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A Predictive Study of Seventh Graders' Academic Achievement from Objective and Subjective Grade Six Ratings

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A PREDICTIVE STUDY OF
SEVENTH GRADERS' ACADEMIC ACHIEVEMENT FROM
OBJECTIVE AND SUBJECTIVE GRADE SIX RATINGS

A Thesis
Presented to
the Graduate Faculty
Central Washington State College

In Partial Fulfillment
of the Requirements for the Degree
Master of Education

by
Allan Gordon Moodie
June 1962

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CHAPTER I

INTRODUCTION

Throughout the history of mankind many civilizations have held great expectations for the schools and have seen these educational institutions as a means for achieving both individual and national aspirations. The schools have been wonderfully responsive to these demands. They have extended their reach downward to teach the retarded child and upward to challenge the gifted child. They have contrived to enroll larger and larger proportions of the population, both young and old; and they have constantly broadened their offerings and services in an attempt to minister to the new needs expressed by a changing society.

Certainly, the schools have not realized all the hopes placed upon them. Even in this age, the demands on education are still growing and taking on new dimensions which constitute a more fundamental challenge to the schools than the necessity for operating with a shortage of both classrooms and qualified teachers. In essence, these new demands spell out the need for a quality mass education which is a demand never before made on the schools of a nation. The demand from the public for better education stems from several sources.

During the last six or seven years; Dr. James B. Conant, President Emeritus of Harvard, has advocated the

development of the comprehensive high school from the small rural schools to provide United States students with a wide and excellent educational program. In Canada, interest in education has been brought into focus by the Canadian Conferences on Education. Accompanying this has been the establishment of several Royal Commissions on education in Canadian provinces.

Approximately twelve years ago another academic counter-revolution was sparked by the controversial writings of Dr. Hilda Neatby, Dr. Robert M. Hutchins and Dr. Mortimer J. Adler.

. . . almost simultaneously in Canada and the United States in the books written by Dr. Neatby in Canada and Dr. Hutchins, Alder [sic] and others in the United States. These authors, and many others since, have condemned many of the newer activities and programs in the public school and called for a return to academic discipline and the training of the mind. Coming under fire particularly were the life adjustment courses, physical education, including sports and games, and practical courses in industrial arts and home economics offered as the general education of all students. Perhaps the shock received from this critical examination was beneficial on the whole but it gave to the average layman the impression that everything new in public education was, ipso facto, bad, and that public education should be concerned only with the training of the mind (16:381).

The second major educational controversy was initiated by the launching of the world's first man-made earth satellite, Russia's Sputnik I. This event was closely related to Nikita Khrushchev's statement, aimed at North America, confidentially predicting that "Your grandchildren in America will live under Socialism." Khrushchev was, in effect,

saying that Communist Socialism possessed a compelling contagion that not even the future American generations could resist. People from all walks of life stated that unless the democracies trained more scientists and engineers to maintain a lead in scientific knowledge over the Communist countries, all would be lost. Devotees of the arts and the humanities unfolded a strong defence for their particular fields. However, the impression was given that a person should be trained in the sciences, or in the humanities, but not in both.

Each of these controversies, important as they may seem, are only reflections of a much wider problem. All potentials—economic, political, cultural and military—of any country can only be attained if all of its human resources are developed to the fullest capacity.

The question is not whether there should be intellectual training, or whether there should be scientists or philosophers or whether emphasis should be placed on bright children, on the average, or on the slow learners. The task is to discover, encourage and develop all the latent talents of every child, so that he may live a full, balanced and self-disciplined life—as a person and citizen (16:381).

Before developing the physical, intellectual and social abilities of a student to maximum capacity, his current level of achievement in all areas of human endeavour must first be determined. This will enable an educational system to adapt a program which will suitably meet the needs and levels of abilities for each child. Prior to each

student's entrance into a secondary high school, one evaluating program of a child's intellectual abilities is conducted annually by the elementary schools in Vancouver, British Columbia.

Each year during the latter part of the month of May, the Vancouver elementary schools in the province of British Columbia evaluate each Grade 6 pupil's academic achievement for the past school term. This evaluation program for Grade 6 pupils consists of determining four ratings for each student by the pupil's home room teacher and by group standardized tests. The four ratings are:

- (1) a teacher's subjective rating of the student's general academic ability in school,
- (2) a teacher's subjective rating of the pupil's attitude to work in school,
- (3) an Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) score, and
- (4) a Stanford Achievement Test (Intermediate Battery Partial: Form J, K, L, M or N) grade equivalent score.

The four ratings which were derived in the Grade 6 evaluating program are recorded on the following three forms for each pupil:

- (1) the student's Permanent Record Card,

(2) the student's High School Enrolment Application Card, and

(3) the Elementary School Promotion List (Form X).

In conferences between the elementary principals and the principals of the secondary high schools, the ratings on these records provide the main basis for determining the promotion of each sixth grade pupil into Grade 7. There are no definite standards that a student must attain for promotion into Grade 7, the first year of junior high school. Each individual case is considered on its own merits by the judgments of the elementary and high school principals.

Besides promotional purposes, the four ratings are also used to divide the beginning Grade 7 students into homogeneous groups. Generally, the Grade 7 counselors are given the High School Enrolment Application Cards from which the four elementary school ratings are used as guides to divide the Grade 7 into "homogeneous" home room classes. The homogeneous classes are primarily formed according to the students' academic abilities. In Grade 7 these homogeneous classes go as a group to the four main academic subjects of English, social studies, mathematics and science.

Prior to this investigation, no research had been undertaken to study the relationship between the elementary school ratings on the Vancouver High School Enrolment Application Card and the future academic achievement of the rated students. In this study the writer has proceeded to

ascertain the effectiveness of teachers' ratings and standardized test scores for predicting academic success of students in the 1960-61 Grade 7 population of the Vancouver Technical Secondary School.

I. PURPOSE OF THE STUDY

The general purpose of this study was to discover the effectiveness of the elementary school ratings in predicting a student's academic performance during his first year of high school (Grade 7). As a result of this investigation, formulas for predicting Grade 7 academic achievement from the four Grade 6 ratings assigned by the elementary schools were developed. The prediction formulas in this study will be limited in scope as the results will only be suitable for future Grade 7 students in so far as they are similar to the study group.

However, school administrators and counselors should be interested in learning the relative academic performance of Grade 7 students as compared with their previous Grade 6 elementary school ratings for promotional and grouping purposes. Also the conclusions of this study may be of value to secondary school personnel who wish to use the results in consultation with elementary school administrators, counselors and the students themselves in planning a desirable and adequate school program.

II. THE STUDY SAMPLE

The study sample was chosen from the 1960-61 Grade 7 population of 232 girls and 266 boys at the Vancouver Technical Secondary School.

The Vancouver Technical Secondary School is situated in an urban-industrial area. This area is located in the eastern section of the city of Vancouver. The school population is composed of children whose parents are primarily industrial and business workers from the middle and lower social classes.

From the 1960-61 Grade 7 population at the Vancouver Technical Secondary School, 50 girls and 50 boys were randomly selected to form the study sample. Before the students were randomly selected, membership in the descriptive research group was limited in the following ways to avoid excessive distortion and incomplete results.

- (1) Students who had left or had transferred to the Vancouver School District during the sixth or seventh grades were omitted from this study. Only those students for whom complete Grades 6 and 7 information was available were randomly selected.
- (2) Also all members in the study group were enrolled in Grade 6 during the 1959-60 school year and in Grade 7 during the 1960-61 school term.

This requirement excluded repeating Grade 7 students from this study group as these students had an academic advantage of studying the Grade 7 subjects during the previous year. Their marks might have been slightly higher than the beginning Grade 7 student who had equal ability. Hence, all students in the study sample have been in Grade 7 for their first year during the school term, 1960-61.

III. DESCRIPTION OF THE MEASURED VARIABLES IN THE STUDY

On every student's High School Enrolment Application Card were two subjective and two objective evaluations. Those subjective and objective ratings in this study were issued by the home room teachers in the following nine Vancouver elementary schools: Chief Maquinna, Laura Secord, Lord Beaconsfield, Lord Nelson, Renfrew, Sir Matthew Begbie, Sir Matthew Begbie #1, Sir Wilfred Grenfell and Sir William Macdonald. Table I shows the number of students from each of these elementary schools that have participated in the study. The small proportionate contribution from some of the elementary schools to the Grade 7 Vancouver Technical Secondary School population indicated that the Grade 6 promoted pupils were divided, in some cases, among several other Vancouver high schools.

TABLE I

BREAKDOWN OF THE SAMPLE GROUP
INTO THEIR GRADE 6 ELEMENTARY SCHOOLS

Elementary School	Girls	Boys
Chief Maquinna	7	2
Laura Secord	8	9
Lord Beaconsfield	2	2
Lord Nelson	0	1
Renfrew	22	21
Sir Matthew Begbie	4	10
Sir Matthew Begbie #1	6	4
Sir Wilfred Grenfell	0	1
Sir William Macdonald	1	0
Total	50	50

.The subjective ratings which were assigned to each Grade 6 pupil by the home room teacher in the elementary school were:

- (1) a teacher's subjective rating of the student's general academic ability in school, and
- (2) a teacher's subjective rating of the pupil's attitude to work in school.

The objective ratings were derived from two group standardized tests which were also administered to the pupils in their respective elementary schools. The two standardized tests, both of which are hand scored editions, were:

- (1) an Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D); and
- (2) a Stanford Achievement Test (Intermediate Battery Partial: Form J).

Basically, five measured variables were used in this study. They were:

- (1) a teacher's subjective rating of the student's general academic ability in school;
- (2) a teacher's subjective rating of the pupil's attitude to work in school;
- (3) an Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D)

- (4) a Stanford Achievement Test (Intermediate Battery Partial: Form J); and
- (5) the Third Report Letter Grades in the academic subjects of English language, English literature, English spelling, social studies, mathematics and science.

Brief capsule descriptions for each of these five measured variables are located on the remaining pages of Chapter I.

A. TEACHER'S SUBJECTIVE RATING OF THE STUDENT'S GENERAL ACADEMIC ABILITY IN SCHOOL

A five point rating scale of A, B, C, D and E was used to grade each student's general academic ability in the elementary schools. Vancouver School Board instructions on the Elementary School Promotion List (Form X) (20:1) suggested that each elementary school Grade 6 population should be divided into fixed percentage groups for assigning the letter grades of this rating. The division instructions were:

"A" meant a child was among the top 5% of the Grade 6 pupils in academic ability on the elementary school enrolment list.

"B" meant a child was among the next 20% of the Grade 6 pupils in academic ability on the elementary school enrolment list.

"C" meant a child was among the next 50% of the Grade 6 pupils in academic ability on the elementary school enrolment list after the "A" and "B" rated students had been chosen.

"D" meant a child was among the next 20% of the Grade 6 pupils in academic ability on the elementary school enrolment list after the "A," "B" and "C" rated students had been chosen.

"E" meant a child was among the lowest 5% of the Grade 6 pupils in academic ability on the elementary school enrolment list after the "A," "B," "C" and "D" rated students had been chosen.

By a cursory examination of the accumulated data, the researcher noted that these instructions were not rigidly followed. There appeared to be a notable lack of the low letter grades, D and E, in the research material. Also several intermediate letter grades of C+ and C- were assigned to several students.

Basically, this rating was an attempt to portray the pupils' "average standing in the year's work" (21:1).

B. TEACHER'S SUBJECTIVE RATING OF THE PUPIL'S ATTITUDE TO WORK IN SCHOOL

A four point numerical rating system of 1, 2, 3 and 4 was used by the elementary school home room teachers for

evaluating a pupil's attitude to work in school during his Grade 6 year. Meanings of these numerical values were provided to the elementary schools by the Vancouver School Board Department of Research and Special Services on the circular, Promotions to Junior High School (21:1). The evaluative interpretations of the numerical points were:

A rating of "1" meant Excellent,
a rating of "2" meant Good,
a rating of "3" meant Fair,
and a rating of "4" meant Poor.

These ratings by the elementary school teachers are based upon his or her judgments as to the quality of the student's attitude toward school work. Admittedly, this method of evaluation is largely subjective, but at the present time it is the method employed. As such, it remains the only criterion used for judging a student's attitude to work in school during the sixth grade.

C. OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY

The objective standardized test used to obtain each student's I.Q. was the Otis Self-Administering Test of Mental Ability (Intermediate Examination). Various equivalent test forms (Forms A, B, C and D) were used among the elementary schools. This test was administered to pupils during the sixth grade school term and consequently was a recently derived I.Q. score for a comparison with

Grade 7 academic achievement. Additional descriptive information on this measuring instrument may be obtained from the sample Otis test (Form B) and its accompanying test manual which are located in Appendices C and D respectively.

D. STANFORD ACHIEVEMENT TEST

The Vancouver School Board Department of Research and Special Services suggested to elementary school principals that the Stanford Achievement Test (Intermediate Battery Partial) be administered to all Grade 6 pupils during the week ending May 27, 1960. This permitted the grade equivalent scores from this test to be all based upon the norm of 6.9. Form J of this test was used throughout the Vancouver elementary schools in the May, 1960 testing program. During the past testing programs the other equivalent forms of the Stanford Achievement Test (Forms K, L, M and N) were administered on a rotational basis. A sample of the Stanford Achievement Test (Form J) is inserted in Appendix E.

E. GRADE 7 ACADEMIC LETTER GRADES

For rating each student's academic achievement in Grade 7, a seven point letter grade scale was utilized. The letter grades were based entirely upon the performances on the Third Report final exams which were administered to all

Grade 7 students of the Vancouver Technical Secondary School. Letter grades for English language, English literature, English spelling, social studies, mathematics and science were assigned in a similar manner to the suggested procedure for grading a student's general academic ability in the elementary school. The total Grade 7 population at the Vancouver Technical Secondary School was grouped and assigned letter grades in the following manner.

"A" letter grade meant a child was in the top 5% of the students on the Grade 7 test score distribution for a specific academic subject.

"B" letter grade meant a child was in the next 20% of the students on the Grade 7 test score distribution for a specific academic subject.

"C+" letter grade meant a child was in the following 15% of the students on the Grade 7 test score distribution for a specific academic subject.

"C" letter grade meant a child was in the next 20% of the students on the Grade 7 test score distribution for a specific academic subject.

"C-" letter grade meant a child was in the next 15% of the students on the Grade 7 test score distribution for a specific academic subject.

"D" letter grade meant a child was in the next 20% of the students on the Grade 7 test score distribution for a specific academic subject.

"E" letter grade meant a child was in the lowest 5% of the students on the Grade 7 test score distribution for a specific academic subject.

These percentages provided a general basis for distributing the letter grades among the Grade 7 students at the Vancouver Technical Secondary School. Table II has illustrated the percentage of pupils that received the letter grades in each of the academic subjects for the Third Report. The Third Report is usually issued during the first week of May prior to the final report in June. The letter grades for the Third Report were based entirely upon each student's performance on grade-wide academic exams which were written by all Grade 7 students.

With the exception of the spelling letter grades, the recommended grouping procedure was generally followed. Some of the discrepancies between the actual and the recommended percentages were partially caused by the large frequency of pupils obtaining each test score. As the pupils obtaining the same exam score could not be divided into separate letter grade groups, the seventh grade teachers made the groups contain approximately the recommended number of students. This is one of the two main reasons for the fluctuations between the recommended and actual percentages in each letter grade group. The second reason for the percentage discrepancies was caused by the mutual consent of the teachers in a specific academic subject. In

TABLE II

BREAKDOWN OF LETTER GRADES
 RECEIVED BY THE 1960-61 GRADE 7 STUDENT POPULATION
 AT THE VANCOUVER TECHNICAL SECONDARY SCHOOL
 FOR THE THIRD REPORT
 (EXPRESSED AS A PERCENTAGE
 TO THE NEAREST TENTH DECIMAL PLACE)

Letter Grade	Subject*					
	En. Lan.	En. Lit.	En. Sp.	S.S.	Ma.	Sc.
A	4.8	5.9	12.1	6.4	4.0	4.6
B	19.8	18.4	10.6	15.9	16.3	18.5
C+	18.0	15.3	18.7	15.2	15.0	15.6
C	20.9	19.9	18.3	26.0	22.9	20.9
C-	17.8	17.1	17.6	15.7	16.3	16.1
D	14.5	18.4	15.4	13.5	19.6	19.2
E	4.2	5.0	7.3	7.3	6.0	5.1
Total	100.0	100.0	100.0	100.0	100.1	100.0

*Key to the subject abbreviations is located on the following page.

TABLE II (continued)

BREAKDOWN OF LETTER GRADES
RECEIVED BY THE 1960-61 GRADE 7 STUDENT POPULATION
AT THE VANCOUVER TECHNICAL SECONDARY SCHOOL
FOR THE THIRD REPORT

KEY TO THE ABBREVIATIONS

Abbreviation		Meaning
En. Lan.	=	English language
En. Lit.	=	English literature
En. Sp.	=	English spelling
S.S.	=	social studies
Ma.	=	mathematics
Sc.	=	science

committee meetings, the teachers decided to modify the percentages for each letter grade group in certain Grade 7 academic test score distributions. These two reasons have primarily accounted for the discrepancies between the recommended and actual percentages in each letter grade group. Table III compares the percentages which were recommended in all Grade 7 courses with the actual percentages that were assigned to each letter grade group for the selected academic subject areas in this study.

TABLE III

A COMPARISON OF THE RECOMMENDED PERCENTAGES
 WITH THE ACTUAL PERCENTAGES
 WHICH WERE RECEIVED IN EACH SELECTED STUDY SUBJECT AREA
 BY THE 1960-61 GRADE 7 STUDENT POPULATION
 AT THE VANCOUVER TECHNICAL SECONDARY SCHOOL
 (PERCENTAGES EXPRESSED
 TO THE NEAREST TENTH DECIMAL PLACE)

Letter Grade	Recommended Percentage	Actual Percentage in each Subject Area*			
		Av. En.	S.S.	Ma.	Sc.
A	5.0	7.6	6.4	4.0	4.6
B	20.0	16.3	15.9	16.3	18.5
C+	15.0	17.3	15.2	15.0	15.6
C	20.0	19.7	26.0	22.9	20.9
C-	15.0	17.5	15.7	16.3	16.1
D	20.0	16.1	13.5	19.6	19.2
E	5.0	5.5	7.3	6.0	5.1
Total	100.0	100.0	100.0	100.1	100.0

*Key to the subject area abbreviations is located on the
 following page.

TABLE III (continued)

A COMPARISON OF THE RECOMMENDED PERCENTAGES
 WITH THE ACTUAL PERCENTAGES
 WHICH WERE RECEIVED IN EACH SELECTED STUDY SUBJECT AREA
 BY THE 1960-61 GRADE 7 STUDENT POPULATION
 AT THE VANCOUVER TECHNICAL SECONDARY SCHOOL

KEY TO THE ABBREVIATIONS

Abbreviation	Meaning
Av. En.	= average English letter grade of language, literature and spelling
S.S.	= social studies
Ma.	= mathematics
Sc.	= science

CHAPTER II

REVIEW OF RELATED RESEARCH AND LITERATURE

Many educational investigations have been conducted in the field of scholastic prediction. Statistical significant results of these studies have shown that reliable objective and subjective measuring instruments have been devised to predict academic success in school.

To provide background research knowledge for this investigation, a review of the literature which has evaluated the relationships between objective standardized test scores, subjective teacher ratings and pupil academic achievement is essential.

From the development of Terman's scale, "known as the Stanford Revision or the Stanford-Binet" (22:33) in 1916; many standardized tests of intelligence have been produced. These measuring instruments have played an important role in American education. As a result of extensive research in the development of standardized tests, teachers have tended to use intelligence test scores as one of the chief indicators for predicting an individual's probable achievement in an academic learning situation. During the past forty years, many research studies have shown relatively high correlations between intelligence test scores and school achievement. This research data has primarily accounted for the popularity of standardized

intelligence tests.

