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Prediction of Eighth-Grade Achievement at Moxee Central School Using Metropolitan Achievement Test Scores from Early Elementary Grades

J. Ted Sehmel
Central Washington University

PREDICTION OF EIGHTH-GRADE ACHIEVEMENT AT MOXEE CENTRAL SCHOOL USING METROPOLITAN ACHIEVEMENT TEST SCORES FROM EARLY ELEMENTARY GRADES

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J. Ted Sehmel

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Eldon E. Jacobsen, COMMITTEE CHAIRMAN

_____

J. Wesley Crum

_____

T. Dean Stinson

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To my wife, Betty, with all my love and devotion for her help in making our ship sail smoothly. And deep love and affection for my Dad who is still my "Skipper." And to Dr. Jacobsen for all his time which he gave so freely.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF GRAPHS

CHAPTER I

INTRODUCTION AND PURPOSE

Forecasting achievement in school has become an area of interest in education because it is one of the chief approaches to educational diagnosis. Accurate descriptive knowledge of each child is regarded as important in order to plan the most appropriate program for him. Consideration of such things as diagnosis and prediction, however, necessitates first, a general consideration of the broad educational points of view involved before specific consideration of prediction is made.

I. INTRODUCTION

Education is the process whereby the human organism (or human being) is helped to advance through various stages of development from helpless infancy to responsible and self-directed maturity.[1]

With this definition as an introduction to education many would question the use of the "helped." But ask "how, when, where" and make many other questioning approaches.

To these questions there are many proposed answers. One is to educate the gifted child by giving him all of the advantages appropriate to his own group and his own interests. This can be done by selection or grouping by placing a child in his own preferred type

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[1]Robert H. Lane, The Teacher in the Modern Elementary School (New York: Houghton Mifflin Company, 1941) , p. 356.

of environment so that he can develop at his own pace. This approach is backed by such individuals as Hildreth who states:

> The mentally gifted boys and girls deserve a special kind of schooling that is worthy of their gifts, training that will furnish incentives to develop their special capacities to the highest degree . . . an environment conducive to insightful learning and experimentation in accordance with the gifted child's mental level and rate of mental growth. The school has no more important task than to make suitable provision for the education of the intellectually elite among the nation's children.[2]

There are those who would group the slow learners together in order that each may go at a reasonably slow pace. In this way he may "get all he can" without meeting complete failure in the face of such great odds as presented to him competing with the gifted student. Saunders uses Farley to clarify the point:

> We force a child to undertake something that is impossible for him, and then we brand him as a failure on his report card, and in the eyes of his fellows because he does not achieve the impossible. If docile, he bears the ordeal the best he can; if he has more spirit he will revolt, and problems of discipline and truancy will increase. Such a revolt is a wholesome sign. It indicates that the child possesses a spark that is worth guiding and developing.[3]

Following these points of view is the general collective group or the "education for the masses" who believe that a person can not be developed as a well-rounded individual unless he is exposed to and treated as the rest of the population.

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[2]Gertrude H. Hildreth, Florence N. Brumbaugh, and Frank T. Wilson, Educating Gifted Children (New York: Harper and Brothers Publishers, 1952), p. 5.

[3]Carleton M. Saunders, Promotion or Failure for the Elementary School Pupil? (New York: Columbia University, 1941), p. 41.

As Lane has put it:

> For the first time in the history of the country, children had to be cared for in large numbers, and it was inevitable that the factory methods of big business should be reproduced in the schools. One of the early developments of this transitional period was the institution of the grade system. . . . The curriculum, previously decided upon by the school authorities, was divided into eight portions, each assigned to a grade. The children were supposed to cover or complete the subject matter assigned a given grade and be promoted, or were forced to repeat the work for the grade and so become failures or retarded children.[4]

In addition to the previous groups, there exist two others, the essentialist and the "develop-the-whole-child" or "character builder." For the essentialist, the main theory is to provide the child with all of the 3-R skills he can absorb which will then yield a "good-citizen." The "character builders" propose that besides the basic essentials the child shall be a working part of society.

Whatever may be their purposes, the different viewpoints seem to have the following things in common: (1) to determine the current achievement of the student (2) to place him in a position where best results will be obtained in order that he may accomplish the most, and (3) to give guidance to the student.

II. PURPOSE

It has been said, that "hindsight is better than foresight" and "never put off till tomorrow what you can do today." Such adages are often either brushed aside as overgeneralizations or overapplied.

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[4] Lane, op. cit., p. 362.

In this context they can be used as general frames of reference and as such might be considered imperative if anyone of the before mentioned programs expect to help the child in a guidance program. For, if a person knows where he has been but does not know where he is going, of what value, functionally, is it to know where he has been? There are many ways of determining previous achievement particularly when standardized tests have been taken such as the Metropolitan Achievement Test. As for the testing of potentials of an individual's intellect there are individual tests such as the Wechsler Intelligence Scale for Children and the Stanford-Binet Intelligence Test as well as many good group tests. For the social aspects there are many types of sociometrics and peer rating devices for present performance and with those of previous years one can obtain insight on his development socially.

If a given school has no reliable way available for predicting a person's future achievement, how is a counselor expected to have reasonably clear-cut and reliable advice available for a student? What counseling can be done with the classroom teachers about placing a student in an environment of "best suite"? How can it be suggested that certain students be watched for possible changes of student habits which might result from labeling him the "brain" or other such wordage that might reflect directly upon his future performance that will show in his eighth-grade achievement test? Crow Proposes:

> Achievement tests can be helpful in two important ways: (1) to furnish the individual himself with scores that help him appraise the progress he is making toward the achievement of his goal (2) to furnish the counselor with information relative to the amount of

knowledge the individual has in a given field of learning.[5]

It has been mentioned by some that the first three or four years of school are rather unstable for the student and therefore should be ungraded. It is suggested that the students can be grouped after this for the upper grades and junior high.[6]

Little mention is made of prediction. This is the one segment to be pursued in the present research: that of predicting "measurable success" four years after the fourth grade.

This study is an attempt to improve current methods of prediction for forecasting junior high school achievement from knowledge of elementary school performance, specifically, eighth-grade standardized test achievement from standardized test achievement in the second, third, and fourth grades.

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[5]Lester D. Crow, and Alice Crow, An Introduction to Guidance (New York: American Book Company, 1951), p. 124.

[6]Saunders, op. cit., p. 54.

CHAPTER II

DESCRIPTION OF THE STUDY SAMPLE AND INSTRUMENT USED

In order to describe the group studied in this research some detail is given concerning the location, population and community characteristics, school size, curriculum, and student characteristics. Similarly the detailed characteristics of the instrument, Metropolitan Achievement Test, is explored.

I. DESCRIPTION OF SAMPLE

Moxee High School is located in Moxee, Washington, seven miles east of Yakima. It averages two hundred and fifty students who are drawn from four general groups: (1) the hop-growing community of Moxee which in general is made up of French descendants and members of the Roman Catholic Church, (2) the Business men's group of Terrace Heights, located about five miles north of Moxee, (3) a general transient hop-workers group which is usually gone during the cold winter months, and (4) about fifteen students from neighboring high school districts.

The local students are drawn from Central School which is located two miles north of Moxee in a somewhat central location between Moxee and Terrace Heights. Central is an eight-year school with about one hundred and eighty seventh and eighth graders. These are drawn from Central's first six grades of three hundred and twenty students and Terrace Heights' six grades of two hundred and fifty students.

In the past Moxee School District's student population has been quite transient. This can be shown by the fact that only forty-seven students were continuously in attendance to take the Metropolitan Achievement Test from grades two through eight. It is shown even more so when one considers that these forty-seven had to be taken from five different years of freshman classes. This is not to imply that there were not many who have moved into the district in recent years.

There usually are more girls than boys attending high school. The students at Moxee are becoming more and more aware of the idea of attending schools of higher education. Several of the students have received scholarships to the junior college and have been selected to compete for candidacy to the U. S. Airforce Academy.

Many of the parents have taken much interest in the Parent-Teacher Association to the extent that they have developed a high school branch. To further the relationship between school and parent the meetings consist of a half-hour pre-meeting parent-teacher conference meeting. During the regular business meeting the topics consist of discussion of the curriculum in relation to the student, his requirements for graduation and prerequisites for college and other programs.

The curriculum provides for a complete four years of science, two years of Latin, four years of English, and one year of psychology. In addition to these the curriculum provides for cooking and sewing in the home economics department. In the commercial department typing, office practice and shorthand are offered. Sociology, civics, United States government and world history are offered. The boys are provided

opportunity to study mechanical drawing, woodship and machine type shop. In the music department provisions are made for band, choir, dance band and ensembles. Last, but of considerable importance is the physical education department which over and above the regular course offerings extends to the extra curricular and turns out championship quality teams and individuals in football, basketball, and track.

The student population from which the study sample was drawn has a California Test of Mental Maturity intelligence quotient that ranges from eighty-two to 129 with an average of about one hundred. The sample of forty-seven that was eventually used had an average I. Q., using the same test, of ninety-nine and a range of eighty-six to 113. The sample consisted of eighteen girls and twenty-nine boys. The selection of which is described in Chapter III, Procedure.

The students are given Metropolitan Achievement Tests each year from grade one through eight. In the ninth grade they are given the California Mental Maturity Test and one of several tests on reading and mathematical comprehension.

In brief, the sample is made of students in a farming community with a sizeable urban population. The educational program is broad covering all the sciences, music, physical education, mathematics, English, social studies and commercial courses. They are also offered Latin, psychology, sociology, several fields of home economics for girls and shop for the boys. The two hundred and fifty students are average in intelligence with an I. Q. range of eighty-two to 129. The study

of this population had an average I. Q of ninety-nine with a range from eighty-six to 113. Of this working sample eighteen were girls and twenty-nine were boys

II. DESCRIPTION OF THE INSTRUMENT

The Metropolitan Achievement Tests (MAT) have been constructed in eight grade levels running from grade one through eight. There are five series (R, S, T, U, V) or comparable tests for each grade level. Pullias writes that the contents of the test are: "drawn almost entirely from courses of study in large cities and have been checked against the contents of other such courses of study and widely used textbooks in the several subjects.[1]

The tests in the lower grades cover: vocabulary, reading comprehension, spelling, arithmetic fundamentals, arithmetic problems.[2]

In the intermediate and upper grades the tests cover the following fields: spelling, geography, history, science, English, grammar, punctuation, arithmetic problems, arithmetic fundamentals, vocabulary, and reading comprehension.[3]

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[1]E. V. Pullias, "Metropolitan Achievement Tests," In O. K. Buro's (Ed.) The Nineteen-Forty Mental Measurement Yearbook (Highland Park, N. J.: Gryphon Press, 1941), p. 27-28.

