your opinion, in which of these subjects are you marked most unfairly? Check off one.

_____ Mathematics _____ English

_____ Science _____ Social Studies

_____ Marked fairly in all

11. Do you agree or disagree with the idea that if you have been doing "A" work in all your tests, you should get an "A" in the course, regardless of the fact that you were always late to class, had very poor attendance, annoyed other students in class, did practically no homework, and threw spit balls in class.

_____ Agree _____ Disagree