I. THE RELATIONSHIP BETWEEN STANDARDIZED TEST SCORES AND SCHOOL ACHIEVEMENT

A. INTELLIGENCE TEST SCORES AND ACADEMIC ABILITY

Many studies have investigated the relationship between standardized intelligence test scores and school achievement. The following studies represent typical examples of this thoroughly investigated relationship.

Aaron (1:138-143) found in his research study that intelligence was significantly related at the .01 level of confidence to spelling achievement in the fourth and eighth grades. In higher education, H. F. Garrett (8:91-138) discovered that there was a substantial positive correlation between intelligence test scores and average grades earned during the freshman year of college. These two studies, in addition to the following studies, have shown that prediction coefficients of general scholastic achievement from group verbal intelligence tests are usually near .70 for elementary school groups but are considerably lower for high school and college groups.

The median of 100 correlations between general college scholarship awards and mental tests was .44 according to Segal (24:178) who made an extensive review of studies on the subject. Durflinger (7:178) compiled studies concerning

the prediction of college success and found correlations of .52 and .475 between intelligence tests and content examinations, and intelligence tests and college scholarships respectively. The results of these and other studies would indicate that the relationship between intelligence and marks would vary from .40 to .55 for college groups. In a few cases some correlations may be higher or lower than this.

With the development of the standardized intelligence exams; other objective measuring instruments such as achievement tests, aptitude tests, interest inventories, personality inventories and attitude scales have been produced. Similarly, positive correlations between these more recently devised standardized tests and academic achievement were found in studies by Thorndike (26:329-337), Kazmier (13:195-198), Carter (5:51-56), Wilson (30:283-298), and Samuelson (23:175-182).

Although a large number of investigations have examined the relationship between standardized tests and school achievement, many of these studies are not directly related to this thesis research for two main reasons. Traditionally, most educational studies have been conducted among senior high school and college students. It would be faulty reasoning to assume that the results of the high school and college investigations would be directly related

to the conclusions derived from the Grade 6 and 7 students which were examined in this research. Secondly, most of the studies have used testing instruments which were different from the two objective tests employed in this research.

However, the investigation of Stalnacker (25:41-66) used standardized tests and research methods that were similar to the materials and procedures employed in this thesis. She found that intelligence as measured by the Otis Quick-Scoring Mental Ability Test showed a definite relationship to academic achievement as measured by the Coordinated Scales of Attainment. Table IV has summarized the more pertinent coefficients of correlation computed in her research.

In the past it was thought that intelligence was the primary determinant of scholastic success. Although it is a truism to say that intelligence is significant in most school situations, Humphries and Boynton (12:600-612) have stated that most research data in recent years has tended to indicate that other factors affect the nature and extent of scholastic achievement. Prescott (19:600-612) emphasized the emotional factor in scholastic achievement. G. P. Mason (15:129-130) stated:

The I.Q. of a child is a measure of his ability to respond to certain test questions. It is a measure of his level of functioning in response to test stimuli under relatively controlled conditions. The level of

TABLE IV

COEFFICIENTS OF CORRELATION BETWEEN
THE OTIS QUICK-SCORING MENTAL ABILITY TEST
AND THE ACADEMIC AREAS FROM
THE COORDINATED SCALES OF ATTAINMENT

Academic Area	Correlation
Language Arts	.57
Reading Comprehension	.58
Arithmetic Comprehension	.62
Problem Reasoning	.55

functioning may be seriously depressed by emotional factors, whether situational or chronic.

Getzels and Jackson (10:173-175) stated that I.Q. tests do not measure "creative" activities. These "creative" activities, they consider, are valid criteria for measuring giftedness in children.

B. ACHIEVEMENT TEST SCORES AND ACADEMIC ABILITY

A large number of studies have investigated the relationship between subject matter achievement tests and grades received in those subjects. In typical studies Kohn (14:433-437) and Gates (9:178) found that correlations between achievement test scores and class grades in the same subject usually range from .42 to .70. Ayers (2:17-18) calculated that the prediction of algebra and geometry grades from arithmetic tests was approximately .50; from special aptitude tests .55; and from special aptitude tests and English comprehension combined .60. Williamson (29:1-16) also noted a tendency for the accuracy of scholastic prediction from previous grades to decrease as one moved up the educational ladder. These studies would indicate that the correlational coefficients between achievement test scores and school marks would range approximately from .40 to .70. While the relationship is by no means perfect, the correlations are certainly high enough to warrant the use of achievement tests in evaluating and supplementing the teachers'

grades..

II. THE RELATIONSHIP BETWEEN TEACHERS' SUBJECTIVE RATINGS AND SCHOOL ACHIEVEMENT

In this thesis two subjective evaluations were utilized. They were a teacher's rating of the student's general academic ability in school and a teacher's rating of the pupil's attitude to work. These subjective ratings have a five point and a four point grading scale respectively. In a discussion of rating scales, Cronbach (6:506-538) concluded that a five point scale obtained more discrimination than the "yes-no" check list because the five point scale had the advantage of drawing attention to various kinds of deviation.

However, the subjective evaluations of pupils by teachers are usually less reliable indicators for predicting academic success than standardized tests. Cronbach (6:506) stated that there was a tendency of raters to give favourable reports. Besides the generosity factor, ambiguities may appear in alternative scale positions through a lack of interpreting each scale point meaning precisely. Teacher ratings also contained constant errors and biases. For an example of a constant error and bias, the teachers in this study may be influenced by the objective standardized test results when formulating the subjective ratings of their

pupils.- Limited information and the halo effect may also obscure the pattern of traits within a pupil.

Werner and Gallistel (27:255-260) concluded that the scores of teacher ratings did not prove adequate by themselves for predicting outcomes of an individual's academic achievement. However, they stated that these subjective teacher rating scales seemed more valuable as supplements to I.Q. information obtained from objective standardized tests. This statement was verified in another study which was performed by Morgan (17:300-304). In his study correlations of .664, .710 and .655 were obtained between the Pintner-Cunningham Primary Test, Form A and the first grade teacher rankings of "slow", "average" and "high" ability for beginning pupils. In the same study rho's of .610 and .642 were also obtained between first grade teacher ratings and the Full-Range Picture Vocabulary Test scores for the slow group and fifteen randomly selected students of the high group respectively. He concluded that an experienced first grade teacher could make reasonably competent placement judgments for evaluating slow, average and high ability of pupils in conjunction with standardized test scores.

Most educators who have investigated the academic prediction problem have agreed that objective standardized test scores and subjective teacher ratings when combined together yield higher coefficients of correlation for

predicting academic success than the scores obtained by separate means.

CHAPTER III

RESEARCH PROCEDURES, RESULTS AND IMPLICATIONS

It would be well to recall at this point that the purpose of this study was to discover the effectiveness of elementary school ratings in predicting a student's academic performance during his first year of high school (Grade 7). This chapter presents the research procedures for obtaining the data and the implications drawn from the resultant calculations of this information.

I. RESEARCH PROCEDURES

Data included in this investigation were collected from every Grade 7 student's Permanent Record Card and High School Enrolment Application Card (Appendices A and B) at the Vancouver Technical Secondary School.

Not all Grade 7 Vancouver Technical students were included in this study. The repeating Grade 7 girls' class and the repeating Grade 7 boys' class were both entirely omitted from this investigation. To form the study sample, ten members were randomly selected from each of the five remaining girls' classes and each of the five remaining boys' classes. Random selection was performed by using the table of random numbers in the book, Elementary Statistical Methods In Psychology and Education (4:512-513).

Prior to random selection, the last name of every student in each class was arranged in alphabetical order and numbered in a numerical sequence. If a transferred student was randomly chosen for whom adequate information was not available, he was omitted from the study sample. Fifty girls and fifty boys had been chosen to form the study group after random selection was completed. Opposite each study group member's name, the following data was also recorded:

- (1) a teacher's subjective rating of the student's general academic ability in elementary school,
- (2) a teacher's subjective rating of the pupil's attitude to work in elementary school,
- (3) an Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. score,
- (4) a Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score,
- (5) the Grade 7 English letter grades for language, literature and spelling in the Third Report,
- (6) the Grade 7 social studies letter grade in the Third Report,
- (7) the Grade 7 mathematics letter grade in the Third Report, and
- (8) the Grade 7 science letter grade in the Third

Report.

A. ASSIGNED NUMERICAL VALUES

1. TEACHER'S SUBJECTIVE RATING OF THE STUDENT'S GENERAL ACADEMIC ABILITY IN SCHOOL

For statistical calculations numerical values were assigned to the five letter rating scale of A, B, C, D and E in the following way.

"A" was assigned a value of 4.

"B" was assigned a value of 3.

"C" was assigned a value of 2.

"D" was assigned a value of 1.

"E" was assigned a value of 0.

Several students were rated half way between the regular letter grades of B, C and D. These ratings which were "C+" and "C-" were assigned the intermediate numerical values of 2.5 and 1.5 respectively.

2. TEACHER'S SUBJECTIVE RATING OF THE PUPIL'S ATTITUDE TO WORK IN SCHOOL

In maintaining a consistent policy of assigning the highest numerical values for the most superior ratings, the following scheme was devised.

A rating of "1" or Excellent was assigned a numerical value of 4.

A rating of "2" or Good was assigned a numerical value of 3.

A rating of "3" or Fair was assigned a numerical value of 2.

A rating of "4" or Poor was assigned a numerical value of 1.

This four point rating by the elementary school teacher was based upon his or her judgment as to how well the student was working at his sixth grade schoolwork. Admittedly, this method of evaluation is largely subjective; but at the present time it remains the only criterion used for judging a pupil's attitude to work in school.

3. OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY

The range of I.Q.'s in the study sample was from 73 to 136. This range was divided into eight equal groups. Each group consisted of intervals of eight I.Q. score units. A numerical value was assigned to each group. The interval limits and the assigned numerical values for each group were as follows.

I.Q.'s of 129-136 were assigned a numerical value of 4.

I.Q.'s of 121-128 were assigned a numerical value of 3.5.

I.Q.'s of 113-120 were assigned a numerical value of 3.

I.Q.'s of 105-112 were assigned a numerical value of 2.5.

I.Q.'s of 97-104 were assigned a numerical value of 2.

I.Q.'s of 89-96 were assigned a numerical value of 1.5.

I.Q.'s of 81-88 were assigned a numerical value of 1.

I.Q.'s of 73-80 were assigned a numerical value of .5.

4. STANFORD ACHIEVEMENT TEST

For the study group the range of equivalent grade scores was from 4.4 to 11.0. Table V shows how the scores of the Stanford Achievement Test (Intermediate Battery Partial: Form J) were grouped and were assigned their numerical values.

5. GRADE 7 ACADEMIC LETTER GRADES

In the Third Report for the Grade 7 study group, the seven letter grades were assigned numerical values as follows.

"A" letter grades were assigned numerical values of 4.

"B" letter grades were assigned numerical values of 3.

TABLE V
ASSIGNED NUMERICAL VALUES
OF THE GROUPED GRADE EQUIVALENT SCORES
OF THE STANFORD ACHIEVEMENT TEST

Grade Equivalent Score	Assigned Numerical Value
11.0-11.9	4.0
10.0-10.9	3.5
9.0- 9.9	3.0
8.0- 8.9	2.5
7.0- 7.9	2.0
6.0- 6.9	1.5
5.0- 5.9	1.0
4.0- 4.9	.5

"C+" letter grades were assigned numerical values of 2.5.

"C" letter grades were assigned numerical values of 2.

"C-" letter grades were assigned numerical values of 1.5.

"D" letter grades were assigned numerical values of 1.

"E" letter grades were assigned numerical values of 0.

The assigned numerical values for Grade 7 academic letter grades were the same as the assigned values for the letter ratings of the students' general academic ability in elementary school.

To find each student's average English letter grade upon which all further calculations were performed, the numerical values of the language, literature and spelling letter grades were divided by three. This division calculation produced the average English letter grade numerical value which was rounded off to the nearest tenth decimal place. Hence, it was often possible for the average English letter grade to have intermediate values between the assigned numerical values as for example 3.2 and 1.7.

In summary, all study sample data for:

- (1) a teacher's subjective rating of the student's general academic ability in elementary school,

- (2) a teacher's subjective rating of the pupil's attitude to work in elementary school,
- (3) an Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. score,
- (4) a Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score,
- (5) the Grade 7 English letter grades for language, literature and spelling in the Third Report,
- (6) the Grade 7 social studies letter grade in the Third Report,
- (7) the Grade 7 mathematics letter grade in the Third Report, and
- (8) the Grade 7 science letter grade in the Third Report

were grouped and assigned numerical values of 4, 3, 2, 1 and 0. Letter grades of C+ and C- which occurred between the regular assigned values were given intermediate values of 2.5 and 1.5 respectively. Also average English letter grades were calculated from the assigned values and rounded off to the nearest tenth decimal place.

B. CORRELATION

When the assigned values had been tabulated, a method of making a comparison between the Grade 7 academic letter

grades and the elementary school ratings was needed. The equation most commonly used in educational research for the purpose of comparing two sets of data was the following Pearson product-moment coefficient of correlation formula (4:391).

$$r = \frac{\sum X_i Y_i - \frac{(\sum X_i)(\sum Y_i)}{N}}{\sqrt{\left[\sum X_i^2 - \frac{(\sum X_i)^2}{N} \right] \left[\sum Y_i^2 - \frac{(\sum Y_i)^2}{N} \right]}}$$

The correlation formula used in this investigation was a modified form of the above equation. Each of the terms in the Pearson product-moment coefficient of correlation formula was multiplied by N to form the modified formula. After algebraic computation the derived formula which was used in this study to compute the coefficients of correlation was:

$$r = \frac{N \sum X_i Y_i - (\sum X_i)(\sum Y_i)}{\sqrt{\left[N \sum X_i^2 - (\sum X_i)^2 \right] \left[N \sum Y_i^2 - (\sum Y_i)^2 \right]}}$$

Basically, the two formulas of correlation produce exactly the same results. Computational procedures for using the modified formula are explained in Appendix F. A sample calculation is shown in Appendix G.

In the Grade 7 girls' study group, Pearson product-

moment coefficients of correlation were calculated for each of the following pairs of data:

- (1) the teachers' subjective ratings of each student's general academic ability in elementary school and the average Grade 7 English letter grades in the Third Report,
- (2) the teachers' subjective ratings of each pupil's attitude to work in elementary school and the average Grade 7 English letter grades in the Third Report,
- (3) the Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. scores and the average Grade 7 English letter grades in the Third Report,
- (4) the Stanford Achievement (Intermediate Battery Partial: Form J) grade equivalent scores and the average Grade 7 English letter grades in the Third Report,
- (5) the teachers' subjective ratings of each student's general academic ability in elementary school and the Grade 7 social studies letter grades in the Third Report,
- (6) the teachers' subjective ratings of each pupil's attitude to work in elementary school and the Grade 7 social studies letter grades in the

- Third Report,
- (7) the Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. scores and the Grade 7 social studies letter grades in the Third Report,
 - (8) the Stanford Achievement (Intermediate Battery Partial: Form J) grade equivalent scores and the Grade 7 social studies letter grades in the Third Report,
 - (9) the teachers' subjective ratings of each student's general academic ability in elementary school and the Grade 7 mathematics letter grades in the Third Report,
 - (10) the teachers' subjective ratings of each pupil's attitude to work in elementary school and the Grade 7 mathematics letter grades in the Third Report,
 - (11) the Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. scores and the Grade 7 mathematics letter grades in the Third Report,
 - (12) the Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent scores and the Grade 7 mathematics letter grades in the Third Report,

- (13) the teachers' subjective ratings of each student's general academic ability in elementary school and the Grade 7 science letter grades in the Third Report,
- (14) the teachers' subjective ratings of each pupil's attitude to work in elementary school and the Grade 7 science letter grades in the Third Report,
- (15) the Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. scores and the Grade 7 science letter in the Third Report, and
- (16) the Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent scores and the Grade 7 science letter grades in the Third Report.

From data in the boys' study group, coefficients of correlation were also separately calculated between the same sixteen relationships that were listed above.

C. PREDICTION

For both the girls' and the boys' study groups, prediction formulas were computed between the sixteen relationships from which coefficients of correlation were calculated. In the generalized prediction formula, $Y = bX + c$, the constants b and c were found by the formulas:

$$b = \frac{\sum x_i y_i}{\sum x_i^2} = \frac{\sum x_i y_i - \frac{(\sum x_i)(\sum y_i)}{N}}{\sum x_i^2 - \frac{(\sum x_i)^2}{N}} = \frac{N \sum x_i y_i - \sum x_i \sum y_i}{N \sum x_i^2 - (\sum x_i)^2}$$

The numerical value of b was then substituted in the next formula with \bar{X} and \bar{Y} to find c .

$$c = \bar{Y} - b\bar{X} \quad \bar{X} = \text{mean or arithmetic average of one set of data}$$

$$\bar{Y} = \text{mean or arithmetic average of the second set of data}$$

Then both the computed constants b and c were substituted in the generalized prediction formula: $Y = bX + c$.

With a completed prediction formula, the assigned numerical value of X (an elementary school rating) can be substituted into the equation with the necessary constants b and c to find the assigned numerical value of Y (a predicted Grade 7 academic letter grade).

II. RESULTS

A. COEFFICIENTS OF CORRELATION

The coefficients of correlation that were computed are listed in Tables VI and VII for the girls' and the boys' study samples respectively. These correlation coefficients were calculated between the four elementary school ratings and the letter grades in each of the selected Grade 7 academic

TABLE VI

COEFFICIENTS OF CORRELATION*
 BETWEEN GRADE 7 ACHIEVEMENT IN ACADEMIC SUBJECTS
 AND ELEMENTARY SCHOOL RATINGS
 FOR THE GIRLS' STUDY GROUP

Elementary School Rating**	Grade 7 Academic Subject			
	English	Social Studies	Mathematics	Science
T.R.	.80	.82	.82	.75
A.W.	.64	.49	.61	.45
I.Q.	.79	.71	.74	.71
S.A.T.	.77	.69	.70	.69

*All correlation coefficients are significant at the 1% level of confidence.

**Key to the elementary school rating abbreviations is located on the second page following.

TABLE VII

COEFFICIENTS OF CORRELATION*
 BETWEEN GRADE 7 ACHIEVEMENT IN ACADEMIC SUBJECTS
 AND ELEMENTARY SCHOOL RATINGS
 FOR THE BOYS' STUDY GROUP

Elementary School Rating**	Grade 7 Academic Subject			
	English	Social Studies	Mathematics	Science
T.R.	.79	.82	.70	.80
A.W.	.71	.73	.61	.66
I.Q.	.81	.79	.69	.79
S.A.T.	.74	.75	.66	.76

*All correlation coefficients are significant at the 1% level of confidence.

**Key to the elementary school rating abbreviations is located on the next page.

TABLES VI AND VII (continued)

COEFFICIENTS OF CORRELATION
 BETWEEN GRADE 7 ACHIEVEMENT IN ACADEMIC SUBJECTS
 AND ELEMENTARY SCHOOL RATINGS
 FOR THE GIRLS' STUDY GROUP
 AND
 FOR THE BOYS' STUDY GROUP

KEY TO THE ABBREVIATIONS

Abbreviation	Meaning
T.R.	= Teacher's subjective rating of the student's general academic ability in elementary school
A.W.	= Teacher's subjective rating of the pupil's attitude to work in elementary school
I.Q.	= Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. score
S.A.T.	= Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score

subject areas.

B. PREDICTION FORMULAS

Besides the calculations of correlation coefficients, prediction formulas were also computed in this research. In each prediction formula ($Y = bX + c$), a numerical value of X (an elementary school rating) can be substituted into the appropriate equation with the necessary constants b and c to find an approximate assigned numerical value of Y (a predicted Grade 7 academic letter grade). If the calculated answers of the predicted letter grades varied in each subject area, the average of the numerical answers would provide the most reliable estimate. This average numerical value should then be rounded off to the nearest assigned value of 4, 3, 2.5, 2, 1.5, 1 or 0 to find the predicted Grade 7 academic letter grade in a specific subject for the Third Report.