[2]Gertrude Hildreth, H. H. Bixler, and others, Metropolitan Achievement Tests, Primary Grades, Directions for Administering (Yonkers, N. Y.: World Book Company, 1946), p. 1.

[3]Richard Allen, H. H. Bixler, and others, Metropolitan Achievement Tests, Intermediate Grades, Directions for Administering (Yonkers, N. Y.: World Book Company, 1946), p. 1.

In order that the reliability may be kept at an optimum the MAT contains those qualities that make a test easier to administer and easier to take. Pullias describes this point:

> Those aspects of the Metropolitan batteries which one can evaluate on the basis of mere examination are very desirable. This is especially true of the primary batteries. The pictures, maps, and typing are all clear and attractive. Nowhere is there evidence of the crowding that frequently makes a test confusing, particularly at the lower levels.[4]

The MAT seems to have rather high reliability as has been shown by several studies. Anastasi reported:

> For each battery of the Metropolitan series subtest reliabilities were found by split-half techniques within single groups. These reliabilities ranged from .80 to .97 being about equally high at all grade levels.[5]

Stability of scores for 105 pupils tested in the second grade and again in the sixth grade was investigated by Townsend. Total scores of first and second administrations correlated .614[6].

Pullias quotes from the Teacher's manual of MAT: "The facts concerning reliability of the tests are complete and indicate a high degree of excellence at this point."[7] Burch reported:

> The reliability coefficients which vary from .87 to .95 indicate a degree of dependability that is adequate for group testing. The standard error of measurement which are usually

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[4]Pullias, loc. cit.

[5]Anne Anastasi, Psychological Testing (New York: Macmillan, 1954), p. 181.

[6]Agatha Townsend, "Some Aspects of Testing in Primary Grades," Educational Research Bulletin, 25:51-55, January, 1944.

[7]Pullias, loc. cit.

> smaller than eight standard score units indicate a stability sufficient for some individual measurement if proper caution is exercised.[8]

Showing that reliability or stability of a test to be reasonably high might lead one to believe the validity (measures what it purports to (measure) of the test to be high. These two test requirements, however, are something quite different.

Wood helps distinguish the concepts stating:

> Validity of the tests was established by selecting items from courses of study of large cities and textbooks. In as much as both sources usually lag behind best practice and not infrequently ignore the teacher's immediate and broader-than-subject-matter objectives, and in the light of the date of the sources, the validity of the tests in general may well be questioned by all save the Essentialist.[9]

As for use in actual grouping of students' ability or subject achievement rating, Wood further states:

> Because changes in the philosophy of teaching skills have been fewer than in the other areas represented, the partial batteries and the primary batteries are (to the reviewer) more valid than the complete batteries. In the typically conventional school or one not too far beyond the average, the former may serve quite well to give groups or subject ratings. Strong points of the test include: (a) provision of comparable scores between grades and subjects over an eight grade range.[10]

The present status of using MAT as a predictor or a heavy weight in deciding the placement and future of an individual is summed up

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[8]R. L. Burch, "Metropolitan Achievement Tests," In O. K. Buro's (Ed.) The Fourth Mental Measurements' Yearbook (Highland Park, N. J. : Gryphon Press, 1953), p. 514.

[9]Hugh B. Wood, "Metropolitan Achievement Test," In Buro's (Ed.) The Nineteen-Forty Mental Measurement Yearbook (Highland Park, N. J.: Gryphon Press, 1940), p. 28.

[10]Ibid.

rather well by Pullias when he points out the following:

> The Metropolitan batteries properly administered and interpreted will uncover valuable data concerning the acquisition of the skills and information covered by the tests. At the same time it is well to remember that there is no convincing evidence that these or any other available tests are sufficiently valid, reliable, and objective to warrant their being used uncritically as a basis for pupil promotion or for instructional evaluation in a particular school system.[11]

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[11]Pullias, loc. cit.

CHAPTER III

APPLICATION OF PREDICTION FORMULAS

Many procedures have been developed to show relationship between several variables and their covariables. In order that the best method may be employed, several procedures should be tried. Methods generally used are linear correlation and the multiple regression procedures. To these could be added any arithmetic and geometric schemes that could be developed.

Studies in guidance and counseling as well as other fields, can best be interpreted when the procedures employed are carefully described so that one can determine whether the results are likely to be applicable in the situation of concern to the reader. Replication of studies for verification of results also requires careful description of procedures.

I. THE STUDY SAMPLE

To study a sample that is too large and has too many variables is both awkward and unnecessary. McNemar says:

> In the absence of any obviously valid scheme for drawing the sample the only thing one can do is describe the samples as completely as possible with regards to the known characteristics of the universe in several variables which are related to the variate being studied, it is safe to assume that it is representative.[1]

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[1] Q. McNemar, "Sampling in Psychological Research," The Psychological Bulletin, 37:348, June, 1940.

To follow this principle a sample of fifteen pupils was drawn from the eighth-grade class of 1956 of the Moxee Central School. The sample was confined to those who were eligible for the problem, namely those who had taken the Metropolitan Achievement Tests (MAT) and who had them on record for the second, third, fourth, and eighth grades. All others were eliminated because they did not have all these elements available.

II. CORRELATION AND RANK APPROACHES TO PREDICTION

From this sample basic study and observations were made as to the correlation coefficients between the eighth and each elementary grade. The results were as follows:

$$r_{82} = .639$$
$$r_{83} = .401$$
$$r_{84} = .487$$

These are in general not significant relationships since an r of .482 is necessary for significance at the five per cent level of confidence and an r = .606 is required for significance at the one per cent level when using a sample of fifteen.

Not only the moderately low value of r but two other main things were obvious. First, the rank position of several individuals was at a great distance from where it was expected he should be as shown by numbers 3, 16, 26, 41, 45, and 46 in Table I. Second, the absolute value of the eighth-grade test is not completely obtainable from the given information as can be seen by numbers, 10, 9, 7, 11, and 12, on

Graph I for the second-grade scattergram nor numbers 32 and 38 on Graph II for the third grade.

Even though a correlation for a group may be substantial or even high, which it is not here, does not necessarily mean that all individuals in the group can be effectively predicted at least to the extent suggested in terms of the groups as a whole. Therefore, it would seem desirable to experiment with methods which might allow greater precision in prediction of individual performance.

III. MULTIPLE REGRESSION APPROACH

The first method tried was a multiple regression formula. To obtain a probable optimum relationship, the two highest r's were used, that is, r_{82} and r_{83}. From this data the correlation was raised from $r_{82} = .427$.

This, of course, brought slight improvement in prediction but still left much to be desired. Therefore, the idea of more variables was considered, such as adding r_{84} which equals .339. This approach at first glance may seem valuable. But as Guilford points out by the use of Thorndike's table of intercorrelations, the combining of more than two variables may not, in general, increase the correlation more than two to six points when the basic variables are moderately intercorrelated.[2]

Therefore, rather than use the laborious four variable

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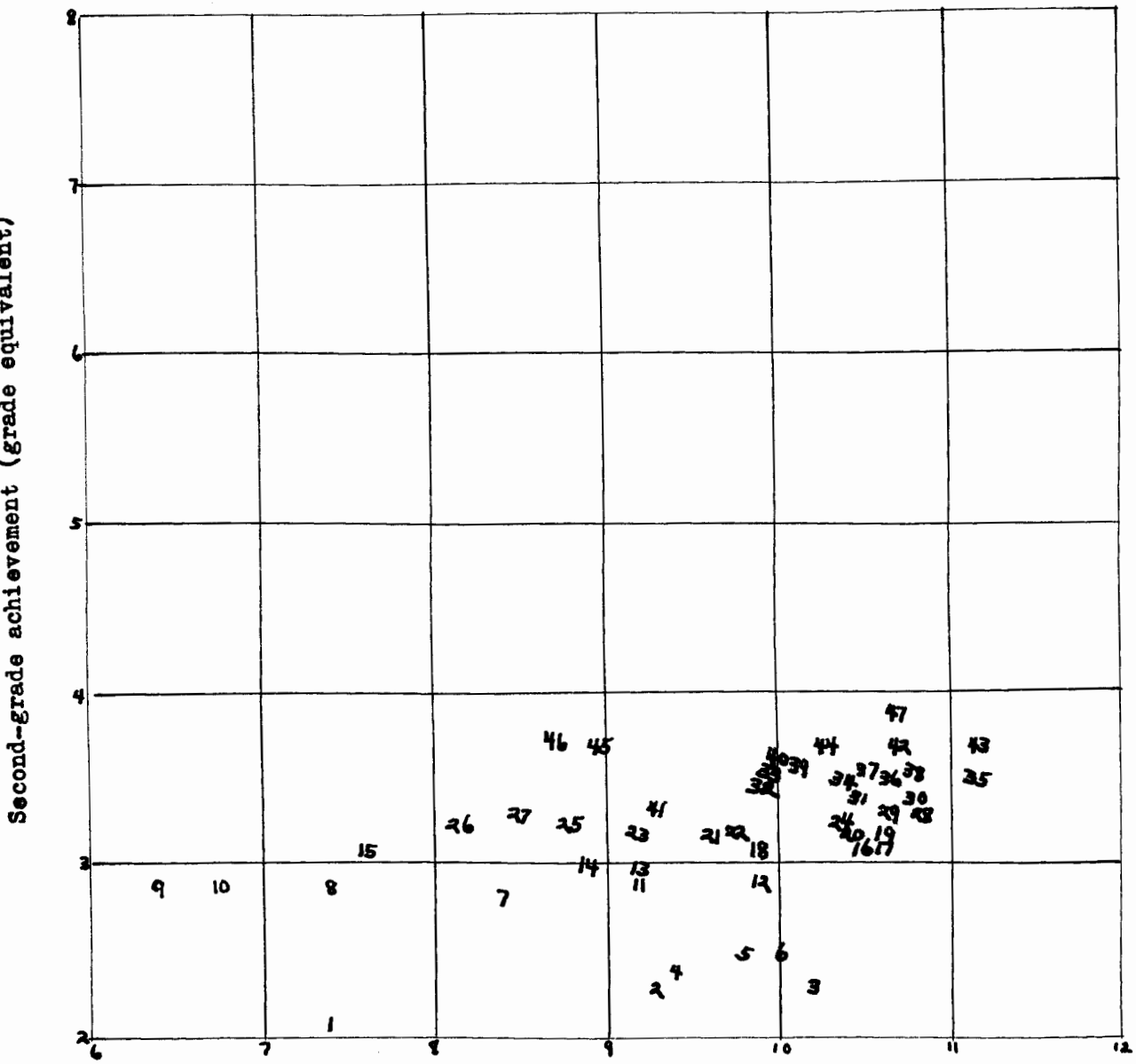
[2] J. P. Guilford, Fundamental Statistics in Psychology and Education (second edition) (New York: McGraw-Hill, 1950), p. 440.