In the following formulas the first sixteen equations may be applied to predict a girl's academic achievement. Grade 7 boys' academic achievement may be found through applying formulas seventeen to thirty-two. The formulas were also divided into groups of four according to each academic subject area. Bracketed abbreviations which were used in the formulas are preceded by a brief definition.

The following formulas were developed from the separated data of the girls' and boys' study samples. These

formulas may be used to accurately predict the academic achievement of future Grade 7 students only to the extent that it may be assumed that the group in this study is representative of another year's group.

Formulas for predicting a girl's average Grade 7 English letter grade in the Third Report (Girl's En. L.G.) from:

- (1) the teacher's subjective rating of the student's general academic ability in elementary school (T.R.).

$$(\text{Girl's En. L.G.}) = .5(\text{T.R.}) + 1.2$$

- (2) the teacher's subjective rating of the pupil's attitude to work in elementary school (A.W.).

$$(\text{Girl's En. L.G.}) = .8(\text{A.W.}) - .2$$

- (3) the Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. score (I.Q.).

$$(\text{Girl's En. L.G.}) = .8(\text{I.Q.}) + .2$$

- (4) the Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score (S.A.T.).

$$(\text{Girl's En. L.G.}) = .9(\text{S.A.T.}) + .3$$

Formulas for predicting a girl's Grade 7 social studies letter grade in the Third Report (Girl's S.S. L.G.) from:

- (5) the teacher's subjective rating of the student's general academic ability in elementary school (T.R.).

$$(\text{Girl's S.S. L.G.}) = .6(\text{T.R.}) + .8$$

- (6) the teacher's subjective rating of the pupil's attitude to work in elementary school (A.W.).

$$(\text{Girl's S.S. L.G.}) = .7(\text{A.W.}) - .3$$

- (7) the Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. score (I.Q.).

$$(\text{Girl's S.S. L.G.}) = .9(\text{I.Q.}) - .3$$

- (8) the Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score (S.A.T.).

$$(\text{Girl's S.S. L.G.}) = 1.0(\text{S.A.T.}) - .1$$

Formulas for predicting a girl's Grade 7 mathematics letter grade in the Third Report (Girl's Ma. L.G.) from:

- (9) the teacher's subjective rating of the student's general academic ability in elementary school (T.R.).

$$(\text{Girl's Ma. L.G.}) = .6(\text{T.R.}) + .6$$

- (10) the teacher's subjective rating of the pupil's attitude to work in elementary school (A.W.).

$$(\text{Girl's Ma. L.G.}) = .8(\text{A.W.}) - .9$$

- (11) the Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B,

C or D) I.Q. score (I.Q.).

$$(\text{Girl's Ma. L.G.}) = .9(\text{I.Q.}) - .4$$

(12) the Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score (S.A.T.).

$$(\text{Girl's Ma. L.G.}) = 1.0(\text{S.A.T.}) - .2$$

Formulas for predicting a girl's Grade 7 science letter grade in the Third Report (Girl's Sc. L.G.) from:

(13) the teacher's subjective rating of the student's general academic ability in elementary school (T.R.).

$$(\text{Girl's Sc. L.G.}) = .5(\text{T.R.}) + 1.1$$

(14) the teacher's subjective rating of the pupil's attitude to work in elementary school (A.W.).

$$(\text{Girl's Sc. L.G.}) = .6(\text{A.W.}) + .3$$

(15) the Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. score (I.Q.).

$$(\text{Girl's Sc. L.G.}) = .8(\text{I.Q.}) + .1$$

(16) the Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score (S.A.T.).

$$(\text{Girl's Sc. L.G.}) = .9(\text{S.A.T.}) + .2$$

Formulas for predicting a boy's average Grade 7 English letter grade in the Third Report (Boy's En. L.G.) from:

- (17) the teacher's subjective rating of the student's general academic ability in elementary school (T.R.).

$$(\text{Boy's En. L.G.}) = .8(\text{T.R.}) + .4$$

- (18) the teacher's subjective rating of the pupil's attitude to work in elementary school (A.W.).

$$(\text{Boy's En. L.G.}) = .8(\text{A.W.}) - .5$$

- (19) the Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. score (I.Q.).

$$(\text{Boy's En. L.G.}) = .9(\text{I.Q.}) - .3$$

- (20) the Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score (S.A.T.).

$$(\text{Boy's En. L.G.}) = 1.2(\text{S.A.T.}) - .7$$

Formulas for predicting a boy's Grade 7 social studies letter grade in the Third Report (Boy's S.S. L.G.) from:

- (21) the teacher's subjective rating of the student's general academic ability in elementary school (T.R.).

$$(\text{Boy's S.S. L.G.}) = .9(\text{T.R.}) + .2$$

- (22) the teacher's subjective rating of the pupil's attitude to work in elementary school (A.W.).

$$(\text{Boy's S.S. L.G.}) = 1.0(\text{A.W.}) - .7$$

- (23) the Otis Self-Administering Test of Mental

Ability (Intermediate Examination: Form A, B, C or D) I.Q. score (I.Q.).

$$(\text{Boy's S.S. L.G.}) = 1.0(\text{I.Q.}) - .2$$

(24) the Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score (S.A.T.).

$$(\text{Boy's S.S. L.G.}) = 1.4(\text{S.A.T.}) - .7$$

Formulas for predicting a boy's Grade 7 mathematics letter grade in the Third Report (Boy's Ma. L.G.) from:

(25) the teacher's subjective rating of the student's general academic ability in elementary school (T.R.).

$$(\text{Boy's Ma. L.G.}) = .7(\text{T.R.}) + .7$$

(26) the teacher's subjective rating of the pupil's attitude to work in elementary school (A.W.).

$$(\text{Boy's Ma. L.G.}) = .7(\text{A.W.}) + 0$$

(27) the Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. score (I.Q.).

$$(\text{Boy's Ma. L.G.}) = .8(\text{I.Q.}) + .3$$

(28) the Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score (S.A.T.).

$$(\text{Boy's Ma. L.G.}) = 1.1(\text{S.A.T.}) - .2$$

Formulas for predicting a boy's Grade 7 science letter grade in the Third Report (Boy's Sc. L.G.) from:

(29) the teacher's subjective rating of the student's general academic ability in elementary school (T.R.).

$$(\text{Boy's Sc. L.G.}) = .9(\text{T.R.}) + .4$$

(30) the teacher's subjective rating of the pupil's attitude to work in elementary school (A.W.).

$$(\text{Boy's Sc. L.G.}) = .8(\text{A.W.}) - .3$$

(31) the Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. score (I.Q.).

$$(\text{Boy's Sc. L.G.}) = .9(\text{I.Q.}) - .1$$

(32) the Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score (S.A.T.).

$$(\text{Boy's Sc. L.G.}) = 1.3(\text{S.A.T.}) - .7$$

C. PREDICTION LINES

From the prediction formulas, prediction lines were plotted in graphs between the following two variable sets of general data:

- (1) elementary school ratings, and
- (2) Grade 7 academic achievement.

To interpret the academic achievement for a future Grade 7 student, the elementary school rating is found on the vertical Y-axis of the appropriate graph. The mark on

the Y-axis is horizontally followed to the prediction line. The point at which the Y-axis mark intersects with the prediction line is then followed vertically to the X-axis and the predicted Grade 7 academic letter grade can be approximately estimated. Although this method of interpolation only provides a crude estimate of academic achievement, it eliminates the tedious mathematical substitutions and calculations that are necessary for solving the prediction formulas.

In the following pages, the numbers for each prediction line figure correspond to the Arabic numbers for the appropriate prediction formulas which were printed on the previous pages. Hence, the prediction formulas are depicted by the prediction line figures in an identical sequence. Bracketed abbreviations in the following figures represent the Grade 6 and Grade 7 ratings. Unbracketed numbers represent the numerical values which were assigned to the elementary and high school ratings.

III. IMPLICATIONS

Throughout this investigation there has been a preponderance of evidence to show a definite correlative relationship between a student's ratings received from his elementary school and the letter grades acquired from his Grade 7 academic achievement. Correlation coefficients

PREDICTION LINE GRAPHS

PREDICTION LINE GRAPHS
FOR GIRLS' GRADE 7 ACADEMIC ACHIEVEMENT

PREDICTION LINE GRAPHS
FOR A GIRL'S AVERAGE GRADE 7 ENGLISH LETTER GRADE
IN THE THIRD REPORT

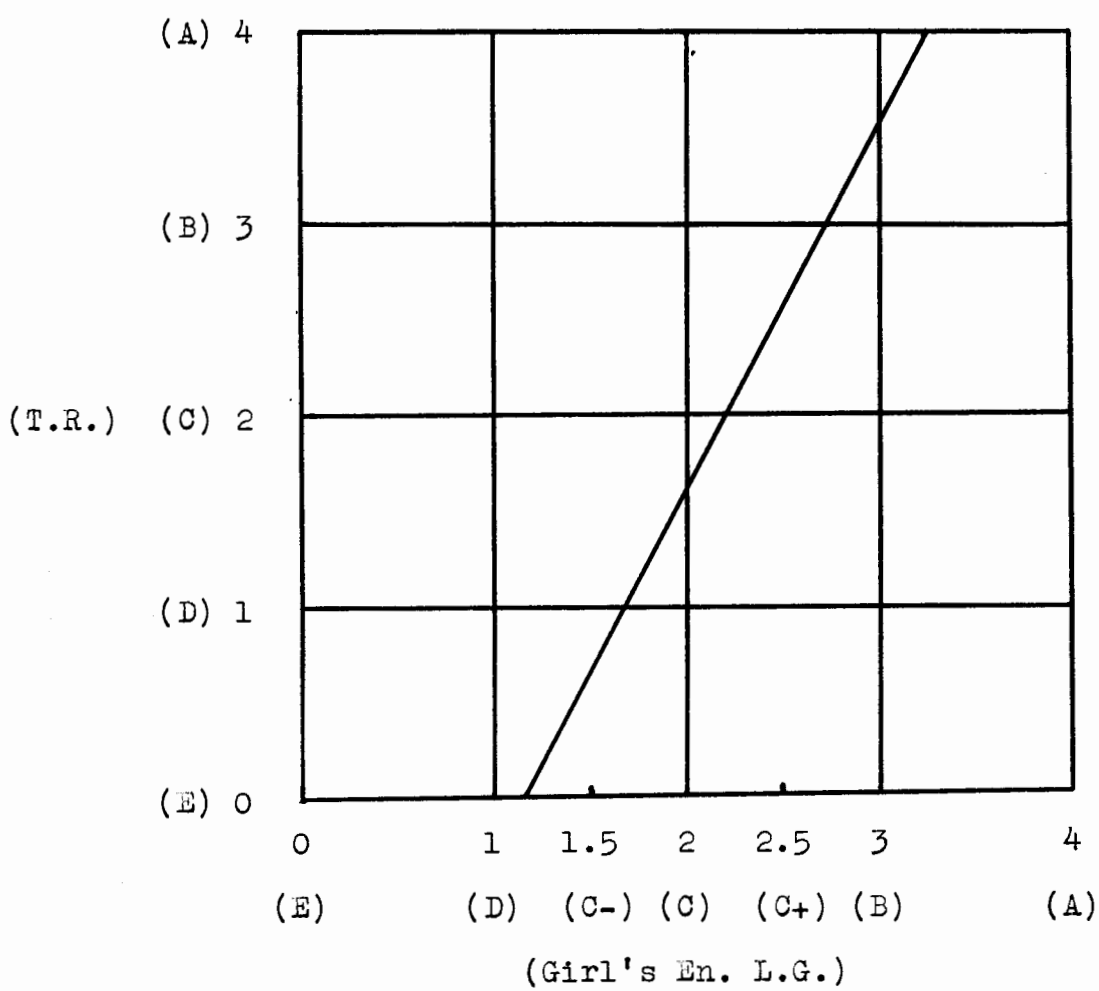


FIGURE 1

PREDICTION LINE
 FOR A GIRL'S AVERAGE GRADE 7 ENGLISH LETTER GRADE
 IN THE THIRD REPORT (Girl's En. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE STUDENT'S GENERAL ACADEMIC ABILITY
 IN ELEMENTARY SCHOOL (T.R.)

$$\text{Girl's En. L.G.} = .5(\text{T.R.}) + 1.2$$

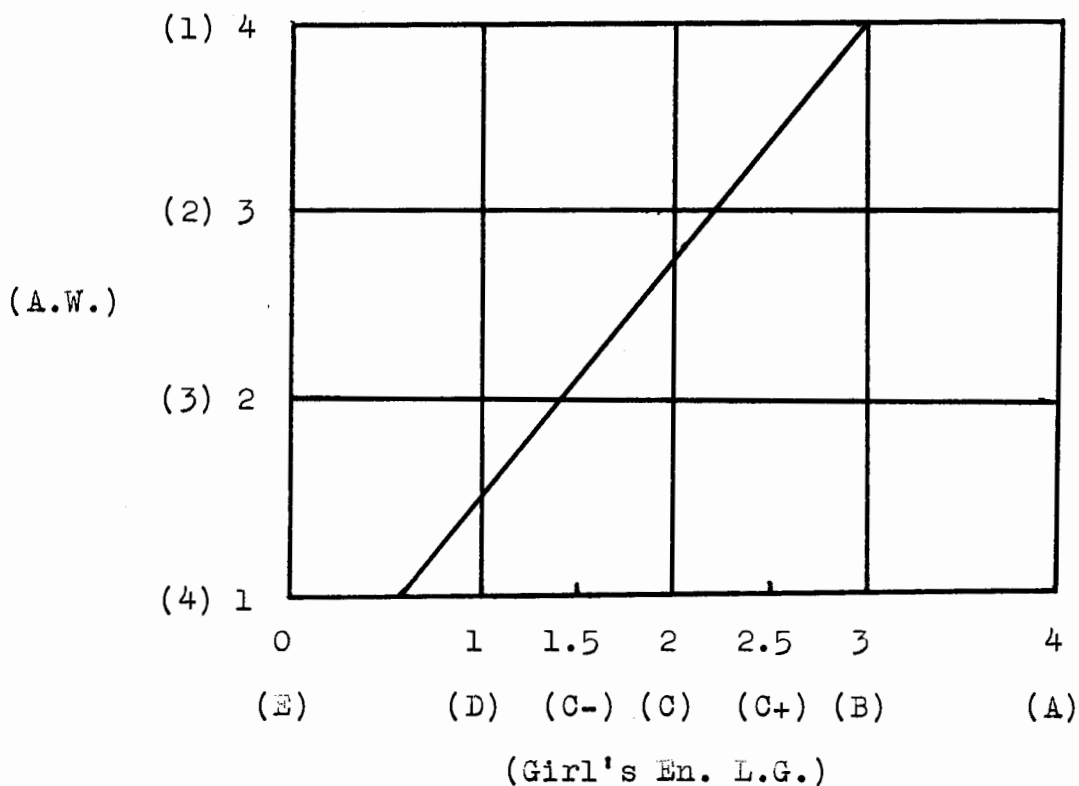


FIGURE 2

PREDICTION LINE
 FOR A GIRL'S AVERAGE GRADE 7 ENGLISH LETTER GRADE
 IN THE THIRD REPORT (Girl's En. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE PUPIL'S ATTITUDE TO WORK
 IN ELEMENTARY SCHOOL (A.W.)

$$\text{Girl's En. L.G.} = .8(\text{A.W.}) - .2$$

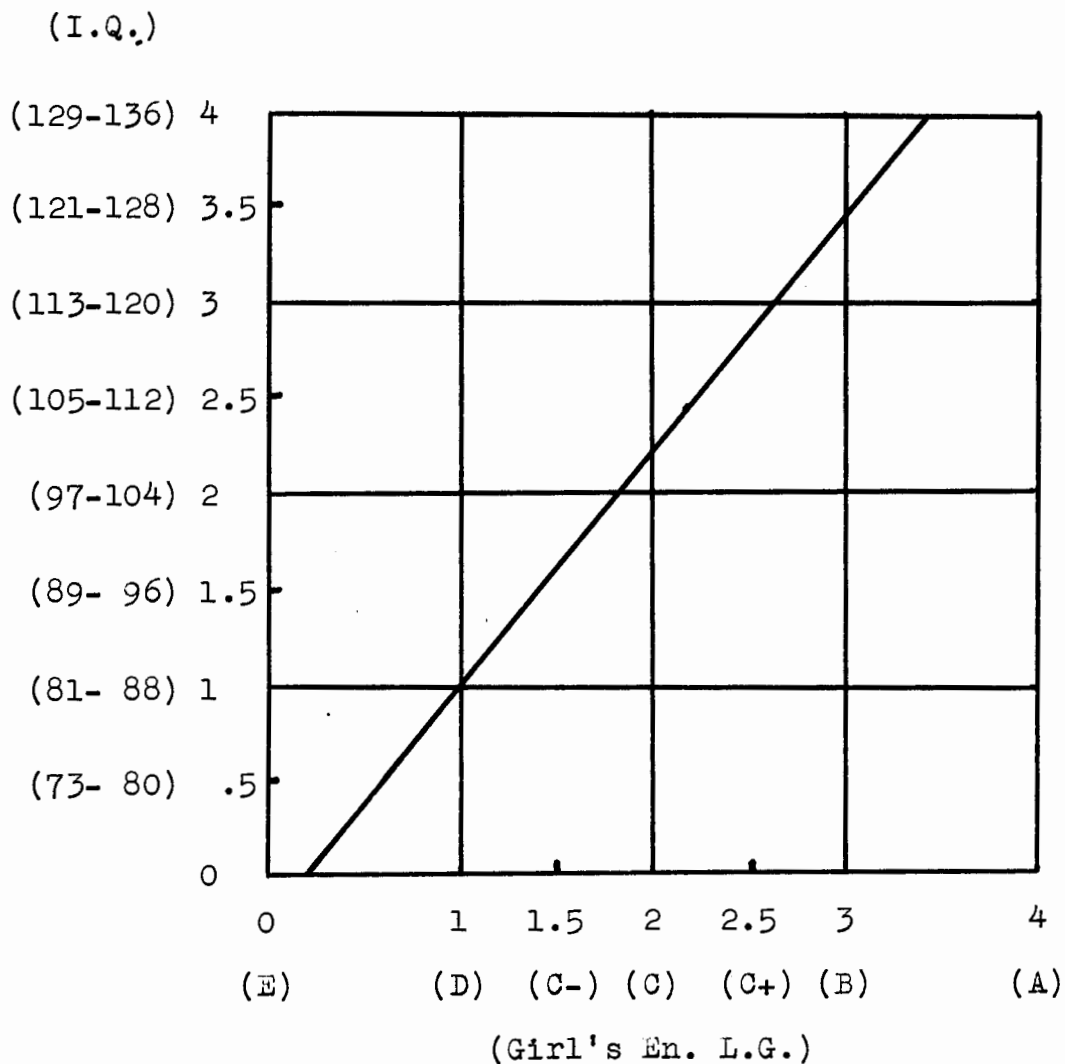


FIGURE 3

PREDICTION LINE
 FOR A GIRL'S AVERAGE GRADE 7 ENGLISH LETTER GRADE
 IN THE THIRD REPORT (Girl's En. L.G.)
 FROM THE OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY
 (INTERMEDIATE EXAMINATION: FORM A, B, C OR D)
 I.Q. SCORE (I.Q.)