GRAPH I

COMPARISON OF SECOND-GRADE ACHIEVEMENT
WITH EIGHTH-GRADE ACHIEVEMENT BY
PERSON NUMBER

TABLE I

RANK ORDER OF TOTAL SAMPLE OF FORTY-SEVEN STUDENTS COMPARING SECOND-GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH EIGHTH-GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

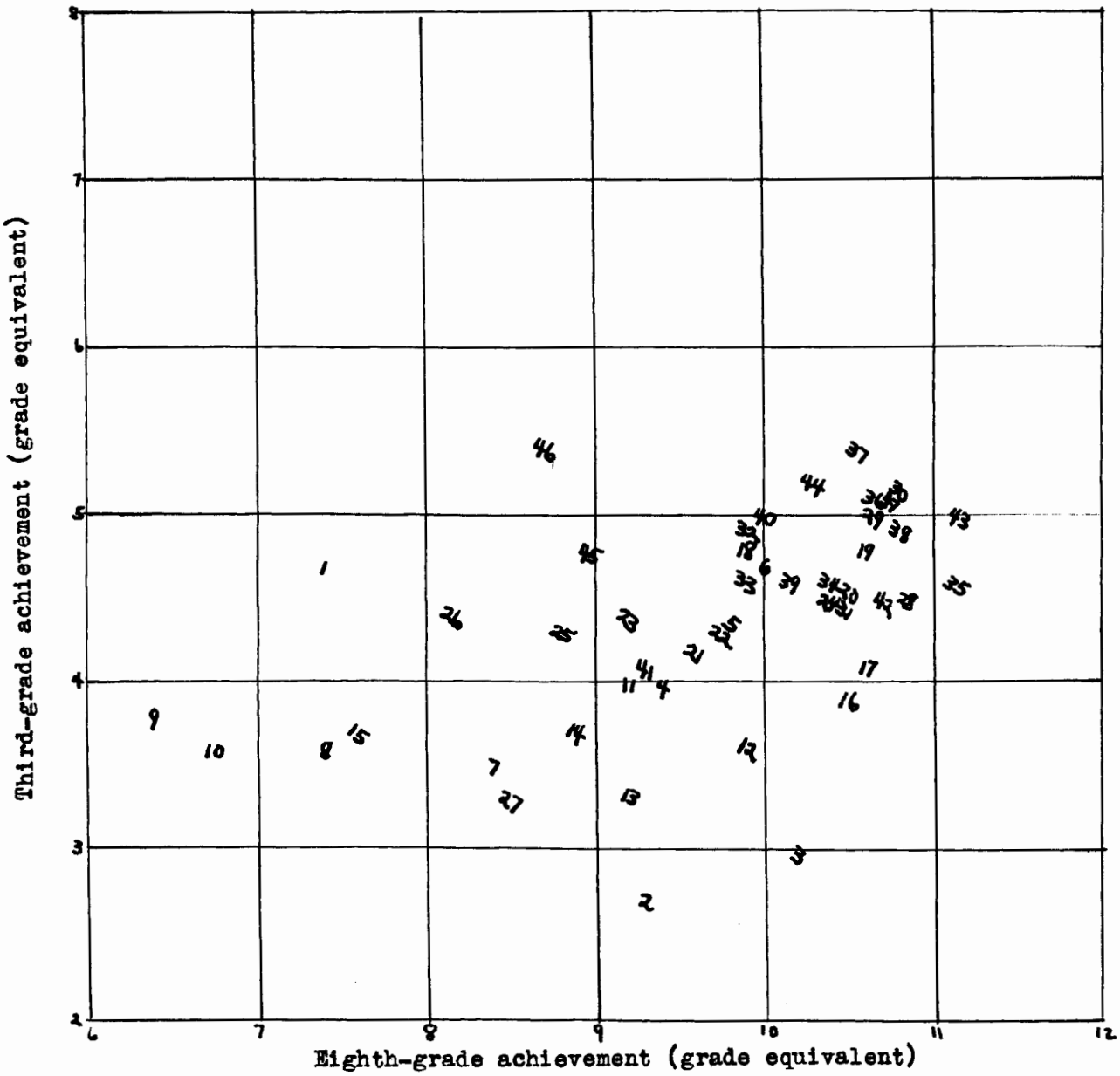
Rank order	Second-grade person	Eighth-grade person	Rank change
1	47	35	12
2	46	43	3
3	45	28	17
4	44	30	14
5	43	38	5
6	42	42	--
7	41	47	6
8	40	36	4
9	39	29	10
10	38	17	21
11	37	19	18
12	36	16	20
13	35	37	2
14	34	31	3
15	33	20	13
16	32	24	8
17	31	34	3
18	30	44	14
19	29	3	26
20	28	39	11
21	27	40	13
22	26	6	20
23	25	32	7
24	24	18	6
25	23	12	11
26	22	33	11
27	21	5	16
28	20	22	2
29	19	21	2
30	18	4	14

Range of rank order = 37 to -26
Mode I of rank change = 3, 13, 14; 4 each
Mode II of rank change = 11, 20; 3 each

TABLE I (continued)

Rank order	Second-grade person	Eighth-grade person	Rank change
31	17	41	24
32	16	2	14
33	15	23	8
34	14	13	1
35	13	11	2
36	12	45	33
37	11	14	3
38	10	25	15
39	9	46	37
40	8	27	19
41	7	7	--
42	6	26	20
43	5	15	10
44	4	8	4
45	3	1	2
46	2	10	13
47	1	9	13

Range of rank order = 37 to -26
Mode I of rank change = 3, 13, 14; 4 each
Mode II of rank change = 11, 20; 3 each



GRAPH II

COMPARISON OF THIRD-GRADE ACHIEVEMENT
WITH EIGHTH-GRADE ACHIEVEMENT BY
PERSON NUMBER

multiple regression solution it would seem best to try a different approach to the problem.

IV. INTELLIGENCE QUOTIENT APPROACH

The next approach used was the rank difference correlation between the I. Q. on the California Test of Mental Maturity and the rank position on the MAT for the eighth grade. This seemed logical since it is assumed one can accomplish more by having a higher I. Q. as Terman[3] has shown in his work and Hildreth[4] has discussed concerning Science High School of New York City. The results were promising as shown by rho = .668, but a closer view of Table II will show that the rank change runs from -28 for student number twenty-eight to 24 for student twenty-one. This brought a person with a tested I. Q. of 98, twenty-four places out of forty-five (two I. Q. not reported) to rank above a person with an I. Q. of 113.

Since only one intelligence test was given, one must be aware of the part standard error plays. One needs to be aware of the fact that the I. Q. scores are not a stable and exact number but for prediction purposes it must be assumed that the obtained score is the most highly probable (most descriptive) score. The obtained score determines the rank on the predictor from which comparison must be made with the predicted (achievement) score. Thus, because of the

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[3] L. M. Terman, Genetic Studies of Genius. Vol. I (Stanford: Stanford University Press, 1925)

[4] Hildreth, op. cit.

TABLE II

RANK ORDER OF THE TOTAL SAMPLE OF FORTY-SEVEN STUDENTS COMPARING INTELLIGENCE QUOTIENT WITH EIGHTH-GRADE MAT ACHIEVEMENT

Rank order	I. Q. person	Eighth-grade person	Rank change
1	35	35	0
2	34	43	7
3	21	28	28
4	22	30	3
5	37	38	13
6	5	42	10
7	30	47	8
8	44	36	16
9	43	29	17
10	41	17	21
11	39	37	6
12	33	31	1
13	31	20	6
14	3	24	7
15	47	34	13
16	42	44	8
17	40	3	3
18	38	39	7
19	20	40	2
20	11	6	16
21	24	32	10
22	12	18	6
23	4	12	1
24	36	33	12
25	46	5	19
26	29	22	21
27	28	21	24

I. Q. range = 86 to 113
I. Q. mean = 99.3
I. Q. median = 100
I. Q. Mode I = 102-6 each
I. Q. Mode II = 95, 103-4 each
I. Q. Mode III = 91, 98, 113-3 each

Range of rank change = 21 to -28
Mode I of rank change = 8.3 - 5 each
Mode II of rank change = 7, 13-4 each

TABLE II (continued)

Rank order	I. Q. person	Eighth-grade person	Rank change
28	18	4	5
29	23	41	19
30	17	2	13
31	32	23	2
32	27	13	8
33	15	11	13
34	8	45	3
35	26	14	3
36	6	25	7
37	45	46	12
38	14	27	6
39	1	7	6
40	13	26	5
41	10	15	8
42	9	8	8
43	2	1	4
44	25	10	3
45	7	9	3

I. Q. range = 86 to 113
I. Q. mean = 99.3
I. Q. median = 100
I. Q. Mode I = 102-6 each
I. Q. Mode II = 95, 103-4 each
I. Q. Mode III = 91, 98, 113-3 each

Range of rank change = 31 to -28
Mode I of rank change = 8,3-5 each
Mode II of rank change = 7, 13-4 each

large standard error in both the intelligence test and achievement this approach to prediction of individual performance still leaves much to be desired.

V. DEVELOPMENT OF A "NEW" FORMULA

concerning the MAT Wood states:

> Because changes in the philosophy of teaching skills have been fewer than in other areas represented the partial batteries and the primary batteries are (to the reviewer) more valid than complete batteries. In the typical conventional school or one not too far beyond the average, the former may serve quite well to give group or subject rates.[5]

With the assumption that individuals do as much learning in two different periods of time as the ratio of the lengths of these periods, a new approach was taken. That is, a rough hypothesis was formulated to begin the empirical testing, namely a person in the eighth grade will have learned four times as much as the second grader or ($4N_2$), eight-thirds as much as the third grader (N_3) and twice the fourth grader ($2N_4$). For example: if the second-grade achievement score was 3.5 then four times this (4x3.5) would equal 14.0 which is about three whole points beyond the maximum score. The third grade score of 3.2 would yield (x3.3) = 8.8 and finally two times the fourth-grade score of 4.9 would produce (2x4.9) = 9.8.

These being computed, it became noticeable that this was not entirely true. For if there were not much correlation between two

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[5]Wood, loc. cit.

grades it surely would not improve relationship to multiply the error. Then, to overcome this error of too high or too low a prediction by multiplication, the arithmetic mean was used. That is summing these multiplications then dividing by three. This gave a fourth number $\frac{4N_2 \quad N_3 \quad 2N_4}{3}$.

This brought the predicted number closer. To make further improvement, two other numbers were used in the empirical trial and error process of arriving at an improved prediction formula. First was $(2N_3 \quad N_2)$ which seemed good but not perfect. The second was two numbers rather than one, $4N_2 \quad 2N_4$. It was seen that both of these numbers were greater than the actual N_8. This was caused by the individual that obtained say 3.4 in the second grade and 5.3 in the fourth grade obtaining a 13.6 and 10.6 respectfully in the eighth. This was brought about by multiplying the small but substantial margins of .5 and .4 in the second and fourth grades. It should be noted that in terms of actual pupil performance the maximum eighth-grade score is in the low elevens. Therefore, the principle of fewer persons or subjects normally found in the third standard deviation must be considered here. This point is brought up in defense of the fact that the individuals sampled generally had high primary and intermediate-achievement scores. Since this sample was taken from a senior high group many of the lower achievers had dropped.

To offset these large numbers produced by multiplication, it was observed that the maximum number that could be experimentally subtracted from each and arrive at a near approximate equivalent was

the following: $4N_2 - 4.70$ and $2N_4 - 1.67$. Of these two results only the larger one seemed close to the desired prediction. But the decimal of either of these numbers seemed generally incorrect for the main representative prediction. Therefore, they were combined in order to determine if a central tendency might be derived. This seemed to be obtained best by dividing by five. This, when added to the integer, gives the fourth mean called Alpha ( ).

At this point there existed four individual averages which were located on opposite sides of the desired prediction point — below and above the desired answer. This again brings up the same numerical conclusion, arithmetic mean obtained by adding the four averages and dividing by four. Since the four original averages were close but on opposite sides of the desired answer it would seem their plus and minus differences should have averaged out. But they did not at all times. This is mainly due to one or two of their achievement tests that may have been extremely strong or weak, thereby having a strong influence toward one side of the mean.

To overcome this it was noticed that a constant of one must be subtracted for each fourteen that showed in the original four predictions. Then, on the other hand, the same constant of one had to be added for each value of each number that was below nine. With two further steps to be elaborated, the correlation coefficient $r_{8c} = .92$ and the rank difference correlation equaled $rho_{8c} = .97$ where c is the calculated score and 8 the actual score. These steps were: first check the calculated score with . If it was the same as then it

was left unaltered. If it was above it was lowered, and if it was below it was raised the same number as the difference between and the calculated score. This had a tendency to level the number back to the point somewhere between the two extremes of the first four years of testing. Lastly, if ($2N_3$ N_3 - = 3 then one was subtracted only if the three other numbers (, ,)than were not the same in integer value.

Having computed a set of scores for the first sample of fifteen, the correlation coefficient and the class order coefficient were determined giving r = .92 and rho = .97.

This, of course, was very high and gave grounds for continued study. The second sample was based on the same principle as the first sample but was taken from the eighth-grade classes of 1955, and also 1954, 1953, and 1952. This, it would seem, gave the formula a rather severe test. First, it set the question against the four other different classes of pupils and their different instructors. Second, it set the question against three other forms of the test battery. To this new sample of thirty-two the above method was applied. The results were: r = 862, rho = .852.

Both of these samples were very small, fifteen and thirty-two but the two things they had in common were that of very high correlation and that the individuals in the respective groups were very near their own predicted position in rank order and their predicted achievement scores were very nearly correct. Using the rank difference method the class of fifteen had five persons at = 0 and five

persons had = 1. The second group had five persons at = .00 and ten at 1.00 as observed on Table III and IV respectively.

Next, the two groups studied were combined giving a sample of forty-seven. With this combined group an r_{c8} = .865 and rho_{c8} = .882 were obtained with the rank order having two persons at = 0, four persons at = 1, ten persons at = 2, and eight persons at = 3. This showed a tendency to drop somewhat as the group got larger, but it still held that the individuals at the worst were within about one quartile of their rank differences. This gave a reasonably exact prediction of their individual scores regardless of their primary-grade scores.

VI. SUMMARY OF PREDICTION APPROACH

As was first pointed out, the assumption of a perfect sample of the population had been taken. From this sample of fifteen students correlations were run between grades 2-8, 3-8, and 4-8. It was found that there was significant correlation (r_{28} = .39, r_{38} = .40, r_{48} =.34) but that there was much room for improvement. Therefore, the two highest correlations, r_{28} and r_{38}, were used in the multiple regression formula which yielded $r_{8.23}$ = .427. Though this correlation is above the one per cent level of significance, it did not answer for all individual prediction. Neither did I. Q. nor rank difference correlation of individuals add much to the solution. And, in fact, they mislead one in the solution for certain individuals by misplacing them completely by up to three-quarters rank difference of the sample.

TABLE III

RANK ORDER OF THE ORIGINAL SAMPLE OF FIFTEEN STUDENTS COMPARING PREDICTED MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) FOR THE EIGHTH GRADE WITH THE EIGHTH-GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Rank order	Predicted person	Eighth-grade person	Rank change
1	35	35	0
2	43	43	1
3	30	28	1
4	34	30	3
5	28	42	2
6	42	24	1
7	40	34	3
8	39	44	1
9	44	39	1
10	23	40	2
11	22	22	0
12	24	23	6
13	26	25	1
14	25	26	1
15	15	15	0

Range of rank order = 6 to -3
Mode I of rank change = 1-6 each
Mode II of rank change = 0 -4
Mode III of rank change = 2, 3-2 each

TABLE IV

RANK ORDER OF THE VERIFYING SAMPLE OF THIRTY-TWO STUDENTS COMPARING PREDICTED MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) FOR THE EIGHTH GRADE WITH THE EIGHTH-GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Rank order	Eighth-grade person	Predicted person	Rank change
1	38	47	1
2	47	37	6
3	36	19	3
4	29	36	1
5	17	31	4
6	19	16	1
7	16	29	3
8	37	20	2
9	31	41	11
10	20	17	5
11	3	38	10
12	6	32	1
13	32	45	11
14	18	21	4
15	12	18	1
16	33	2	5
17	5	33	1
18	21	5	1
19	4	3	8
20	41	12	5
21	2	6	9
22	13	4	3
23	11	11	0
24	45	13	2
25	14	46	1
26	46	14	1
27	27	27	0
28	7	7	0
29	8	8	0
30	1	9	0
31	10	1	1
32	9	10	1

Range of rank change = 10 to -11
Mode I of rank change = 1 -10
Mode II of rank change = 0 -4 each
Modes III of rank change = 2,3, 5 -3 each

It was then decided to try empirically some new approaches based on the assumption that individuals do as much learning in two different periods of time as the ratio of the lengths of those two periods. These ratio products, which seemed to be approaching the solution, were averaged and a certain observed value was subtracted or added as necessary to approach the best solution.

CHAPTER IV

THE MANIPULATION OF THE NEW FORMULA

In order that one may understand the manipulation of the new formula, three samples, namely students 1, 26, and 49, have been selected to illustrate the complete manipulative procedure. The formula must be manipulated following definite steps so that the desired results may be obtained.

I. FORMULA DEFINITIONS

N_2 = the actual score for the second grade achievement test in terms of the grade equivalent.

N_3 = the actual score for the third grade achievement test in terms of the grade equivalent.

N_4 = the actual score for the fourth grade achievement test in terms of the grade equivalent.

N_8 = the actual score for the eighth grade achievement test in terms of the grade equivalent.

C_1 = the calculated score for the eighth grade based on $4\ N_2$.

C_2 = the calculated score for the eighth grade based on $2\ N_4$.

C_3 = the calculated score for the eighth grade based on N_3.

C_8 = the calculated score for the eighth grade based on the New Formula which will be demonstratively developed in this chapter.

C = current developed stage of C_8.

= the calculated score for the eighth grade based on $(C_1\ C_2\ C_3)$.

= the calculated score for the eighth grade based on N_3 which is the same as C_3 but which will have this new signature in order to distinguish location in their use.

= the calculated score for the eighth grade based on $(2N_3\ N_2)$.

= $(C_1-4.70)$.

= $(C_2-1.67)$.

= empirical derivations of constants explained in the previous section.

= the calculated score for the eighth grade based on the following: determine and , then use the integer of the greater, or . For the decimal portion combine the fractions of and which sum is then divided by five yielding the decimal fraction. Combining the calculated integer and the calculated decimal yields a number to be referred to as .

II. MANIPULATION

First, determine the values of the following parts: N_2, N_3, N_4, C_1, C_2, C_3, , which is the same as C_3, and . These values are shown for students 1, 26, and 49 as follows:

No.	N_2	N_3	N_4	C_1 ($4N_2$)	C_2 ($2N_4$)	C_3 (N_3)	(C_1 C_2 C_3)(N_3)	($2N_3$ N_2)
1.	2.1	3.16	4.7	8.40	9.4	8.43	8.742	8.43	8.42
26.	3.3	3.30	5.1	13.20	10.2	8.80	10.73	8.80	9.90
49.	3.84	5.40	6.9	15.36	13.8	14.40	14.52	14.40	14.64

Second, determine the values of and which are C_1-4.70 and C_2-1.67 respectively.

No. 1. = 8.40-4.70 = 3.70 and = 9.40-1.67 = 7.73
26. = 13.20-4.70 = 8.50 and = 10.20-1.67 = 8.53
49. = 15.36-4.70 = 10.66 and = 13.80-1.67 = 12.13

Third, determine the value for . Using the higher integer, or , the following integers would apply:

No. 1. = 7
26. = 8
49 = 12

Then, for the decimal fraction combine the decimal portions of and which is then divided by five, (empirical derivation is shown in previous section), such as the following:

No. 1.	.70	.73	= 1.43	1.43	5 = .286
26.	.50	.53	= 1.03	1.03	5 = .206
49.	.66	.13	= .79	.79	5 = .158

Combining these decimal fractions with the integers obtained from above, the following values for are obtained:

No. 1. = 7.286 No. 26. = 8.206 No. 49. = 12.158

Next, determine the value of

by substituting the proper value for the symbol as was obtained from above.