$$\text{Girl's En. L.G.} = .8(\text{I.Q.}) + .2$$

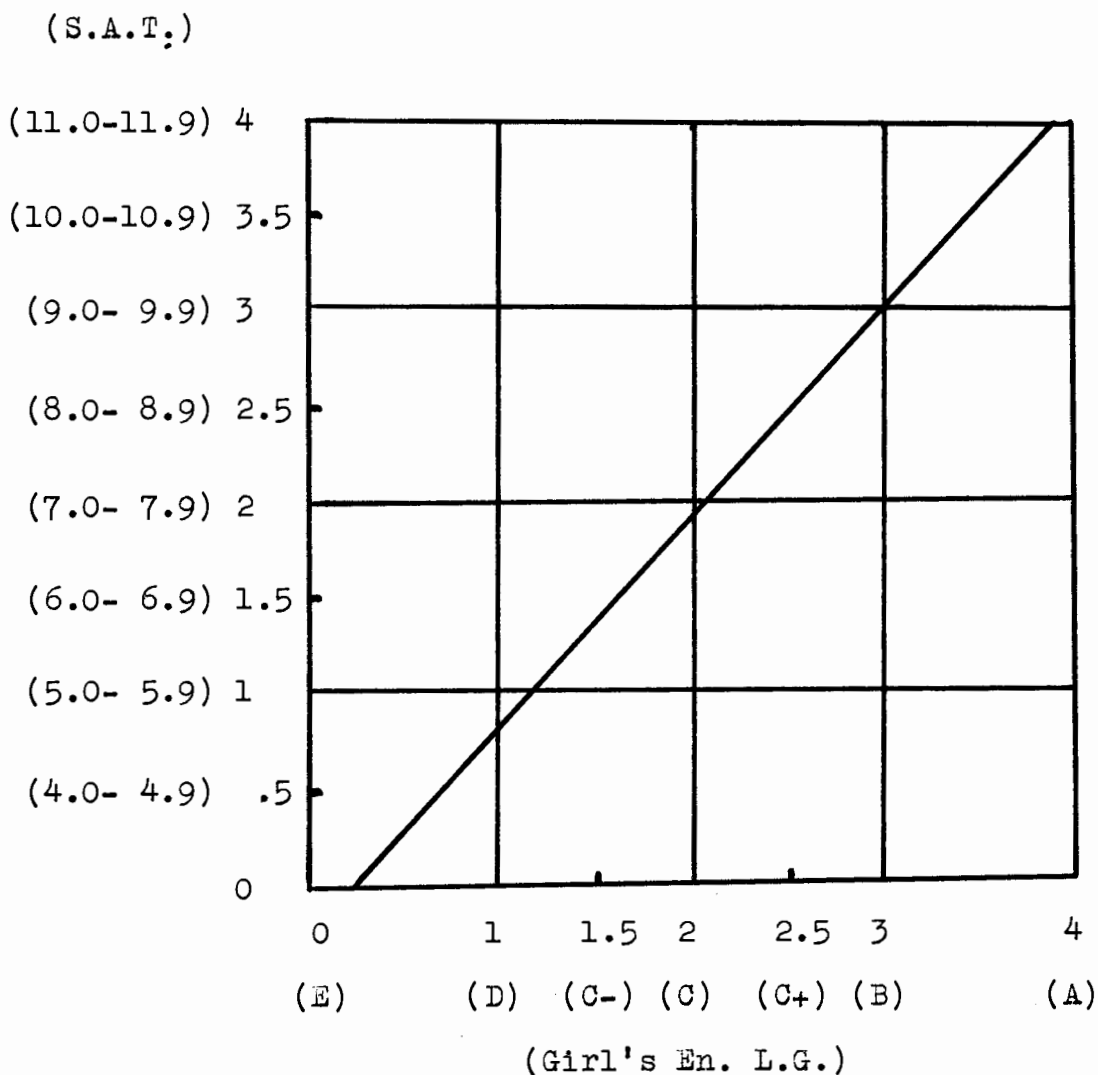


FIGURE 4

PREDICTION LINE
 FOR A GIRL'S AVERAGE GRADE 7 ENGLISH LETTER GRADE
 IN THE THIRD REPORT (Girl's En. L.G.)
 FROM THE STANFORD ACHIEVEMENT TEST
 (INTERMEDIATE BATTERY PARTIAL: FORM J)
 GRADE EQUIVALENT SCORE (S.A.T.)

$$\text{Girl's En. L.G.} = .9(\text{S.A.T.}) + .3$$

PREDICTION LINE GRAPHS
FOR A GIRL'S GRADE 7 SOCIAL STUDIES LETTER GRADE
IN THE THIRD REPORT

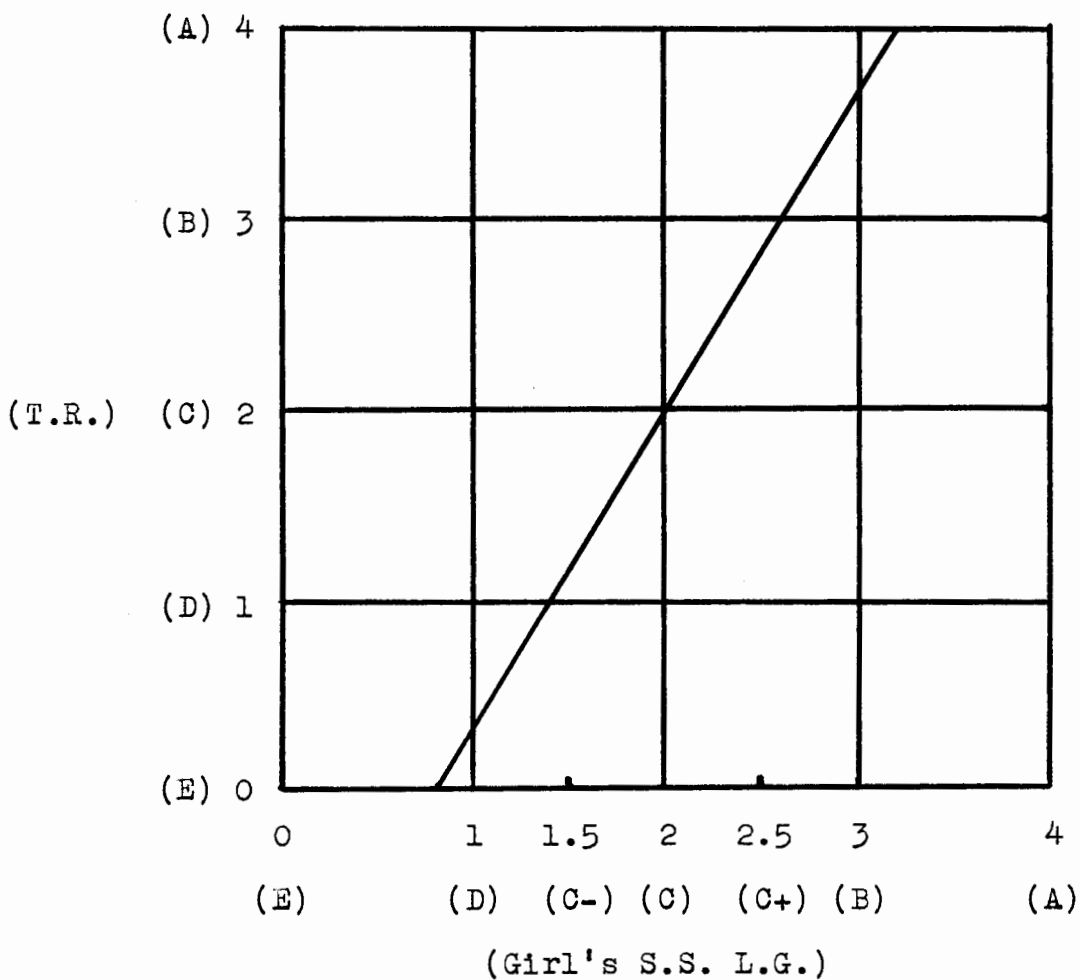


FIGURE 5

PREDICTION LINE
 FOR A GIRL'S GRADE 7 SOCIAL STUDIES LETTER GRADE
 IN THE THIRD REPORT (Girl's S.S. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE STUDENT'S GENERAL ACADEMIC ABILITY
 IN ELEMENTARY SCHOOL (T.R.)

$$\text{Girl's S.S. L.G.} = .6(\text{T.R.}) + .8$$

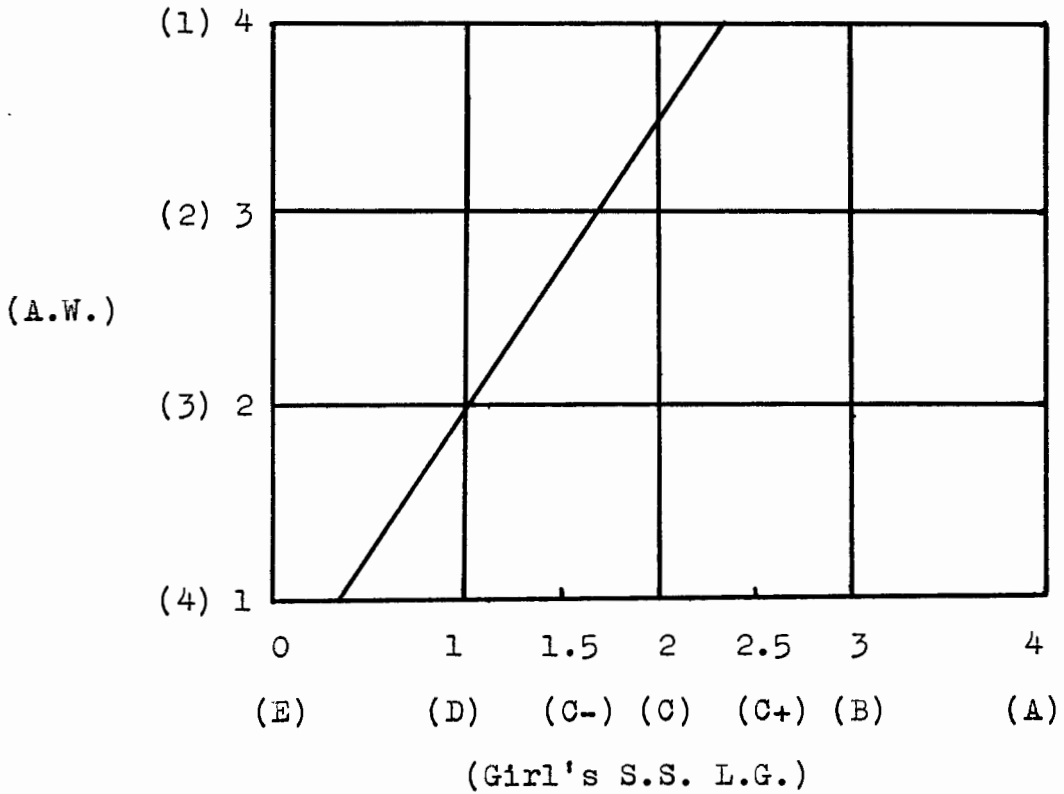


FIGURE 6

PREDICTION LINE
 FOR A GIRL'S GRADE 7 SOCIAL STUDIES LETTER GRADE
 IN THE THIRD REPORT (Girl's S.S. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE PUPIL'S ATTITUDE TO WORK
 IN ELEMENTARY SCHOOL (A.W.)

$$\text{Girl's S.S. L.G.} = .7(\text{A.W.}) - .3$$

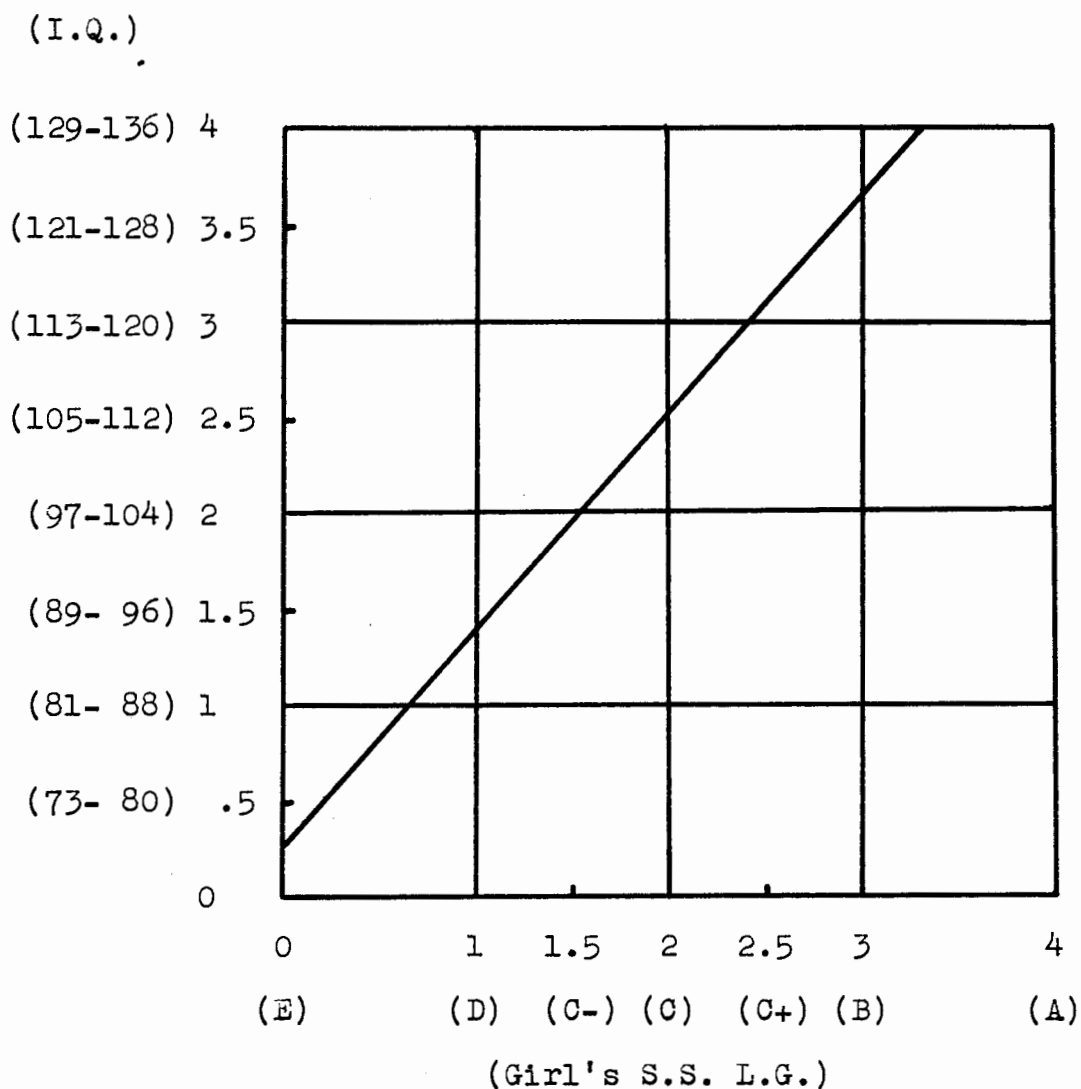


FIGURE 7

PREDICTION LINE
 FOR A GIRL'S GRADE 7 SOCIAL STUDIES LETTER GRADE
 IN THE THIRD REPORT (Girl's S.S. L.G.)
 FROM THE OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY
 (INTERMEDIATE EXAMINATION: FORM A, B, C OR D)
 I.Q. SCORE (I.Q.)

$$\text{Girl's S.S. L.G.} = .9(\text{I.Q.}) - .3$$

(S.A.T.)

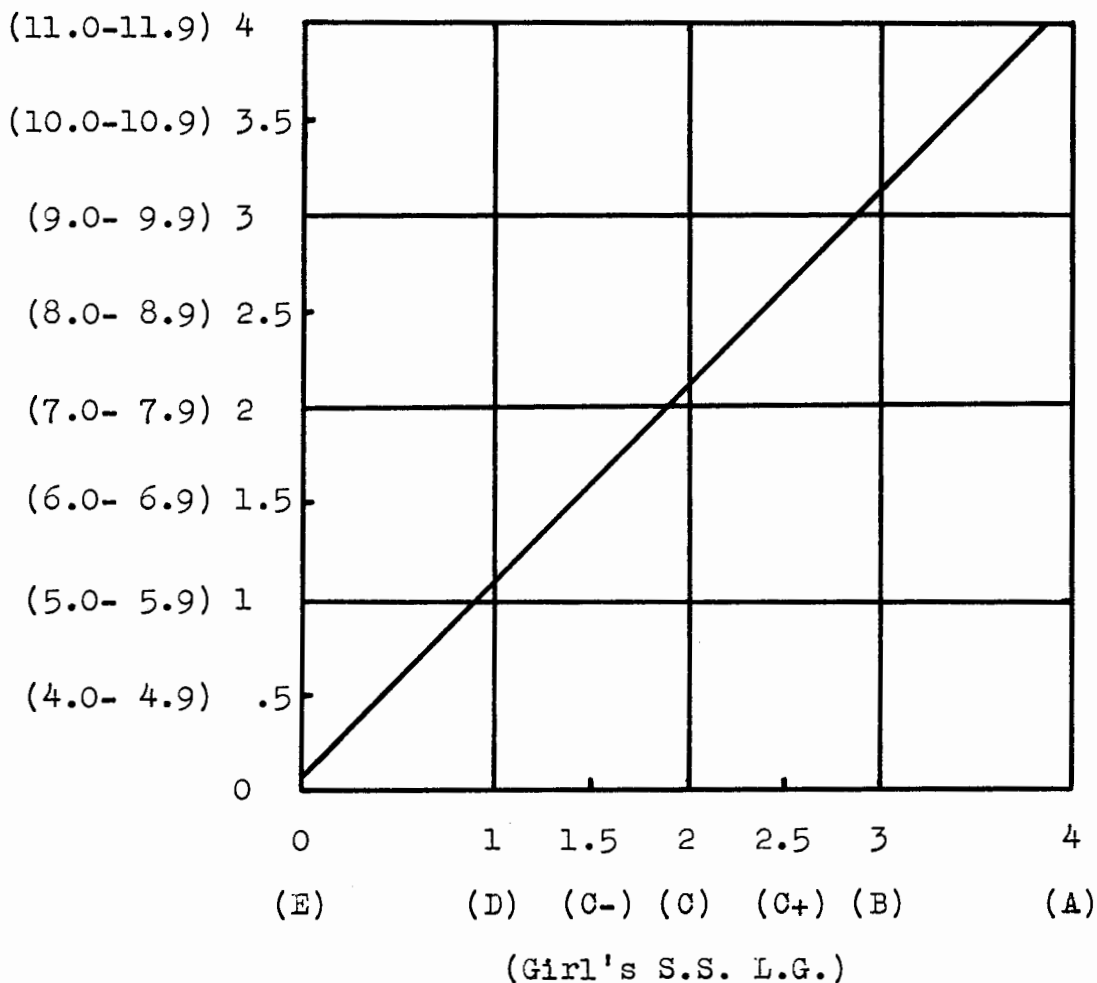


FIGURE 8

PREDICTION LINE
 FOR A GIRL'S GRADE 7 SOCIAL STUDIES LETTER GRADE
 IN THE THIRD REPORT (Girl's S.S. L.G.)
 FROM THE STANFORD ACHIEVEMENT TEST
 (INTERMEDIATE BATTERY PARTIAL: FORM J)
 GRADE EQUIVALENT SCORE (S.A.T.)