No. 1. $\frac{7.286\ 8.42\ 8.43\ 8.742}{4} - 2 = \frac{32.878}{4} - 2 = 8.2195 - 2 = 6.22$

No. 26. $\frac{8.206\ 9.9\ 8.8\ 10.73}{4} - 2 = \frac{37.636}{4} - 2 = 0.409 - 2 = 7.409$

No. 49. $\frac{12.168\ 14.64\ 14.4\ 14.52}{4} - 2 = \frac{55.718}{4} - 2 = 13.9295 - 2 = 11.9295$

Next, if any of the integers in the above formula ( ) are less than nine, (empirically derived as explained in previous section), then add one whole number to C for any and every unit of value below nine for which , , , or may fall. That is to imply that if the integer is 8 then one is added to C . If the integer is 7 the two is to be added to C . This also is to imply that all integers, , , , and , are operating simultaneously to increase the integer value of C . Therefore, if = 8.01, = 7.53, and = 5.41 then the value of C will increase one for two for , and four for , which will give a total increased value to of seven whole units. Observe this procedure on the sample problems.

No. 1. (9- = 2) (9- = 1) (9- = 1) (9- = 1) = 5

It happens that all numbers in number one were below nine, therefore the procedure is void here and the 5 does not count.

No. 26. (9- = 1) (9- = 0) (9- =1) (9- = -1) = 2 only.

α and γ were the only ones below nine in value.

No. 49. $(9-\alpha = -3)$ $(9-\beta = -5)$ $(9-\gamma = -5)$ $(9-\Delta = -5) = -18$

There were none below 9 in number in number forty-nine therefore the procedure is null in forty-nine. But observe the three fourteens in this problem, number forty-nine, namely β, γ, and Δ. One is subtracted for each of these fourteens. Therefore, a total of three is subtracted in number forty-nine. This gives a net result as follows:

No. 1. 6.22+0 = 6.22

This is because all integers of α, β, γ, Δ were under nine in value in which case this rule does not apply.

No. 26. 7.409+2 -0 = 9.409

No. 49. 11.9295+0 -3 = 8.9295

The minus three obtains because of the three fourteens. We now have a value for C_1' as follows:

No. 1. 6.22

No. 26. 9.409

No. 49. 8.9295

Following this, check the integer of α with that of C_2'.
If $\alpha - C_1'$ is negative subtract one from C_2'.
If, on the other hand, $\alpha - C_1'$ is positive, then add one to C_2'.

No. 1. $[\alpha = 7] - [C_1' = 6] = 1$ $\therefore$ $C_2' = 7.22$; (6.22+1 = 7.22)

No. 26. $[\alpha = 8] - [C_1' = 9] = -1$ $\therefore$ $C_2' = 8.409$; (9.409-1 = 8.409)

No. 49. $[\alpha = 12] - [C_1' = 8] = 4$ $\therefore$ $C_2' = 8.9295$; (8.9295+0 = 8.929)

The reason no raise was made in number forty-nine was because all numbers (α, β, γ, Δ) were twelve or above and the rule does

not apply at this range. If, on the other hand -C is neither positive nor negative then leave C at its current value unless covered by the following step: observe and integers. If then add one to the integer of C . If - does not equal three then no adding is done. Neither is there any adding because of the fact that - = 3 if = in their integer portions only. No corrections were necessary because these rules were not applicable here as can be seen by referring to the completed models of

$\frac{\quad}{4}$ -2 = C .

Therefore, the calculated value for the eighth-grade achievement as derived by the formula, and so far corrected, is as follows:

No. 1.	C = 7.22	N_8 = 7.39	C -N_8 = -.170
No. 26.	C = 8.409	N_8 = 8.50	C -N_8 = -.091
No. 49.	C = 8.9295	N_8 = 8.60	C -N_8 = .3295

This brings us to the final calculated point referred to as

Since the standard error of measurement between the predicted and the actual scores is .359 then it can be assumed that the scores will run in the following manner as far as range is concerned about sixty-eight per cent of the time.

Predicted score	Range of score 68 % of the time	Actual (obtained) score
No. 1. 7.22 .359 =	7.579 to 6.861	7.39
No. 26. 8.409 .359 =	8.768 to 8.050	8.50
No. 49. 8.9295 .359 =	9.2885 to 8.5705	8.60

This would imply that the individual's actual score then will be somewhere between the higher and lower score about sixty-eight per cent of the time and in these cases not more than about .359

grade-equivalent years off.

III. SUMMARY OF MANIPULATION

In short, the New Formula is manipulated as follows: multiply the grade-equivalent scores of the second, third, and fourth grades by such a ratio as the amount the grade level of the student would be raised to the integer 8, for example, $4N_2 = C$; $N_3 =$; and $2N_4 = C_2$. Find the average of these three values $\frac{(4N_2 \quad N_3 \quad 2N_4)}{3}$ which gives us a fourth value, Delta. For a quantity to be known as Beta add $2N_3 \; N_2$. To derive one other variable, subtract 4.70 from C $(C - 4.70)$ and 1.67 from C $(C_2 - 1.67)$ which produces two numbers. Select the larger integer of these two numbers as the integer of the variable. For the decimal fraction combine the decimal fractions of $(C - 4.70)$ and $(C_2 - 1.67)$ which is then divided by five. This combination of integer and decimal fraction is Alpha.

Next, divide the sum of Alpha, Beta, Gamma, and Delta by four then subtract two, $\frac{\qquad\qquad}{4} - 2$, which is then called C or the estimated calculation of the eighth-grade score. To C add one unit for each number of units that , , , and are below nine in value. This does not hold if , , , or are all below nine. To this value subtract one unit for each time , , , and are fourteen or above. Now compare the present C with Alpha. Change the integer value the amount and direction as in the differences in integers between C and Alpha. However, if

Beta, Gamma, and Delta are not equal and Beta minus Alpha yields three, add one to C . This produces C_8 which is the calculated score for the eighth-grade achievement test as determined by the Metropolitan Achievement Test or purportedly, any other achievement test.

CHAPTER V

SUMMARY AND CONCLUSIONS

The main purpose of this study was to determine the relationship between the grade equivalent scores of the second, third, and fourth grades of the Metropolitan Achievement Tests (MAT) and the eighth-grade scores of the same MAT test for use in predicting success in subsequent achievement tests as found on file at the Moxee High School. Achievement-tests scores are assumed to be reasonably valid indexes of at least academic achievement during school years. They are frequently found to correlate quite substantially with teachers' grades when factors other than academic accomplishment are removed.

A second purpose that developed during the study was to determine a more suitable method of predicting the eighth-grade score by use of the same tests.

I. SUMMARY

The independent variables chosen were the achievement-tests scores of the second, third, and fourth grades on the Metropolitan Achievement Tests (MAT). The dependent variable used was the eighth-grade score by the same student on the MAT. The students having taken the MAT tests for the eighth grade during the year 1956 were chosen as the study sample with students from the classes of 1952, and also, 1953, 1954, and 1955 being used as a varification group.

Form S was taken by the sample group at the end of their eighth grade. Grade-equivalent scores at the second, third, fourth, and eighth grades were obtained from the original tests kept on file in the principal's office at Moxee High School. The grade-equivalent scores were used in the computations.

The study sample group was composed of fifteen students who were selected on the basis of having had on record the MAT tests for all the grades -- two, three, four, and eight. The study group was found to be higher in achievement than the national norms due to the higher group found in high school than the general grade school group; hence, it is reasonable to state that the correlations obtained in this study are slightly attenuated due to the restrictions of the range.

Pearson product-moment correlations were computed between grades two and grade three with the value of grade eight class order correlations also computed. For the original sample of fifteen, the class rank order coefficients were rho 28 = .568, rho .557, and rho .614.

For the verifying sample of thirty-two the class rank order coefficients were: rho_{28} .643, rho_{38} .582, and rho_{48} .779. A multiple regression coefficient was computed for the eighth grade based on the correlation coefficients of the second and third grades which yielded $r_{8.23}$ .427. This was for the total population of forty-seven which was the binding of the sample and verifying group. The following r's were found for this total group: r_{28} .394,

r_{38} .401, and r_{48} .339.

This left room for improvement since individual persons could be tied down neither to reasonably exact class rank order nor to achievement score. Therefore, a formula was empirically developed which produced on the original sample of fifteen an r_{c8} .926 and rho_{c8} .978. The verifying sample of thirty-two yielded r_{c8} .864 and rho_{c8} .852.

The combining of the sample and verifying groups, a sample of forty-seven yielded r_{8c} .865, and rho_{8c} .882.

These are all well above the 1 per cent level of confidence and of such high magnitude as to suggest their important value for individual and group prediction if the formula holds in replications of this study.

II. CONCLUSION

At Moxee Central School the achievement scores for the primary and lower intermediate grades are fair predictors of eighth-grade achievement, but for individual prediction the class rank order and the exact achievement score cannot be predicted with much confidence especially when the future of the individual is at stake. However, the formula developed in this thesis seems to be more capable of predicting the class rank order at its poorest, the limits of one quartile and the achievement score with the greatest error within twelve months and with a standard error of measurement of .347 years.

Group predictions could feasibly be made if caution were used.

Individual prediction should not be attempted until a greater verification of this procedure has been made since the sample of forty-seven is rather small.

The study points to a need for further correlation studies at schools other than the one studied and in other locations to determine if the formula can stand up under varied conditions. It is under such varied conditions that the formula must be tested in order that it can be confidently relied upon for the prediction of placement for an individual.

This formula should also be applied to other achievement tests than MAT to determine if it has broader application.

If this is to be used, its best results can probably be obtained when tied in with the mathematics and guidance departments of the high school which can be used to manipulate the mathematical procedures. Only when a counselor can confidently predict an individual's success in later grades can he have a long range value to the student in the need of guidance and special instruction.