$$\text{Girl's S.S. L.G.} = 1.0(\text{S.A.T.}) - .1$$

PREDICTION LINE GRAPHS
FOR A GIRL'S GRADE 7 MATHEMATICS LETTER GRADE
IN THE THIRD REPORT

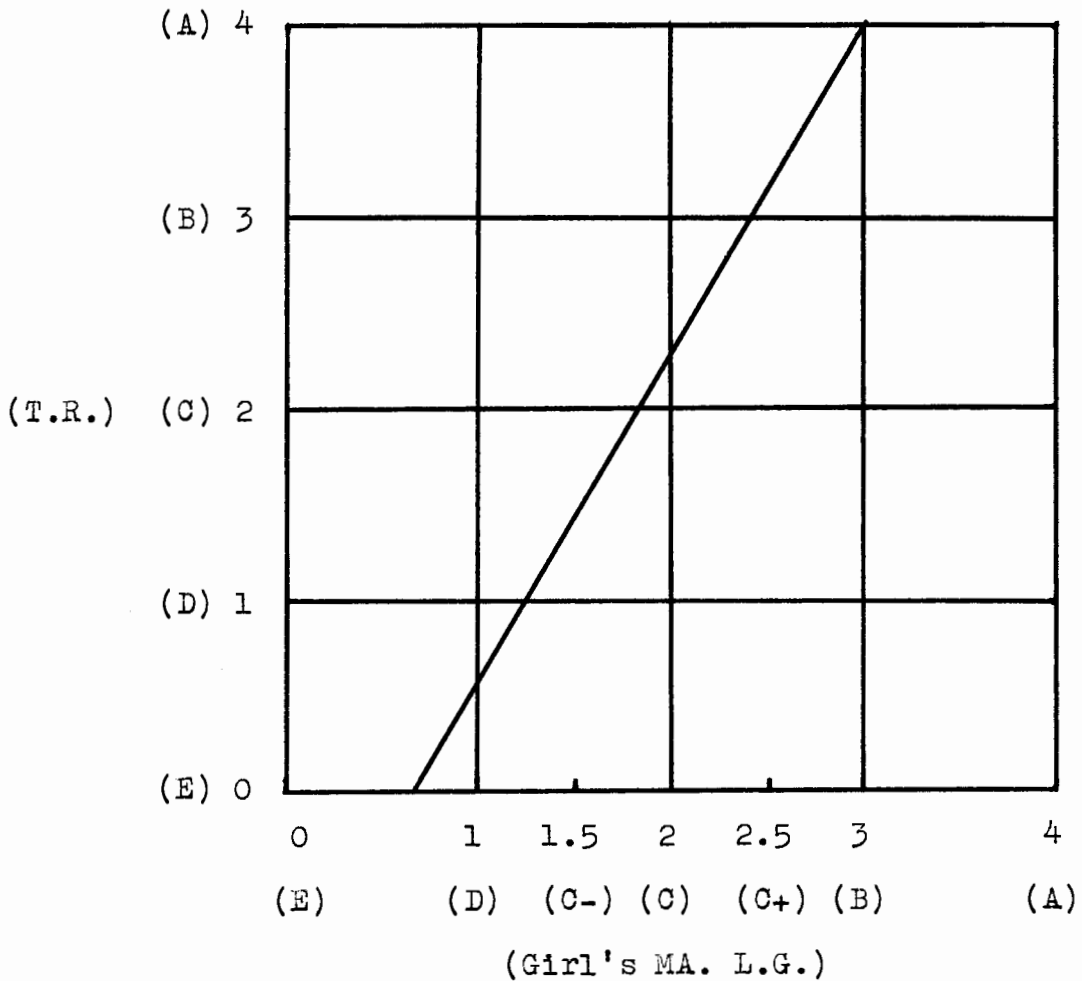


FIGURE 9

PREDICTION LINE
 FOR A GIRL'S GRADE 7 MATHEMATICS LETTER GRADE
 IN THE THIRD REPORT (Girl's Ma. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE STUDENT'S GENERAL ACADEMIC ABILITY
 IN ELEMENTARY SCHOOL (T.R.)

$$\text{Girl's Ma. L.G.} = .6(\text{T.R.}) + .6$$

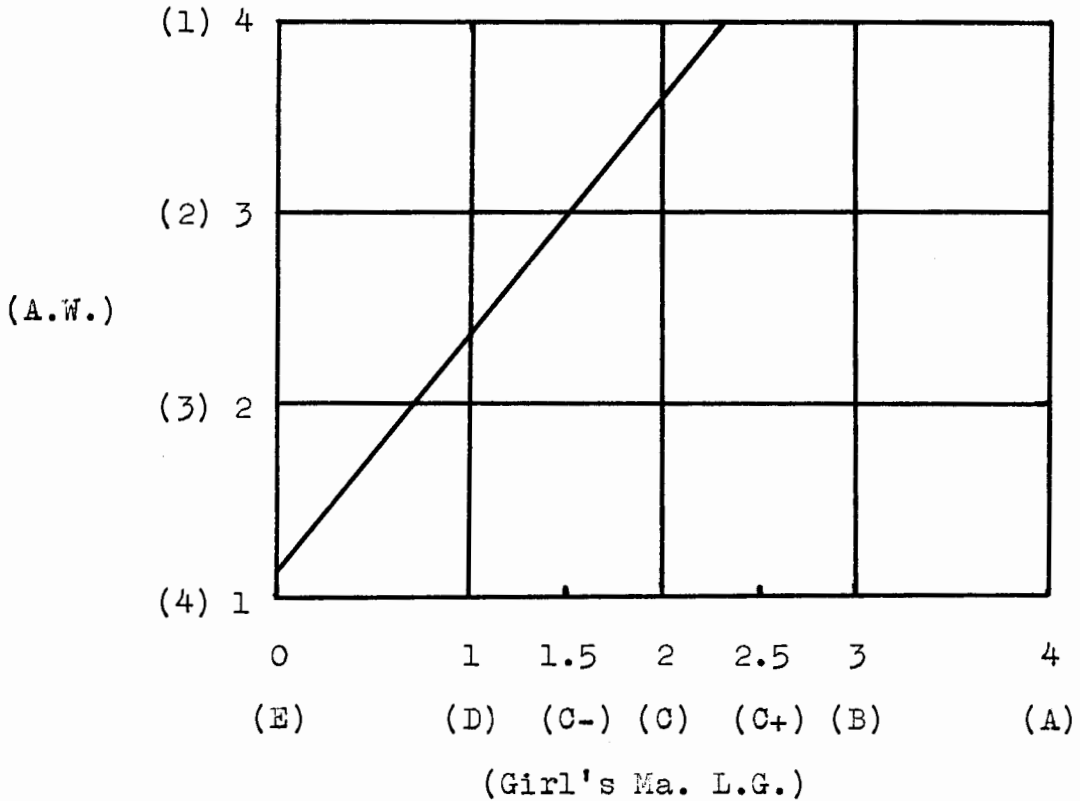


FIGURE 10

PREDICTION LINE
 FOR A GIRL'S GRADE 7 MATHEMATICS LETTER GRADE
 IN THE THIRD REPORT (Girl's Ma. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE PUPIL'S ATTITUDE TO WORK
 IN ELEMENTARY SCHOOL (A.W.)

$$\text{Girl's Ma. L.G.} = .8(\text{A.W.}) - .9$$

(I.Q.)

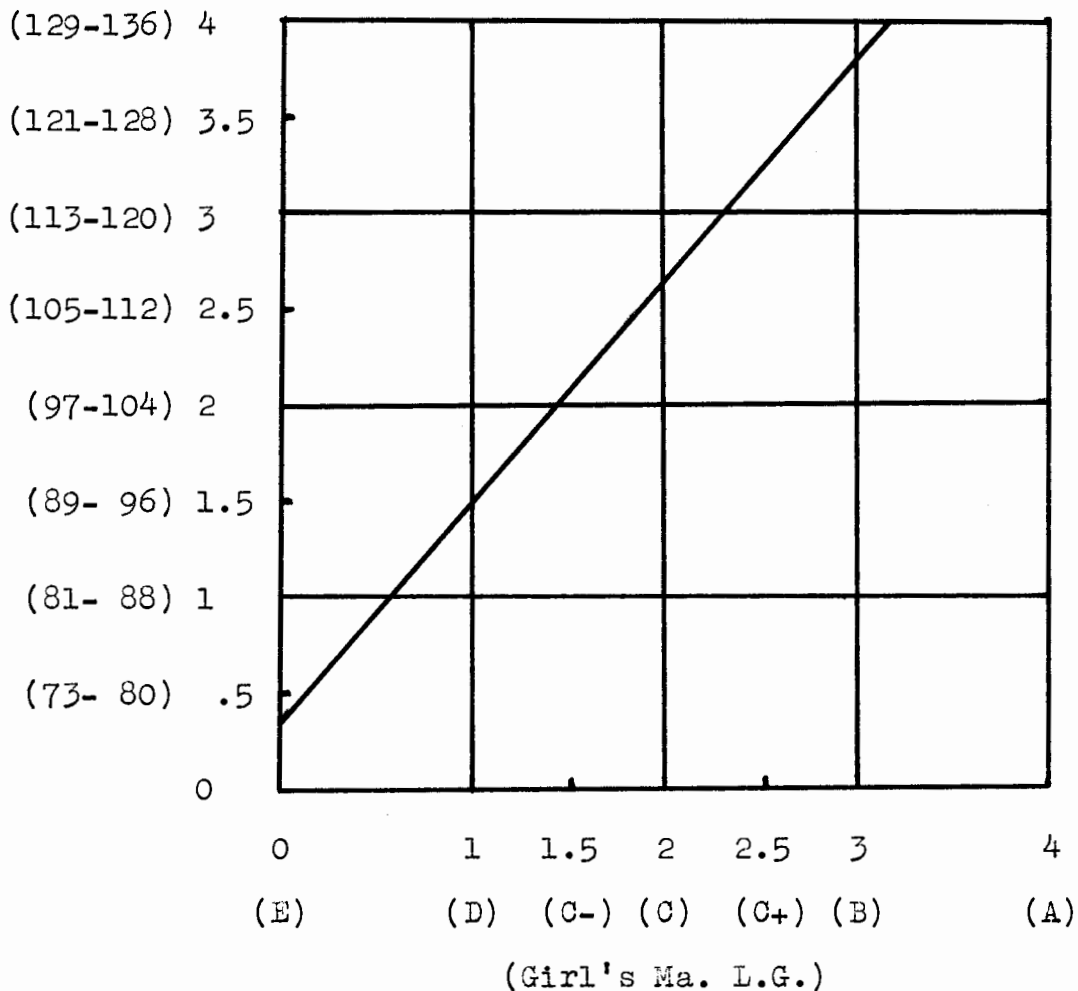


FIGURE 11

PREDICTION LINE
 FOR A GIRL'S GRADE 7 MATHEMATICS LETTER GRADE
 IN THE THIRD REPORT (Girl's Ma. L.G.)
 FROM THE OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY
 (INTERMEDIATE EXAMINATION: FORM A, B, C OR D)
 I.Q. SCORE (I.Q.)

$$\text{Girl's Ma. L.G.} = .9(\text{I.Q.}) - .4$$

(S.A.T.)

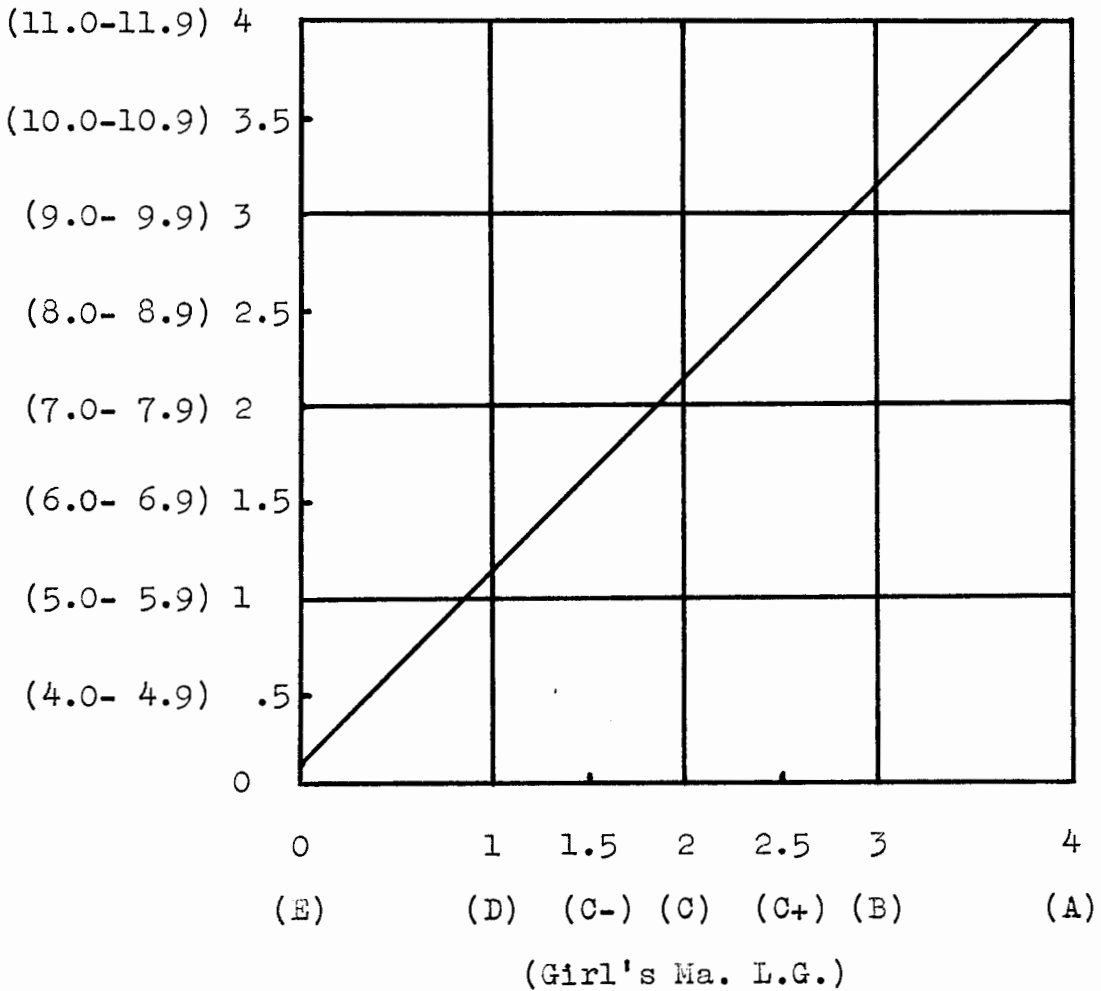


FIGURE 12

PREDICTION LINE
 FOR A GIRL'S GRADE 7 MATHEMATICS LETTER GRADE
 IN THE THIRD REPORT (Girl's Ma. L.G.)
 FROM THE STANFORD ACHIEVEMENT TEST
 (INTERMEDIATE BATTERY PARTIAL: FORM J)
 GRADE EQUIVALENT SCORE (S.A.T.)

$$\text{Girl's Ma. L.G.} = 1.0(\text{S.A.T.}) - .2$$

PREDICTION LINE GRAPHS
FOR A GIRL'S GRADE 7 SCIENCE LETTER GRADE
IN THE THIRD REPORT

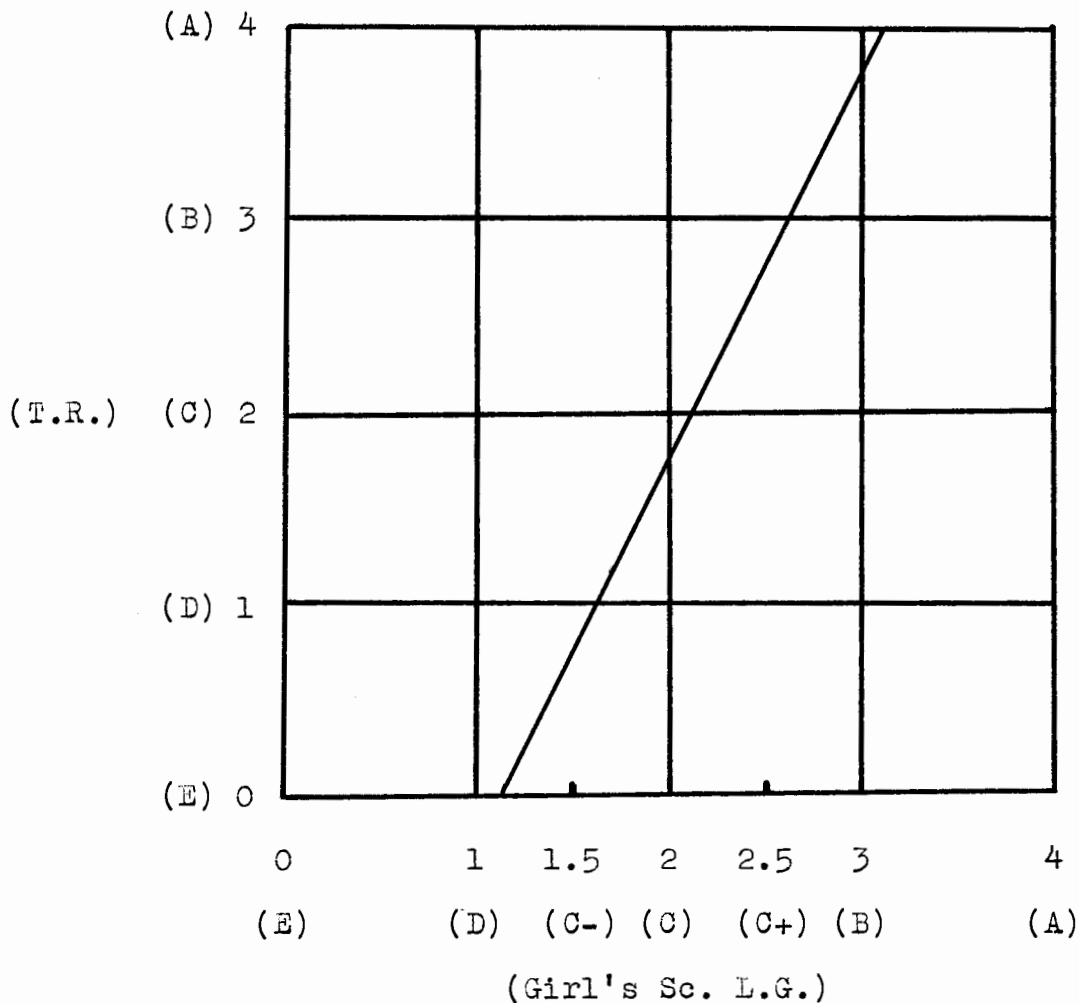


FIGURE 13

PREDICTION LINE
 FOR A GIRL'S GRADE 7 SCIENCE LETTER GRADE
 IN THE THIRD REPORT (Girl's Sc. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE STUDENT'S GENERAL ACADEMIC ABILITY
 IN ELEMENTARY SCHOOL (T.R.)

$$\text{Girl's Sc. L.G.} = .5(\text{T.R.}) + 1.1$$

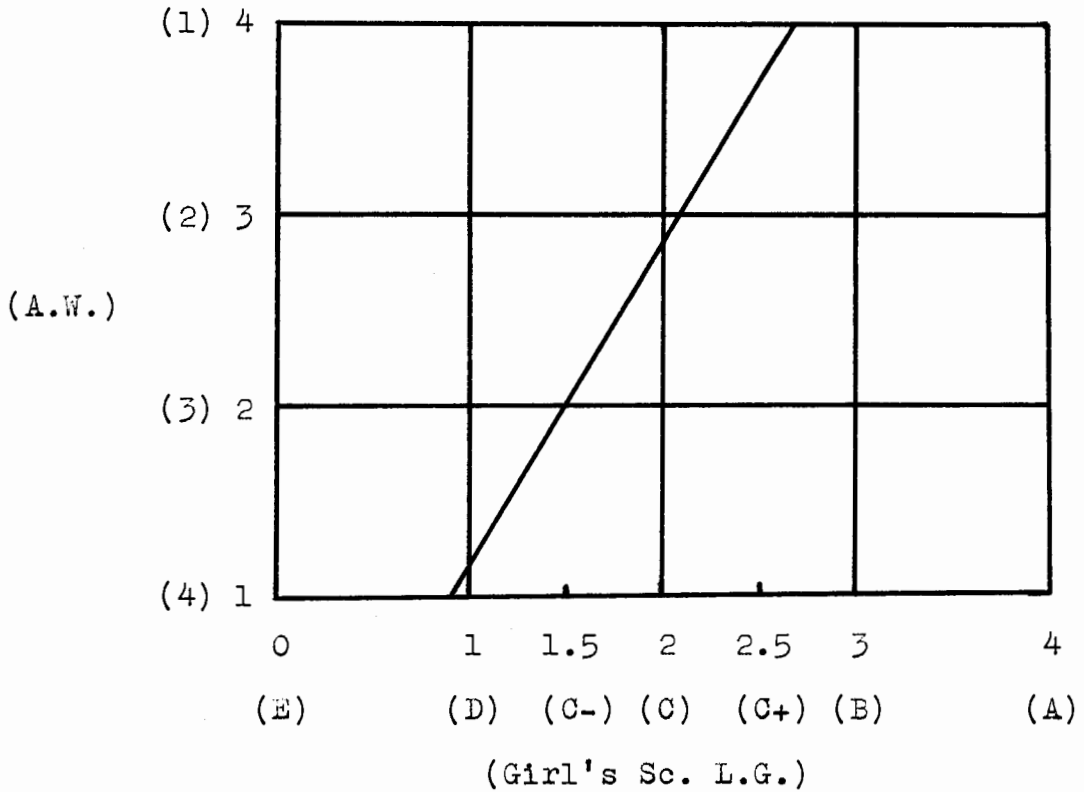


FIGURE 14

PREDICTION LINE
 FOR A GIRL'S GRADE 7 SCIENCE LETTER GRADE
 IN THE THIRD REPORT (Girl's Sc. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE PUPIL'S ATTITUDE TO WORK
 IN ELEMENTARY SCHOOL (A.W.)

$$\text{Girl's Sc. L.G.} = .6(\text{A.W.}) + .3$$

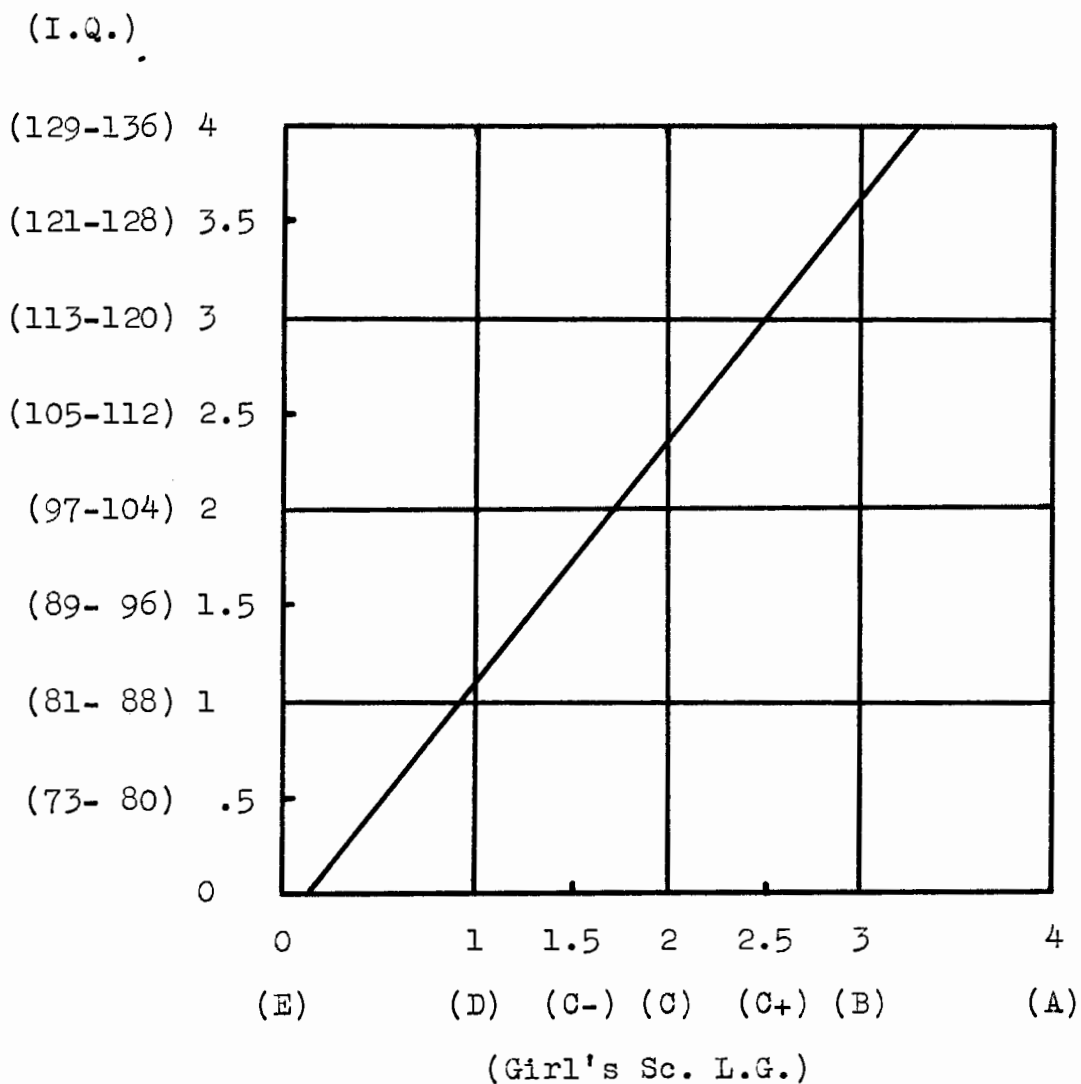


FIGURE 15

PREDICTION LINE
 FOR A GIRL'S GRADE 7 SCIENCE LETTER GRADE
 IN THE THIRD REPORT (Girl's Sc. L.G.)
 FROM THE OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY
 (INTERMEDIATE EXAMINATION: FORM A, B, C OR D)
 I.Q. SCORE (I.Q.)

$$\text{Girl's Sc. L.G.} = .8(\text{I.Q.}) + .1$$

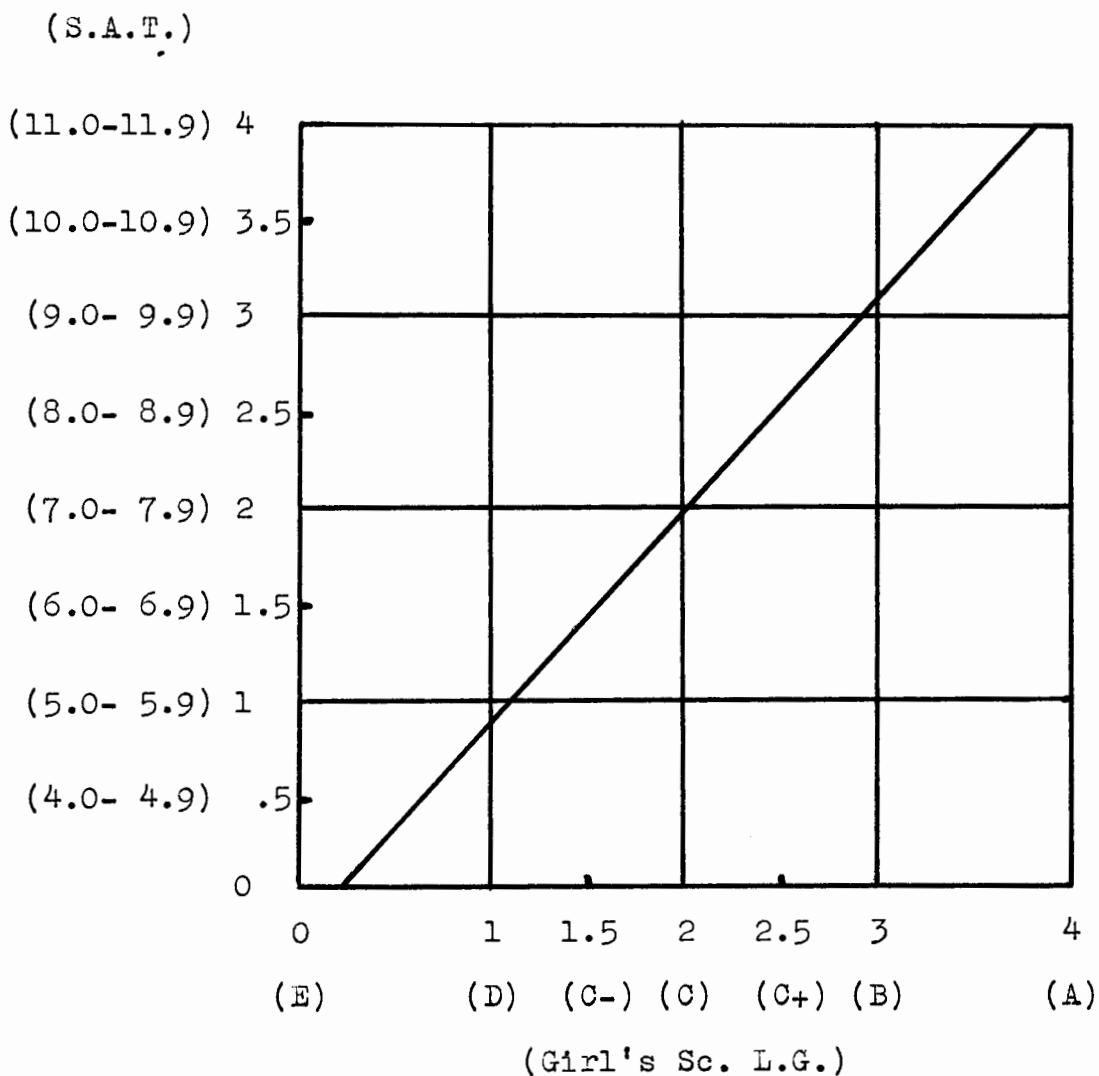


FIGURE 16

PREDICTION LINE
 FOR A GIRL'S GRADE 7 SCIENCE LETTER GRADE
 IN THE THIRD REPORT (Girl's Sc. L.G.)
 FROM THE STANFORD ACHIEVEMENT TEST
 (INTERMEDIATE BATTERY PARTIAL: FORM J)
 GRADE EQUIVALENT SCORE (S.A.T.)

$$\text{Girl's Sc. L.G.} = .9(\text{S.A.T.}) + .2$$

PREDICTION LINE GRAPHS
FOR BOYS' GRADE 7 ACADEMIC ACHIEVEMENT

PREDICTION LINE GRAPHS
FOR A BOY'S AVERAGE GRADE 7 ENGLISH LETTER GRADE
IN THE THIRD REPORT

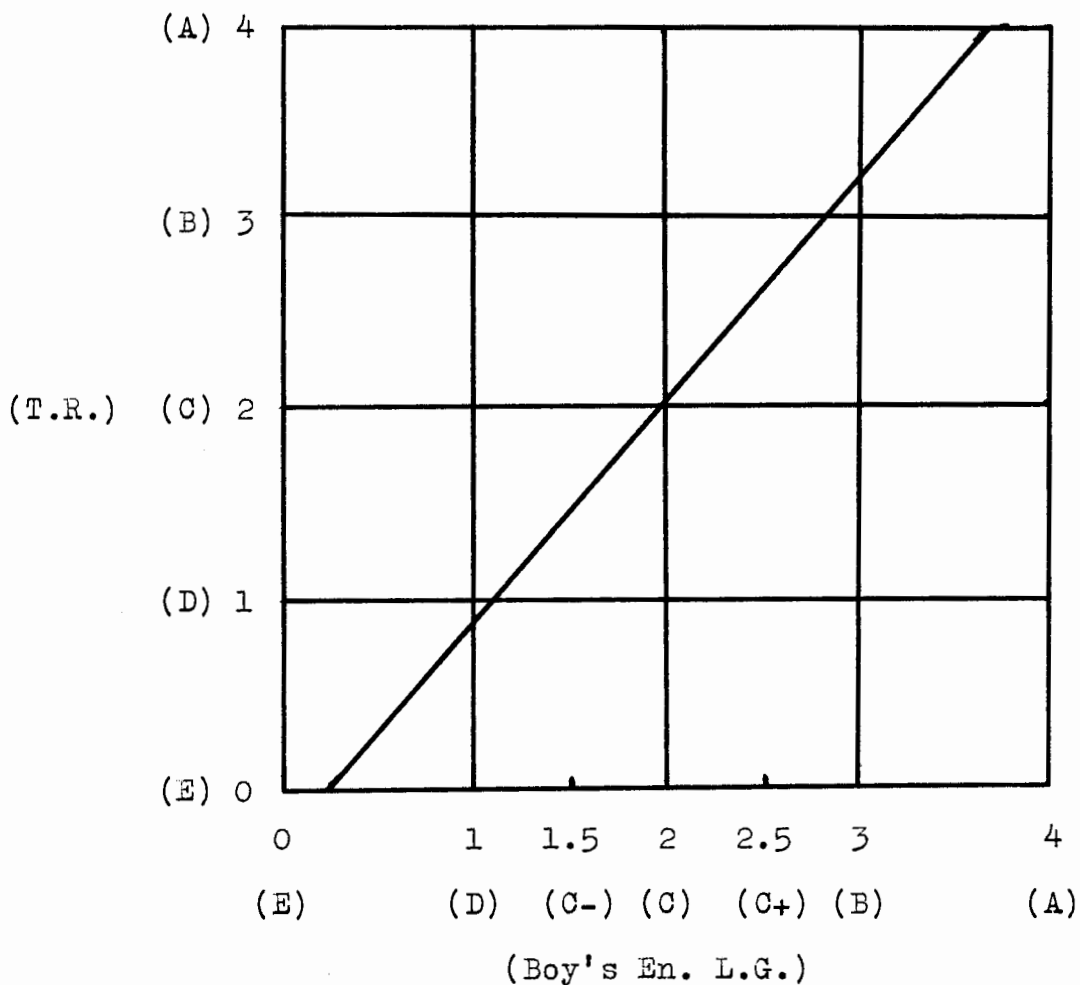


FIGURE 17

PREDICTION LINE
 FOR A BOY'S AVERAGE GRADE 7 ENGLISH LETTER GRADE
 IN THE THIRD REPORT (Boy's En. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE STUDENT'S GENERAL ACADEMIC ABILITY
 IN ELEMENTARY SCHOOL (T.R.)

$$\text{Boy's En. L.G.} = .8(\text{T.R.}) + .4$$

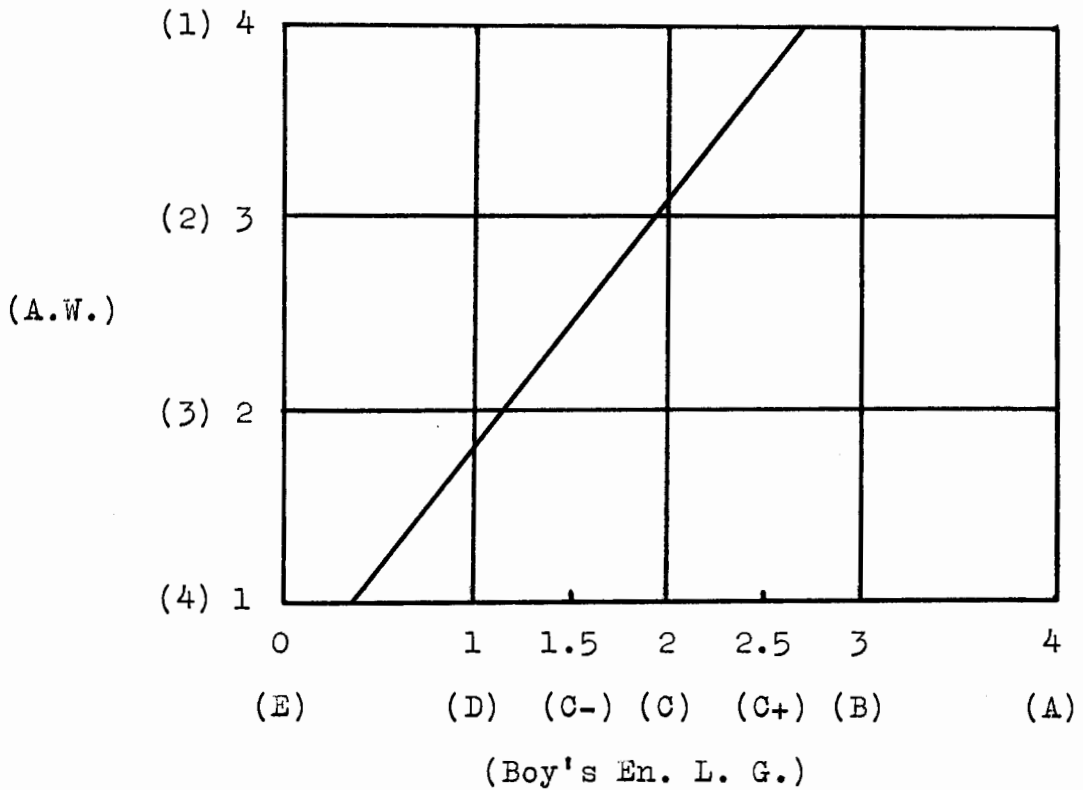


FIGURE 18

PREDICTION LINE
 FOR A BOY'S AVERAGE GRADE 7 ENGLISH LETTER GRADE
 IN THE THIRD REPORT (Boy's En. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE PUPIL'S ATTITUDE TO WORK
 IN ELEMENTARY SCHOOL (A.W.)

$$\text{Boy's En. L.G.} = .8(\text{A.W.}) - .5$$

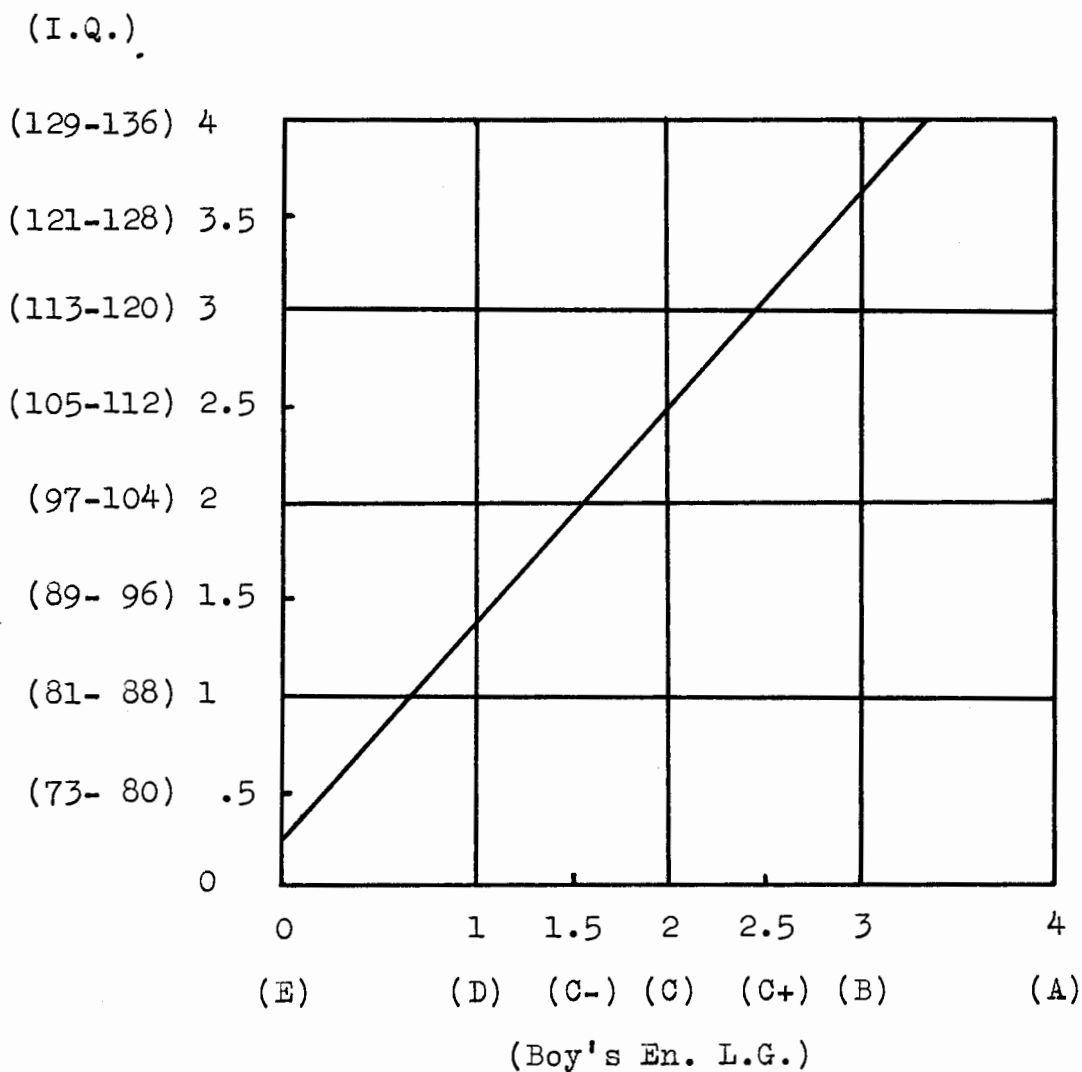


FIGURE 19

PREDICTION LINE
 FOR A BOY'S AVERAGE GRADE 7 ENGLISH LETTER GRADE
 IN THE THIRD REPORT (Boy's En. L.G.)
 FROM THE OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY
 (INTERMEDIATE EXAMINATION: FORM A, B, C OR D)
 I.Q. SCORE (I.Q.)