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APPENDIX

TABLE V

RANK ORDER OF ORIGINAL SAMPLE OF FIFTEEN STUDENTS COMPARING SECOND GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH EIGHTH-GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Second-grade person	Eighth-grade person	Rank change
1	44	35	5
2	43	43	0
3	42	28	6
4	40	30	4
5	39	42	2
6	35	24	6
7	34	34	0
8	30	44	7
9	28	39	4
10	26	40	6
11	25	22	3
12	24	23	1
13	23	25	2
14	22	26	4
15	15	15	0

Range of rank order change = 6 to -7
Mode I of rank order change = 0, 4, 6 -3 each
Mode II of rank order change = 2 -2 each

TABLE VI

RANK ORDER OF THE VERIFYING SAMPLE OF THIRTY-TWO STUDENTS COMPARING SECOND GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH EIGHTH-GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Second-grade person	Eighth-grade person	Rank change
1	47	38	4
2	46	47	1
3	45	36	4
4	41	29	7
5	38	17	12
6	37	19	9
7	36	16	9
8	33	37	2
9	32	31	1
10	31	20	4
11	29	3	19
12	27	6	15
13	21	32	4
14	20	18	4
15	19	12	3
16	18	33	8
17	17	5	11
18	16	21	5
19	14	4	10
20	13	41	16
21	12	2	10
22	11	13	2
23	10	11	1
24	9	45	21
25	8	14	6
26	7	46	24
27	6	27	15
28	5	7	2
29	4	8	4
30	3	1	2
31	2	10	8
32	1	9	8

Range of rank order change = 19 to -24
Mode I of rank order change = 4-6 each
Mode II of rank order change = 2-4 each
Mode III of rank order change = 1, 8-3 each
Mode IV of rank order change = 9, 15-2 each

TABLE VII

RANK ORDER OF THE TOTAL SAMPLE OF FORTY-SEVEN STUDENTS COMPARING SECOND-GRADE MAT ACHIEVEMENT (GRADE EQUIVALENT SCORE) WITH EIGHTH-GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Second-grade person	Eighth-grade person	Rank change
1	47	35	12
2	46	43	3
3	45	28	17
4	44	30	14
5	43	38	5
6	42	42	0
7	41	47	6
8	40	36	4
9	39	29	10
10	38	17	21
11	37	19	18
12	36	16	20
13	35	37	2
14	34	31	3
15	33	20	13
16	32	24	8
17	31	34	3
18	30	44	14
19	29	3	26
20	28	39	11
21	27	40	13
22	26	6	20
23	25	32	7
24	24	18	6
25	23	12	11
26	22	33	11
27	21	5	16
28	20	22	2
29	19	21	2
30	18	4	14

Range of rank order = 37 to -26
Mode I of rank change = 3, 13, 14-4 each
Mode II of rank change = 11, 20-3 each

TABLE VII (continued)

Order of rank	Second-grade person	Eighth-grade person	Rank change
31	17	41	24
32	16	2	14
33	15	23	8
34	14	13	1
35	13	11	2
36	12	45	33
37	11	14	3
38	10	25	15
39	9	46	37
40	8	27	19
41	7	7	0
42	6	26	20
43	5	15	10
44	4	8	4
45	3	1	2
46	2	10	13
47	1	9	13

Range of rank order = 37 to -26
Mode I of rank change = 3 13, 14-4 each
Mode II of rank change = 11, 20-3 each

TABLE VIII

RANK ORDER OF THE ORIGINAL SAMPLE OF FIFTEEN STUDENTS COMPARING THIRD GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Third-grade person	Eighth-grade person	Rank change
1	44	35	5
2	30	43	1
3	43	28	6
4	40	30	2
5	39	42	3
6	35	24	4
7	34	34	0
8	42	44	4
9	28	39	4
10	24	40	6
11	26	22	3
12	23	23	0
13	25	25	0
14	22	26	3
15	15	15	0

Rank change range = 6 to -6
Mode I = 0-4 each
Mode II = 3, 4-3 each
Mode III = 6-2 each

TABLE IX

RANK ORDER OF THE VERIFYING SAMPLE OF THIRTY-TWO STUDENTS COMPARING THIRD GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Third-grade person	Eighth-grade person	Rank change
1	46	38	5
2	37	47	1
3	47	36	1
4	36	29	1
5	29	17	13
6	38	19	3
7	32	16	14
8	45	37	6
9	19	31	5
10	18	20	3
11	6	3	20
12	33	6	1
13	20	32	6
14	31	18	4
15	5	12	9
16	21	33	4
17	41	5	2
18	17	21	2
19	11	4	1
20	4	41	3
21	16	2	11
22	9	13	6
23	14	11	4
24	12	45	16
25	10	14	2
26	7	46	20
27	8	27	2
28	13	7	2
29	27	8	2
30	1	1	0
31	3	10	6
32	2	9	10

Rank change range = 20 to -20
Mode I = 2-6 each
Mode II = 1-5 each
Mode III = 6-4 each
Mode IV = 3, 4-3 each

TABLE X

RANK ORDER OF THE TOTAL SAMPLE OF FORTY-SEVEN STUDENTS COMPARING THIRD GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Third-grade person	Eighth-grade person	Rank change
1	46	35	16
2	37	43	5
3	44	28	20
4	47	30	2
5	36	38	5
6	30	42	15
7	43	47	3
8	40	36	3
9	29	29	0
10	38	17	22
11	32	19	2
12	45	16	23
13	19	37	11
14	18	31	8
15	6	20	5
16	39	24	8
17	35	34	1
18	34	44	15
19	33	3	26
20	20	39	4
21	42	40	13
22	31	6	7
23	28	32	12
24	24	18	10
25	26	12	14
26	23	33	7
27	5	5	0
28	25	22	1
29	22	21	1

Rank change range = 38 to -26
Mode I of rank change = 0-5 each
Mode II of rank change = 1, 2-4 each
Mode III of rank change = 5, 7, 15-3 each
Mode IV of rank change = 3, 6, 8, 10, 11, 16-2 each

TABLE X (continued)

Order of rank	Third-grade person	Eighth-grade person	Rank change
30	21	4	4
31	41	41	0
32	17	2	15
33	11	23	7
34	4	13	9
35	16	11	2
36	9	45	24
37	15	14	1
38	14	25	10
39	12	46	38
40	10	27	4
41	7	7	0
42	8	26	16
43	13	15	6
44	27	8	2
45	1	1	0
46	3	10	6
47	2	9	11

Rank change range = 38 to -26
Mode I of rank change = 0-5 each
Mode II of rank change = 1, 2-4 each
Mode III of rank change = 5, 7, 15-3 each
Mode IV of rank change = 3, 6, 8, 10, 11, 16-2 each

TABLE XI

RANK ORDER OF THE ORIGINAL SAMPLE OF FIFTEEN STUDENTS COMPARING FOURTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Fourth-grade person	Eighth-grade person	Rank change
1	39	35	5
2	44	43	2
3	34	28	5
4	43	30	1
5	30	42	5
6	35	24	3
7	40	34	4
8	28	44	6
9	24	39	8
10	42	40	3
11	22	22	0
12	23	23	0
13	26	25	1
14	25	26	1
15	15	15	0

Range of rank order change = 5 to -8
Mode I of rank order change = 0, 1, 5-3 each
Mode II of rank order change = 3-2 each

TABLE XII

RANK ORDER OF THE VERIFYING SAMPLE OF THIRTY-TWO STUDENTS COMPARING FOURTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Fourth-grade person	Eighth-grade person	Rank change
1	46	38	9
2	47	47	0
3	29	36	2
4	37	29	1
5	36	17	3
6	2	19	11
7	32	16	10
8	17	37	4
9	21	31	2
10	38	20	2
11	31	3	14
12	20	6	3
13	18	32	6
14	45	18	1
15	6	12	12
16	41	33	4
17	16	5	4
18	4	21	9
19	19	4	1
20	33	41	4
21	5	2	15
22	27	13	4
23	14	11	1
24	11	45	10
25	3	14	2
26	13	46	25
27	12	27	5
28	7	7	0
29	1	8	2
30	9	1	1
31	8	10	1
32	10	9	2

Range of rank order change = 14 to -15
Mode I of rank change = 1, 2-6 each
Mode II of rank change = 4-4 each
Mode III of rank change = 3-2 each

TABLE XIII

RANK ORDER OF THE TOTAL SAMPLE OF FORTY-SEVEN STUDENTS COMPARING FOURTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Fourth-grade person	Eighth-grade person	Rank change
1	46	35	14
2	47	43	5
3	39	28	18
4	44	30	6
5	29	38	12
6	34	42	19
7	43	47	5
8	37	36	1
9	36	29	4
10	30	17	3
11	2	19	19
12	32	16	16
13	17	37	5
14	21	31	4
15	35	20	4
16	40	24	7
17	38	34	11
18	31	44	14
19	20	3	19
20	18	39	17
21	28	40	5
22	45	6	2
23	24	32	11
24	6	18	4
25	42	12	16
26	41	33	5
27	22	5	5
28	16	22	1

Range of rank order change = 19 to -38
Mode I of rank order change = 1-8 each
Mode II of rank order change = 2, 5-6 each
Mode III of rank order change = 6-5 each
Mode IV of rank order change = 4, 14, 19-3 each
Mode V of rank order change = 11, 16-2 each

TABLE XIII (continued)

Order of rank	Fourth-grade person	Eighth-grade person	Rank change
29	4	21	15
30	19	4	1
31	33	41	5
32	23	2	21
33	5	23	1
34	27	13	6
35	14	11	2
36	26	45	14
37	11	14	2
38	3	25	1
39	25	46	38
40	13	27	6
41	12	7	1
42	7	26	6
43	1	15	1
44	15	8	2
45	9	1	2
46	8	10	1
47	10	9	2

Range of rank order change = 19 to -38
Mode I of rank order change = 1-8 each
Mode II of rank order change = 2, 5-6 each
Mode III of rank order change = 6-5 each
Mode IV of rank order change = 4, 14, 19-3 each
Mode V of rank order change = 11, 16-2 each

TABLE XIV

RANK ORDER OF ORIGINAL SAMPLE OF FIFTEEN STUDENTS COMPARING SECOND GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORES) WITH THIRD GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORES)

Order of rank	Second-grade person	Third-grade person	Rank change
1	44	44	0
2	43	30	6
3	42	43	1
4	40	40	0
5	39	39	0
6	35	35	0
7	34	34	0
8	30	42	5
9	28	28	0
10	26	24	2
11	25	26	1
12	24	23	1
13	23	25	2
14	22	22	0
15	15	15	0

Range of rank order change = 6 to -5
Mode I of rank order change = 0-8 each
Mode II of rank order change = 1-3 each
Mode III of rank order change = 2-2 each

TABLE XV

RANK ORDER OF THE VERIFYING SAMPLE OF THIRTY-TWO STUDENTS COMPARING SECOND GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORES) WITH THIRD GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORES)

Order of rank	Second-grade person	Third-grade person	Rank change
1	47	46	1
2	46	37	4
3	45	47	2
4	41	36	3
5	38	29	6
6	37	38	1
7	36	32	2
8	33	45	5
9	32	19	6
10	31	18	6
11	29	6	16
12	27	33	4
13	21	20	1
14	20	31	4
15	19	5	13
16	18	21	3
17	17	41	13
18	16	17	1
19	14	11	3
20	13	4	9
21	12	16	3
22	11	9	2
23	10	14	4
24	9	12	3
25	8	10	2
26	7	7	0
27	6	8	2
28	5	13	8
29	4	27	17
30	3	1	2
31	2	3	1
32	1	2	1