$$\text{Boy's En. L.G.} = .9(\text{I.Q.}) - .3$$

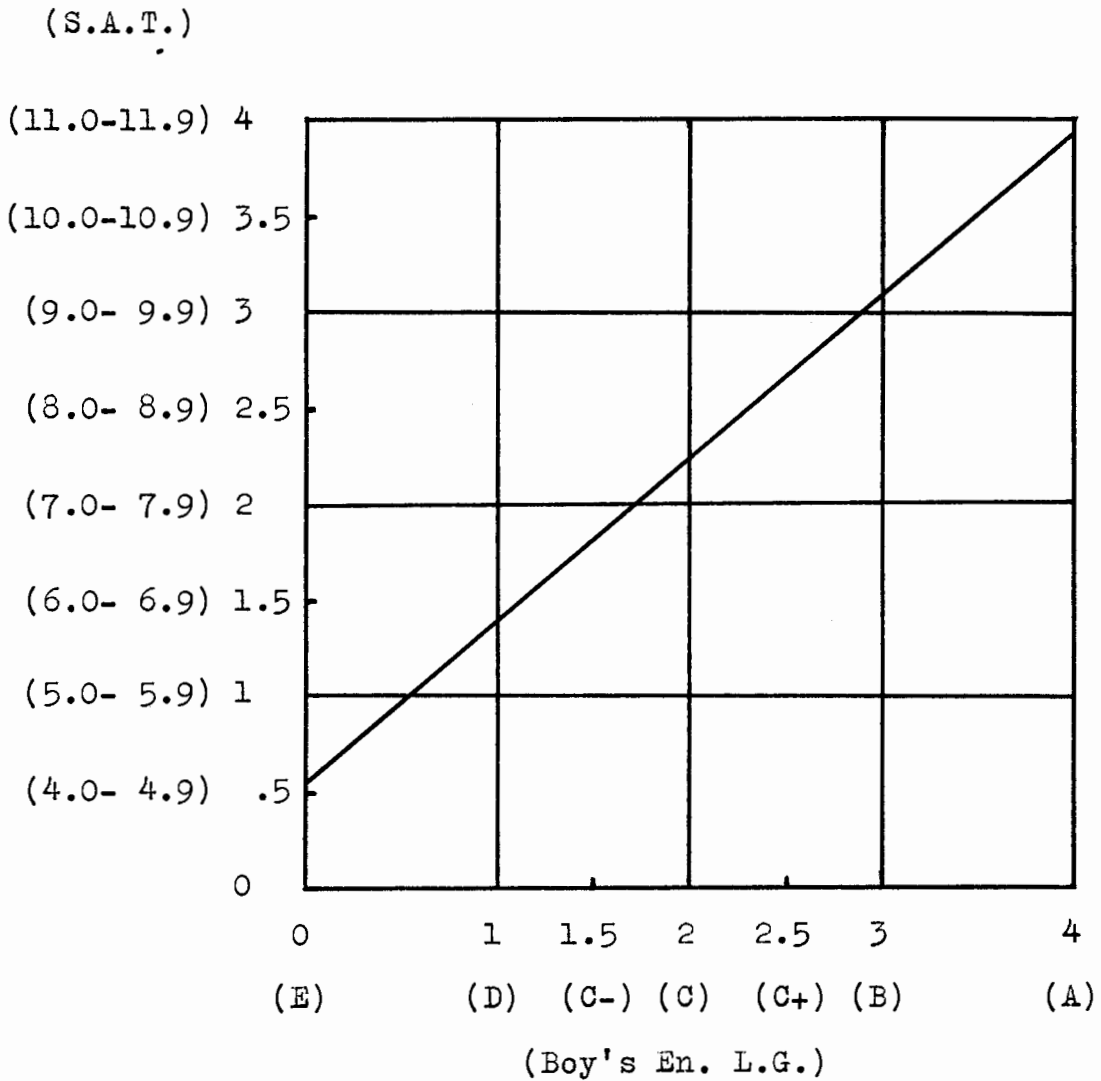


FIGURE 20

PREDICTION LINE
 FOR A BOY'S AVERAGE GRADE 7 ENGLISH LETTER GRADE
 IN THE THIRD REPORT (Boy's En. L.G.)
 FROM THE STANFORD ACHIEVEMENT TEST
 (INTERMEDIATE BATTERY PARTIAL: FORM J)
 GRADE EQUIVALENT SCORE (S.A.T.)

$$\text{Boy's En. L.G.} = 1.2(\text{S.A.T.}) - .7$$

PREDICTION LINE GRAPHS
FOR A BOY'S GRADE 7 SOCIAL STUDIES LETTER GRADE
IN THE THIRD REPORT

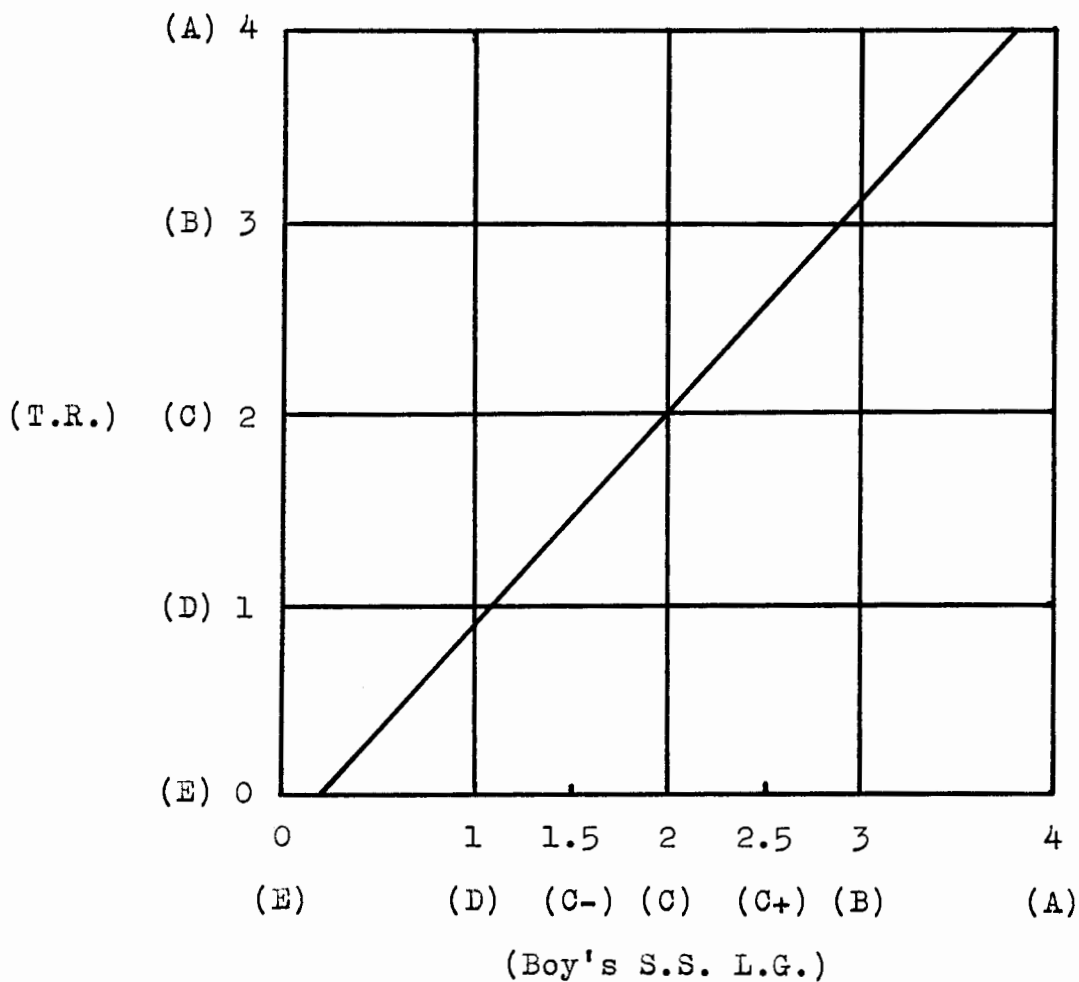


FIGURE 21

PREDICTION LINE
 FOR A BOY'S GRADE 7 SOCIAL STUDIES LETTER GRADE
 IN THE THIRD REPORT (Boy's S.S. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE STUDENT'S GENERAL ACADEMIC ABILITY
 IN ELEMENTARY SCHOOL (T.R.)

$$\text{Boy's S.S. L.G.} = .9(\text{T.R.}) + .2$$

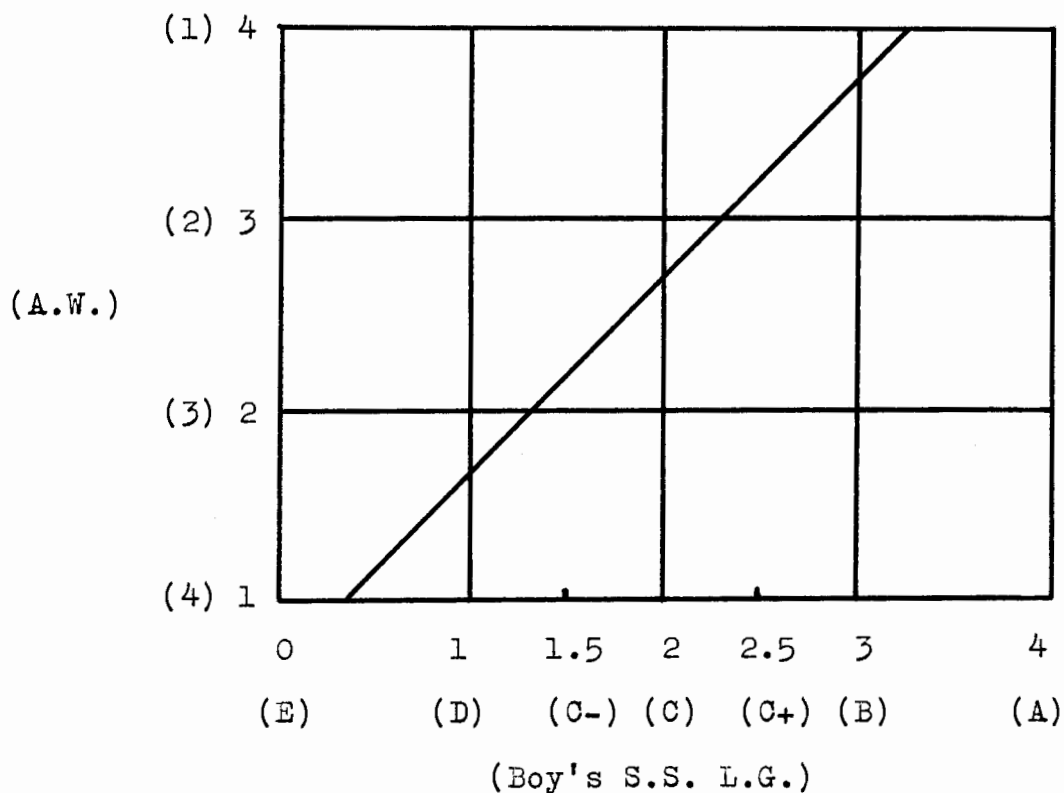


FIGURE 22

PREDICTION LINE
 FOR A BOY'S GRADE 7 SOCIAL STUDIES LETTER GRADE
 IN THE THIRD REPORT (Boy's S.S. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE PUPIL'S ATTITUDE TO WORK
 IN ELEMENTARY SCHOOL (A.W.)

$$\text{Boy's S.S. L.G.} = 1.0(\text{A.W.}) - .7$$

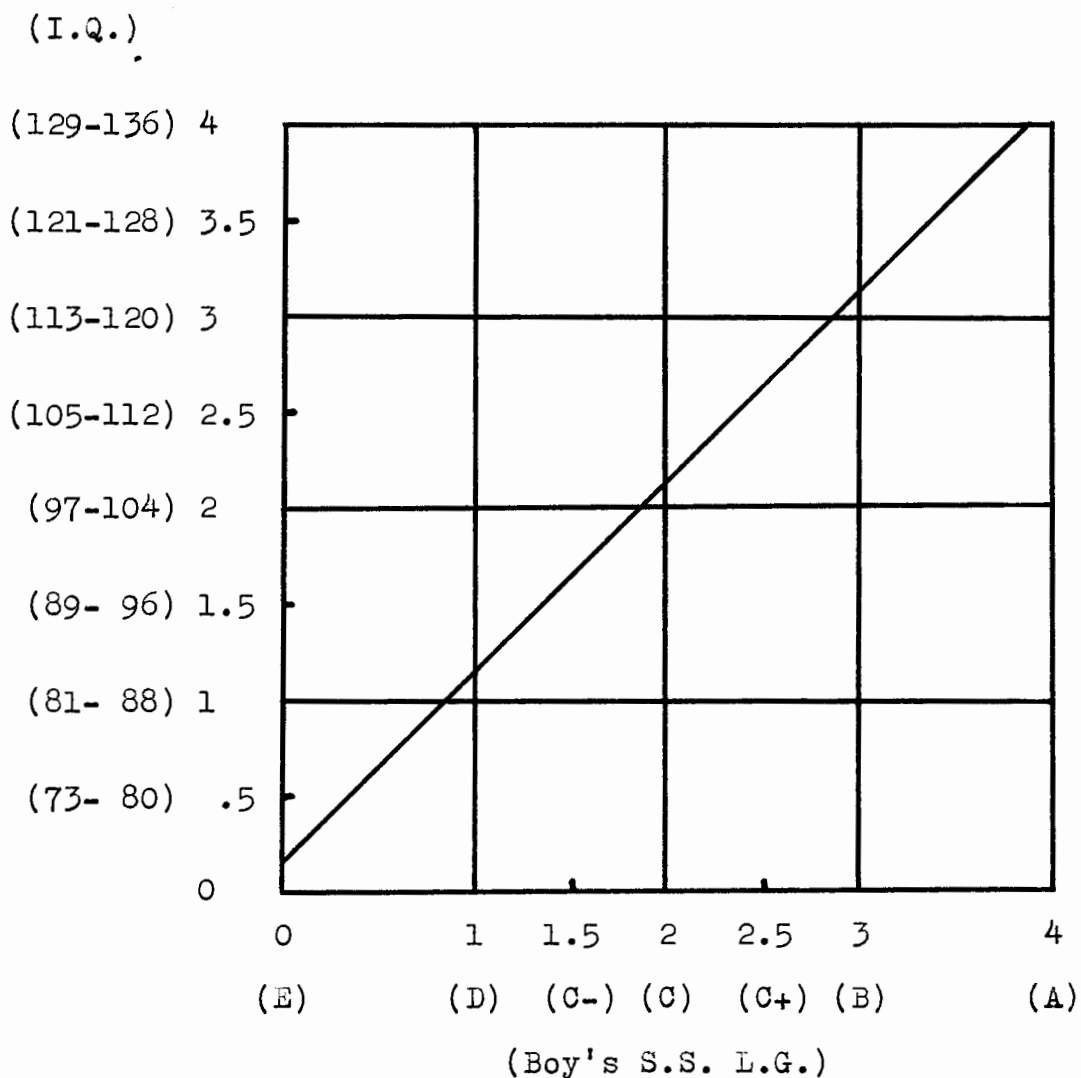


FIGURE 23

PREDICTION LINE
 FOR A BOY'S GRADE 7 SOCIAL STUDIES LETTER GRADE
 IN THE THIRD REPORT (Boy's S.S. L.G.)
 FROM THE OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY
 (INTERMEDIATE EXAMINATION: FORM A, B, C OR D)
 I.Q. SCORE (I.Q.)

$$\text{Boy's S.S. L.G.} = 1.0(\text{I.Q.}) - .2$$

(S.A.T.)

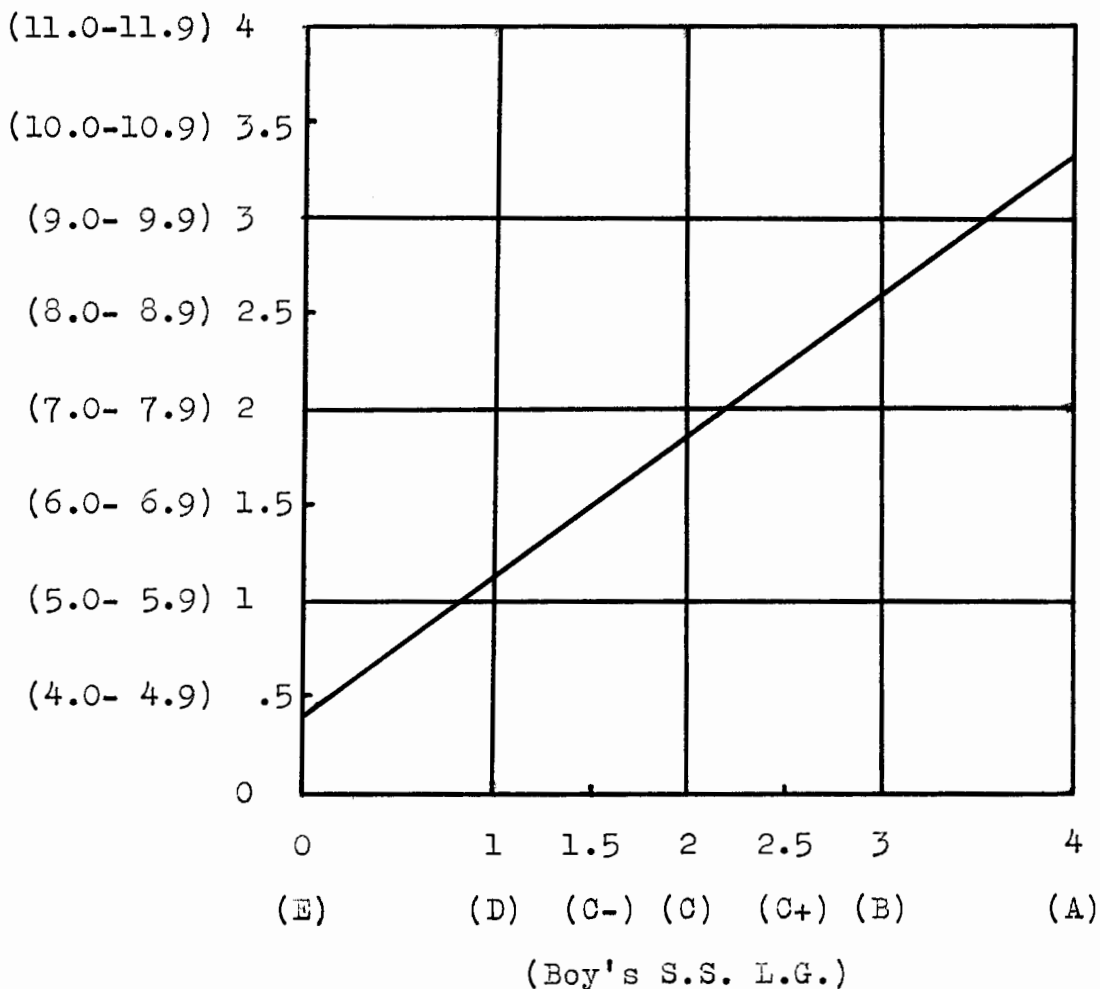


FIGURE 24

PREDICTION LINE
 FOR A BOY'S GRADE 7 SOCIAL STUDIES LETTER GRADE
 IN THE THIRD REPORT (Boy's S.S. L.G.)
 FROM THE STANFORD ACHIEVEMENT TEST
 (INTERMEDIATE BATTERY PARTIAL: FORM J)
 GRADE EQUIVALENT SCORE (S.A.T.)