Range of rank order change = 16 to -17
Mode I of rank order change = 1, 2-6 each
Mode II of rank order change = 3-5 each
Mode III of rank order change = 4-4 each
Mode IV of rank order change = 6-3 each

TABLE XVI

RANK ORDER OF THE TOTAL SAMPLE OF FORTY-SEVEN STUDENTS COMPARING SECOND GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORES) WITH THIRD GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORES)

Order of rank	Second-grade person	Third-grade person	Rank change
1	47	46	1
2	46	37	9
3	45	44	1
4	44	47	3
5	43	36	7
6	42	30	12
7	41	43	2
8	40	40	0
9	39	29	10
10	38	38	0
11	37	32	5
12	36	45	9
13	35	19	16
14	34	18	16
15	33	6	27
16	32	39	7
17	31	35	4
18	30	34	4
19	29	33	4
20	28	20	8
21	27	42	15
22	26	31	5
23	25	28	3
24	24	24	0
25	23	26	3
26	22	23	1
27	21	5	16
28	20	25	5

Range of rank order change = 27 to -24
Mode I of rank order change = 3-8 each
Mode II of rank order change = 1, 4-6 each
Mode III of rank order change = 0, 2-4 each
Mode IV of rank order change = 5, 16-3 each

TABLE XVI (continued)

Order of rank	Second-grade person	Third-grade person	Rank change
29	19	22	3
30	18	21	3
31	17	41	24
32	16	17	1
33	15	11	4
34	14	4	10
35	13	16	3
36	12	9	3
37	11	15	4
38	10	14	4
39	9	12	3
40	8	10	2
41	7	7	0
42	6	8	2
43	5	13	8
44	4	27	23
45	3	1	2
46	2	3	1
47	1	2	1

Range of rank order change = 27 to -24
Mode I of rank order change = 3-8 each
Mode II of rank order change = 1, 4-6 each
Mode III of rank order change = 0, 2-4 each
Mode IV of rank order change = 5, 16-3 each

TABLE XVII

RANK ORDER OF THE ORIGINAL SAMPLE OF FIFTEEN STUDENTS COMPARING THIRD GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH FOURTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Third-grade person	Fourth-grade person	Rank change
1	44	39	4
2	30	44	1
3	43	34	4
4	40	43	1
5	39	30	3
6	35	35	0
7	34	40	3
8	42	28	1
9	28	24	1
10	24	42	2
11	26	22	3
12	23	23	0
13	25	26	2
14	22	25	1
15	15	15	0

Range of rank order change = 4 to -3
Mode I of rank order change = 1-5 each
Mode II of rank order change = 0, 3-3 each
Mode III of rank order change = 2, 4-2 each

TABLE XVIII

RANK ORDER OF THE VERIFYING SAMPLE OF THIRTY-TWO STUDENTS COMPARING THIRD GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH FOURTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Third-grade person	Fourth-grade person	Rank change
1	46	46	0
2	37	47	1
3	47	29	2
4	36	37	2
5	29	36	1
6	38	2	26
7	32	32	0
8	45	17	10
9	19	21	7
10	18	38	4
11	6	31	3
12	33	20	1
13	20	18	3
14	31	45	6
15	5	6	4
16	21	41	1
17	41	16	4
18	17	4	2
19	11	19	10
20	4	33	8
21	16	5	6
22	9	27	7
23	14	14	0
24	12	11	5
25	10	3	6
26	7	13	2
27	8	12	3
28	13	7	2
29	27	1	1
30	1	9	8
31	3	8	4
32	2	10	7

Range of rank order change = 26 to -10
Mode I of rank order change = 1, 2-5 each
Mode II of rank order change = 4-4 each
Mode III of rank order change = 0, 3, 6, 7-3 each
Mode IV of rank order change = 8, 10-2 each

TABLE XIX

RANK ORDER OF THE TOTAL SAMPLE OF FORTY-SEVEN STUDENTS COMPARING THIRD GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH FOURTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Third-grade person	Fourth-grade person	Rank change
1	46	46	0
2	37	47	2
3	44	39	13
4	47	44	1
5	36	29	4
6	30	34	12
7	43	43	0
8	40	37	6
9	29	36	4
10	38	30	4
11	32	2	36
12	45	32	1
13	19	17	19
14	18	21	16
15	6	35	2
16	39	40	8
17	35	38	7
18	34	31	4
19	33	20	1
20	20	18	6
21	42	28	2
22	31	45	10
23	28	24	1
24	24	6	9
25	26	42	4
26	23	41	5
27	5	22	2

Range of rank order change = 36 to -17
Mode I of rank order change = 4-7 each
Mode II of rank order change = 2-6 each
Mode III of rank order change = 1-5 each
Mode IV of rank order change = 6, 7-4 each
Mode V of rank order change = 0, 5, 8, 9, 10, 11, 12-2 each

TABLE XIX (continued)

Order of rank	Third-grade person	Fourth-grade person	Rank change
28	25	16	7
29	22	4	5
30	21	19	17
31	41	33	12
32	17	23	6
33	11	5	6
34	4	27	10
35	16	14	3
36	9	26	11
37	15	11	4
38	14	3	8
39	12	25	11
40	10	13	3
41	7	12	2
42	8	7	1
43	13	1	2
44	27	15	7
45	1	9	9
46	3	8	4
47	2	10	7

Range of rank order change = 36 to -17
Mode I of rank order change = 4-7 each
Mode II of rank order change = 2-6 each
Mode III of rank order change = 1-5 each
Mode IV of rank order change = 6, 7-4 each
Mode V of rank order change = 0, 5, 8, 9, 10, 11, 12-2 each

TABLE XX

RANK ORDER OF THE ORIGINAL SAMPLE OF FIFTEEN STUDENTS COMPARING SECOND GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH FOURTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Second-grade person	Fourth-grade person	Rank change
1	44	39	4
2	43	44	1
3	42	34	4
4	40	43	2
5	39	30	3
6	35	35	0
7	34	40	3
8	30	28	1
9	28	24	3
10	26	42	7
11	25	22	3
12	24	23	1
13	23	26	3
14	22	25	3
15	15	15	0

Range of rank order change = 4 to -7
Mode I of rank order change = 3-6 each
Mode II of rank order chage = 1-3 each
Mode III of rank order change = 0-2 each

TABLE XXI

RANK ORDER OF THE VERIFYING SAMPLE OF THIRTY-TWO STUDENTS COMPARING SECOND GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH FOURTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Second-grade person	Fourth-grade person	Rank change
1	47	46	1
2	46	47	1
3	45	29	8
4	41	37	2
5	38	36	2
6	37	2	25
7	36	32	2
8	33	17	9
9	32	21	4
10	31	38	5
11	29	31	1
12	27	20	2
13	21	18	3
14	20	45	11
15	19	6	12
16	18	41	12
17	17	16	1
18	16	4	11
19	14	19	4
20	13	33	12
21	12	5	7
22	11	27	10
23	10	14	4
24	9	11	2
25	8	3	5
26	7	13	6
27	6	12	6
28	5	7	2
29	4	1	3
30	3	9	6
31	2	8	6
32	1	10	9

Range of rank order change = 25 to -12
Mode I of rank order change = 2-6 each
Mode II of rank order change = 1, 6-4 each
Mode III of rank order change = 12-3 each

TABLE XXII

RANK ORDER OF THE TOTAL SAMPLE OF FORTY-SEVEN STUDENTS COMPARING SECOND GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH FOURTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Second-grade person	Fourth-grade person	Rank change
1	47	46	1
2	46	47	1
3	45	39	6
4	44	44	0
5	43	29	14
6	42	34	8
7	41	43	2
8	40	37	3
9	39	36	3
10	38	30	8
11	37	2	35
12	36	32	4
13	35	17	18
14	34	21	13
15	33	35	2
16	32	40	8
17	31	38	7
18	30	31	1
19	29	20	9
20	28	18	10
21	27	28	1
22	26	45	19
23	25	24	1
24	24	6	18
25	23	42	19
26	22	41	19
27	21	22	1
28	20	16	4

Range of rank order change = 35 to -19
Mode I of rank order change = 1-9 each
Mode II of rank order change = 6, 7, 8, 19-3 each
Mode III of rank order change = 0, 2, 3, 4, 5, 10, 13, 14, 16, 18-2 each

TABLE XXII (continued)

Order of rank	Second-grade person	Fourth-grade person	Rank change
29	19	4	15
30	18	19	1
31	17	33	16
32	16	23	7
33	15	5	10
34	14	27	13
35	13	14	1
36	12	26	14
37	11	11	0
38	10	3	7
39	9	25	16
40	8	13	5
41	7	12	5
42	6	7	1
43	5	1	4
44	4	15	11
45	3	9	6
46	2	8	6
47	1	10	9

Range of rank order change = 35 to -19
Mode I of rank order change = 1-9 each
Mode II of rank order change = 6, 7, 8, 19-3 each
Mode III of rank order change = 0, 2, 3, 4, 5, 10, 13, 14, 16, 18-2 each

TABLE XXIII

RANK ORDER OF THE ORIGINAL SAMPLE OF FIFTEEN STUDENTS COMPARING INTELLIGENCE QUOTIENT WITH EIGHTH GRADE MAT ACHIEVEMENT

Order of rank	I. Q. person	Eighth-grade person	Rank change
1	5	28	8
2	30	30	0
3	44	42	3
4	31	47	1
5	47	31	1
6	42	20	1
7	20	44	4
8	46	6	5
9	28	32	1
10	32	5	9
11	27	45	3
12	15	46	4
13	6	27	2
14	45	15	2
15	10	10	0

Range of rank change = 8 to -9
Mode I of rank change = 1-4 each
Mode II of rank change = 0, 2, 3, 4-2 each
= .524

TABLE XXIV

RANK ORDER OF THE VERIFYING SAMPLE OF THIRTY-TWO STUDENTS COMPARING INTELLIGENCE QUOTIENT WITH EIGHTH GRADE MAT ACHIEVEMENT
(Two persons not reporting)

Order of rank	I. Q. person	Eighth-grade person	Rank change
1	35	35	0
2	34	43	4
3	21	38	9
4	22	36	13
5	37	29	13
6	43	17	15
7	41	37	2
8	39	24	6
9	33	34	7
10	3	3	0
11	40	39	3
12	38	40	1
13	11	18	6
14	24	12	1
15	12	33	6
16	4	22	12
17	36	21	14
18	29	4	2
19	18	41	12
20	23	2	8
21	17	23	1
22	8	13	4
23	26	11	10
24	14	14	0
25	1	25	4
26	13	7	4
27	9	26	4
28	2	8	6
29	25	1	4
30	7	9	3
31	—	—	—
32	—	—	—

Range of rank change = 14 to -15
Mode I of rank change = 4-6 each
Mode II of rank change = 6-4 each
Mode III of rank change = 1-3 each
Mode IV of rank change = 12, 13-2 each
= .644

TABLE XXV

RANK ORDER OF THE TOTAL SAMPLE OF FORTY-SEVEN STUDENTS COMPARING INTELLIGENCE QUOTIENT WITH EIGHTH GRADE MAT ACHIEVEMENT
(Two persons not reporting)

Order of rank	I. Q. person	Eighth-grade person	Rank change
1	35	35	0
2	34	43	7
3	21	28	24
4	22	30	3
5	37	38	13
6	5	42	10
7	30	47	8
8	44	36	16
9	43	29	17
10	41	17	20
11	39	37	6
12	33	31	1
13	31	20	6
14	3	24	7
15	47	34	13
16	42	44	8
17	40	3	3
18	38	39	7
19	20	40	2
20	11	6	16
21	24	32	10
22	12	18	6
23	4	12	1
24	36	33	12
25	46	5	19
26	29	22	22
27	28	21	24

Range of rank change = 24 to -24
Mode I of rank change = 3-6 each
Mode II of rank change = 6-5 each
Mode III of rank change = 13-4 each
Mode IV of rank change = 1, 5, 10, 12, 19, 24-2 each
= .668

TABLE XXV (continued)

Order of rank	I. Q. person	Eighth-grade person	Rank change
28	18	4	5
29	23	41	19
30	17	2	13
31	32	23	2
32	27	13	8
33	15	11	13
34	8	45	3
35	26	14	3
36	6	25	8
37	45	46	12
38	14	27	6
39	1	7	6
40	13	26	5
41	10	15	7
42	9	8	8
43	2	1	4
44	25	10	3
45	7	9	3
46	--	--	--
47	--	--	--

Range of rank change = 24 to -24
Mode I of rank change = 3-6 each
Mode II of rank change = 6-5 each
Mode III of rank change = 13-4 each
Mode IV of rank change = 1, 5, 10, 12, 19, 24-2 each
= .668

TABLE XXVI

RANK ORDER OF THE ORIGINAL SAMPLE OF FIFTEEN STUDENTS COMPARING PREDICTED MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH THE EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Predicted person	Eighth-grade person	Rank change
1	35	35	0
2	43	43	0
3	30	28	2
4	34	30	1
5	28	42	1
6	42	24	6
7	40	34	3
8	39	44	1
9	44	39	1
10	23	40	3
11	22	22	0
12	24	23	2
13	26	25	1
14	25	26	1
15	15	15	0

Range of rank order change = 6 to -3
Mode I of rank change = 1-6 each
Mode II of rank change = 0-4 each
Mode III of rank change = 2, 3-2 each
= .9782

TABLE XXVII

RANK ORDER OF THE VERIFYING SAMPLE OF THIRTY-TWO STUDENTS COMPARING PREDICTED MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH THE EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Predicted person	Eighth-grade person	Rank change
1	47	38	10
2	37	47	1
3	19	36	1
4	36	29	3
5	31	17	5
6	16	19	3
7	29	16	1
8	20	37	6
9	41	31	4
10	17	20	2
11	38	3	8
12	32	6	9
13	45	32	1
14	21	18	1
15	18	12	5
16	2	33	1
17	33	5	1
18	5	21	4
19	3	4	3
20	12	41	11
21	6	2	5
22	4	13	2
23	11	11	0
24	13	45	11
25	46	14	1
26	14	46	1
27	27	27	0
28	7	7	0
29	8	8	0
30	9	1	1
31	1	10	1
32	10	9	2

Range of rank change = 10 to-11
Mode I of rank change = 1-10 each
Mode II of rank change = 0-4 each
Mode III of rank change = 2, 3, 5-3 each

TABLE XXVIII

RANK ORDER OF THE TOTAL SAMPLE OF FORTY-SEVEN STUDENTS COMPARING PREDICTED MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH THE EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Predicted person	Eighth-grade person	Rank change
1	47	35	2
2	37	43	4
3	35	28	10
4	19	30	3
5	36	38	14
6	43	42	8
7	30	47	6
8	31	36	3
9	34	29	3
10	16	17	8
11	29	19	7
12	20	16	2
13	28	37	11
14	42	31	6
15	40	20	3
16	39	24	9
17	41	34	8
18	17	44	2
19	38	3	12
20	44	39	4
21	23	40	6
22	32	6	11
23	45	32	1
24	22	18	3
25	24	12	7
26	21	33	3
27	18	5	3
28	2	22	4

Range of rank change = 14 to -13
Mode I of rank change = 2-9 each
Mode II of rank change = 3-8 each
Mode IV of rank change = 6, 8-3 each
= .882

TABLE XXVIII (continued)

Order of rank	Predicted person	Eighth-grade person	Rank change
29	33	21	3
30	5	4	4
31	3	41	14
32	12	2	4
33	6	23	12
34	4	13	2
35	11	11	0
36	13	45	13
37	46	14	3
38	26	25	1
39	25	46	2
40	14	27	2
41	15	7	2
42	27	26	4
43	7	15	2
44	8	8	0
45	9	1	1
46	1	10	1
47	10	9	2

Range of rank change = 14 to -13
Mode I of rank change = 2-9 each
Mode II of rank change = 3-8 each
Mode III of rank change = 1, 4-4 each
Mode IV of rank change = 6, 8-3 each
= .882

TABLE XXIX

REAL VALUES OF THE ORIGINAL FIFTEEN STUDENTS COMPARING PREDICTED MAT ACHIEVEMENT (GRADE EQUIVALENT SCORE) WITH THE EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Person	Calculated value	Eighth-grade value	Error of calculated value in yrs.
1	35	10.95	11.17	.22
2	43	10.65	11.13	.48
3	30	10.65	10.82	.17
4	34	10.52	10.39	.13
5	28	10.44	10.83	.39
6	42	10.44	10.71	.27
7	39	10.40	10.16	.24
8	40	10.40	10.08	.32
9	44	10.24	10.27	.03
10	23	10.14	9.20	.94
11	22	10.02	9.74	.28
12	24	9.97	10.41	.43
13	26	8.16	8.89	.73
14	25	8.78	8.80	.02
15	15	8.52	7.61	.91

Range of error = .94 to -.73 years
Average error = .370
Mean error = .0053 years
r = .926

TABLE XXX

REAL VALUES OF THE VERIFYING SAMPLE OF THIRTY-TWO STUDENTS COMPARING PREDICTED MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH THE EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Person	Calculated value	Eighth-grade value	Error of calculated value in yrs.
1	38	10.17	10.80	.63
2	47	11.26	10.69	.57
3	36	10.48	10.67	.19
4	29	10.68	10.66	.02
5	17	10.28	10.64	.36
6	19	10.69	10.60	.09
7	16	10.46	10.52	.06
8	37	10.98	10.50	.48
9	31	10.54	10.50	.04
10	20	10.44	10.44	.00
11	3	9.36	10.20	.84
12	6	9.21	10.00	.79
13	32	10.09	9.90	.19
14	18	9.77	9.90	.13
15	12	9.33	9.88	.55
16	33	9.60	9.86	.26
17	5	9.38	9.80	.42
18	21	9.78	9.60	.18
19	4	9.18	9.40	.22
20	41	10.28	9.30	.98
21	2	9.63	9.28	.35
22	13	8.99	9.20	.21
23	11	9.12	9.20	.08
24	45	10.04	8.96	1.08
25	14	8.80	8.90	.10
26	46	8.93	8.60	.33
27	27	8.41	8.50	.09
28	7	8.12	8.40	.28
29	8	7.70	7.40	.30
30	1	7.21	7.39	.18
31	10	6.97	6.75	.22
32	9	7.54	6.39	1.15

Range of error = 1.15 to -.84 years
Average error = .355 years
Mean error = -.017 years
r = .882

TABLE XXXI

REAL VALUES OF THE TOTAL SAMPLE OF FORTY-SEVEN STUDENTS COMPARING PREDICTED MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE) WITH THE EIGHTH GRADE MAT ACHIEVEMENT (GRADE-EQUIVALENT SCORE)

Order of rank	Person	Calculated value	Eighth-grade value	Error of calculated value in yrs.
1	35	10.95	11.17	.22
2	43	10.65	11.13	.48
3	28	10.44	10.83	.39
4	30	10.65	10.82	.17
5	38	10.17	10.80	.63
6	42	10.44	10.71	.27
7	47	11.26	10.69	.57
8	36	10.48	10.67	.19
9	29	10.68	10.66	.02
10	17	10.28	10.64	.36
11	19	10.69	10.60	.09
12	16	10.46	10.52	.06
13	37	10.98	10.50	.48
14	31	10.54	10.50	.04
15	20	10.44	10.40	.00
16	24	9.97	10.41	.43
17	34	10.52	10.39	.13
18	44	10.24	10.27	.03
19	3	9.36	10.20	.84
20	39	10.40	10.16	.24
21	40	10.40	10.08	.32
22	6	9.21	10.00	.79
23	32	10.09	9.90	.19
24	18	9.77	9.90	.13
25	12	9.33	9.88	.55
26	33	9.60	9.86	.26
27	5	9.38	9.80	.42
28	22	10.02	9.74	.28

Range of error = 1.15 to -.84 years
Average error = .36 years
Mean error = -.0098

TABLE XXXI (continued)

Order of rank	Person	Calculated value	Eighth-grade value	Error of calculated value in yrs.
29	21	9.78	9.60	.18
30	4	9.18	9.40	.22
31	41	10.28	9.30	.98
32	2	9.63	9.28	.35
33	23	10.14	9.20	.94
34	13	8.99	9.20	.21
35	11	9.12	9.20	.08
36	45	10.04	8.96	1.08
37	14	8.80	8.90	.10
38	25	8.78	8.80	.02
39	46	8.93	8.60	.33
40	27	8.41	8.50	.09
41	7	8.12	8.40	.28
42	26	8.16	8.89	.73
43	15	8.52	7.61	.91
44	8	7.70	7.40	.30
45	1	7.21	7.39	.18
46	10	6.97	6.75	.22
47	9	7.54	6.39	1.15

Range of error = 1.15 to -.84 years
Average error = .36 years
Mean error = -.0098