$$\text{Boy's S.S. L.G.} = 1.4(\text{S.A.T.}) - .7$$

PREDICTION LINE GRAPHS
FOR A BOY'S GRADE 7 MATHEMATICS LETTER GRADE
IN THE THIRD REPORT

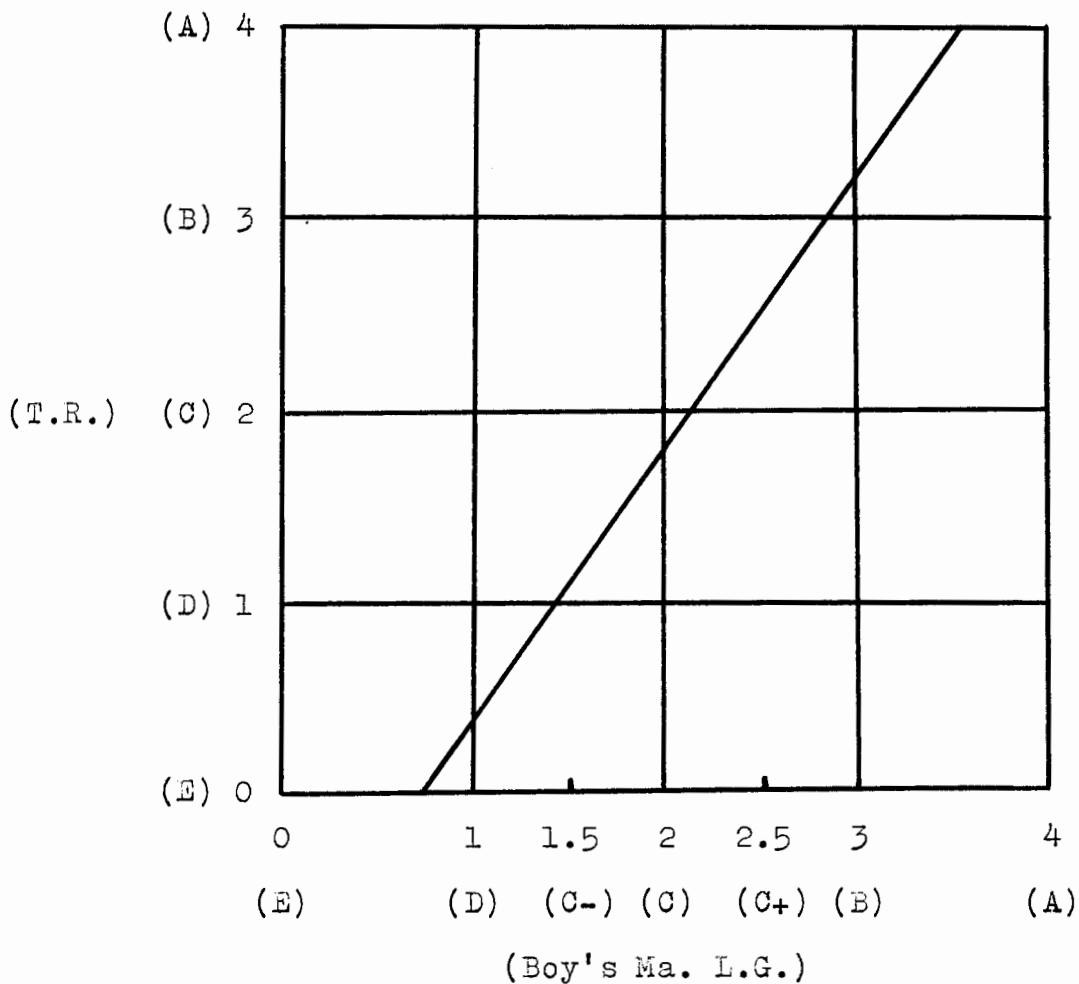


FIGURE 25

PREDICTION LINE
 FOR A BOY'S GRADE 7 MATHEMATICS LETTER GRADE
 IN THE THIRD REPORT (Boy's Ma. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE STUDENT'S GENERAL ACADEMIC ABILITY
 IN ELEMENTARY SCHOOL (T.R.)

$$\text{Boy's Ma. L.G.} = .7(\text{T.R.}) + .7$$

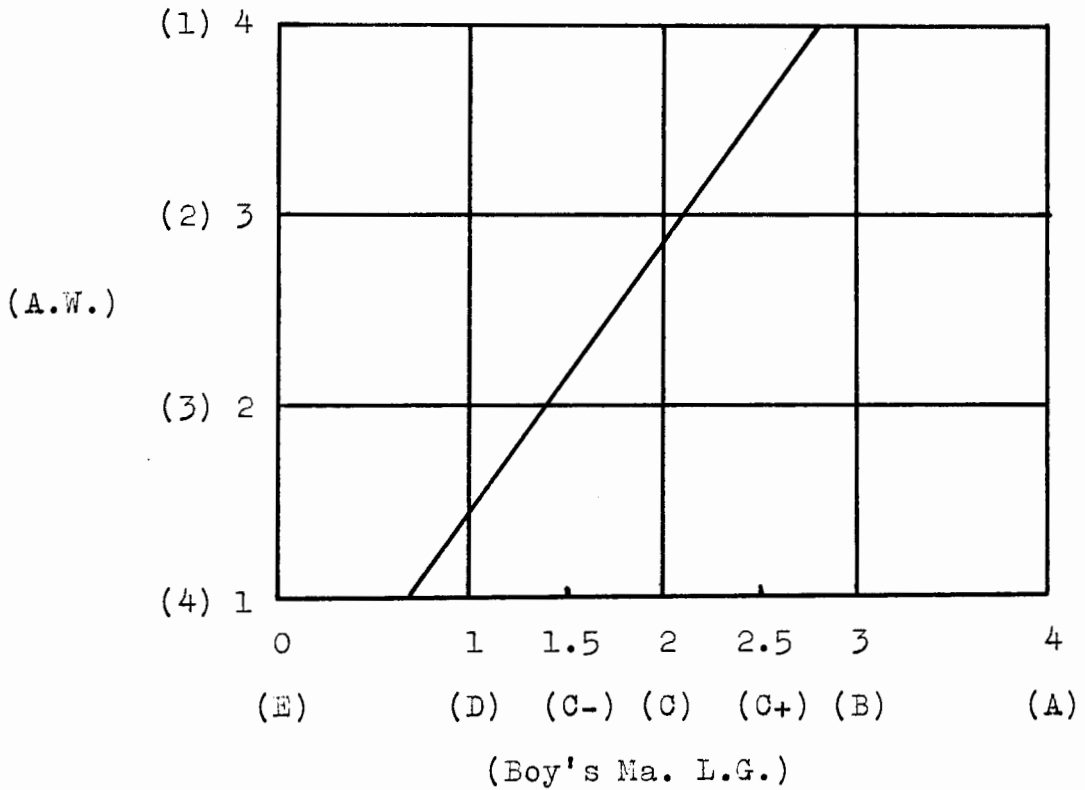


FIGURE 26

PREDICTION LINE
 FOR A BOY'S GRADE 7 MATHEMATICS LETTER GRADE
 IN THE THIRD REPORT (Boy's Ma. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE PUPIL'S ATTITUDE TO WORK
 IN ELEMENTARY SCHOOL (A.W.)

$$\text{Boy's Ma. L.G.} = .7(\text{A.W.}) + 0$$

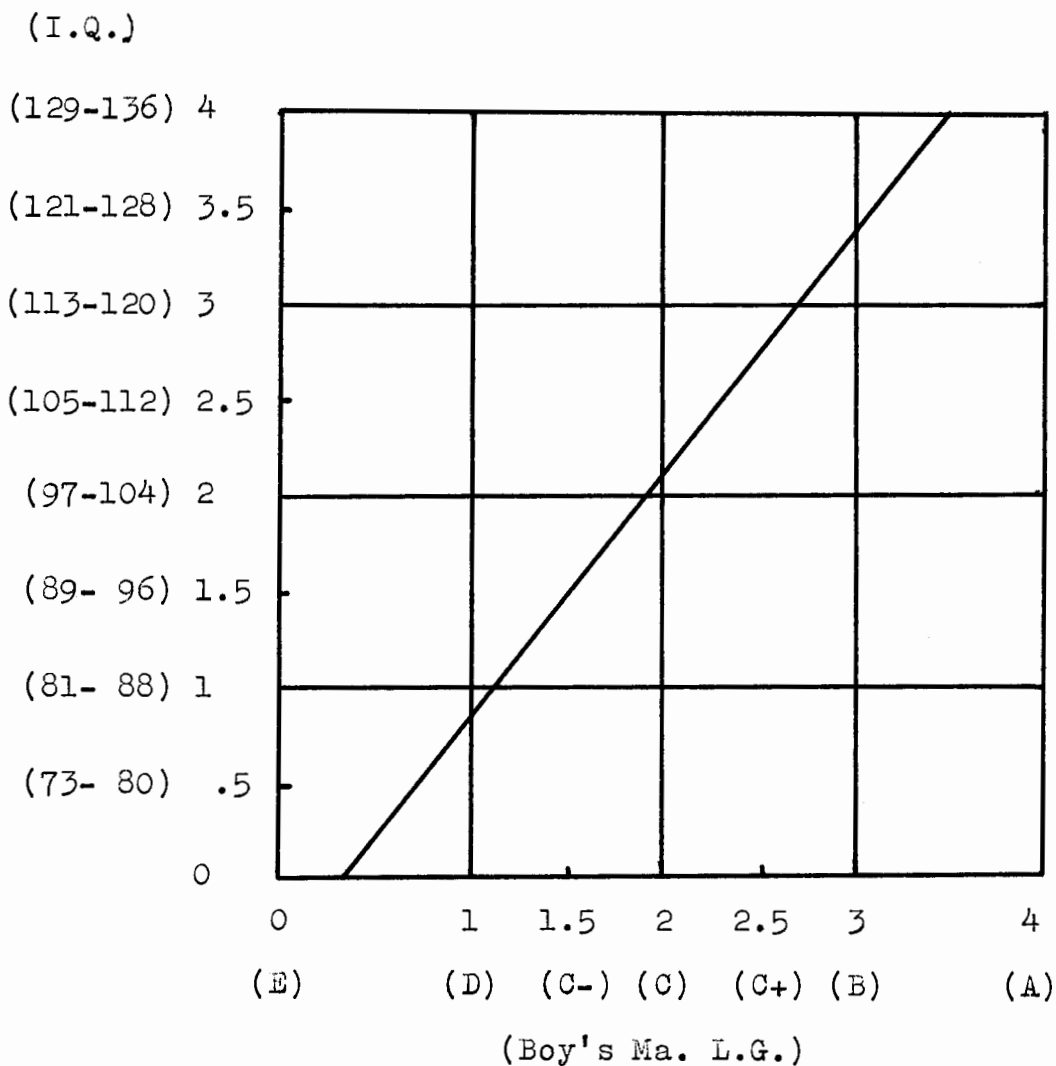


FIGURE 27

PREDICTION LINE
 FOR A BOY'S GRADE 7 MATHEMATICS LETTER GRADE
 IN THE THIRD REPORT (Boy's Ma. L.G.)
 FROM THE OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY
 (INTERMEDIATE EXAMINATION: FORM A, B, C OR D)
 I.Q. SCORE (I.Q.)

$$\text{Boy's Ma. L.G.} = .8(\text{I.Q.}) + .3$$

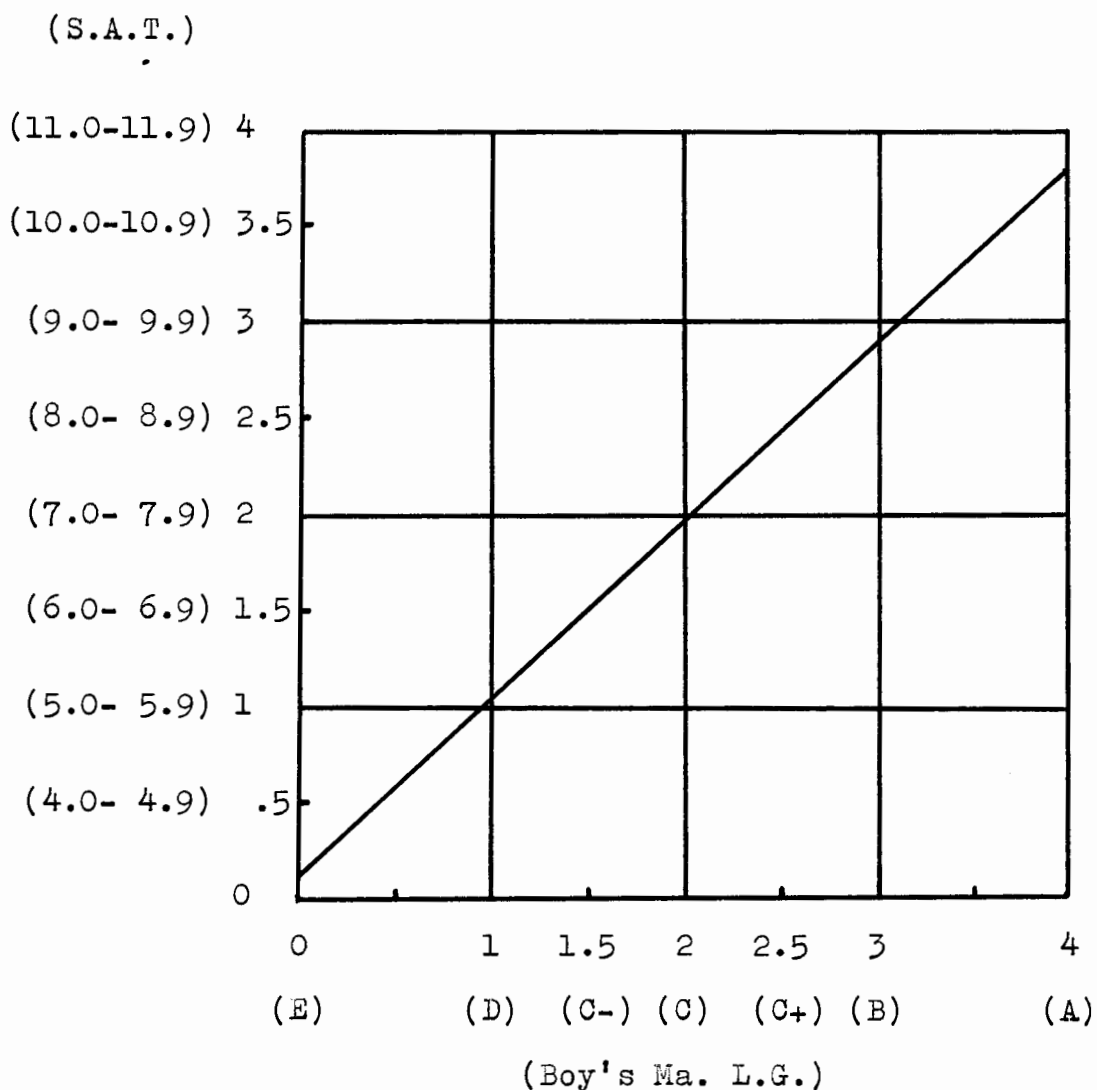


FIGURE 28

PREDICTION LINE
 FOR A BOY'S GRADE 7 MATHEMATICS LETTER GRADE
 IN THE THIRD REPORT (Boy's Ma. L.G.)
 FROM THE STANFORD ACHIEVEMENT TEST
 (INTERMEDIATE BATTERY PARTIAL: FORM J)
 GRADE EQUIVALENT SCORE (S.A.T.)

$$\text{Boy's Ma. L.G.} = 1.1(\text{S.A.T.}) - .2$$

PREDICTION LINE GRAPHS
FOR A BOY'S GRADE 7 SCIENCE LETTER GRADE
IN THE THIRD REPORT

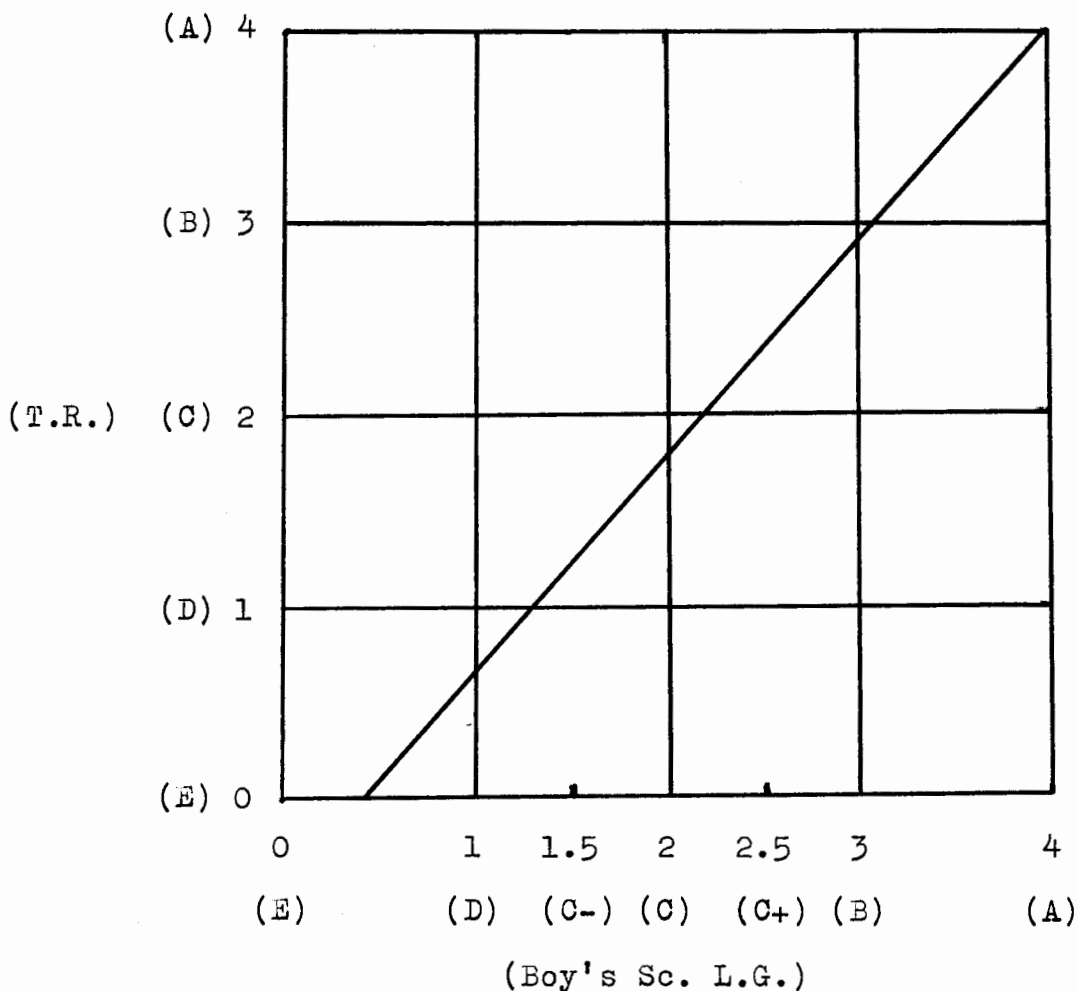


FIGURE 29

PREDICTION LINE
 FOR A BOY'S GRADE 7 SCIENCE LETTER GRADE
 IN THE THIRD REPORT (Boy's Sc. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE STUDENT'S GENERAL ACADEMIC ABILITY
 IN ELEMENTARY SCHOOL (T.R.)

$$\text{Boy's Sc. L.G.} = .9(\text{T.R.}) + .4$$

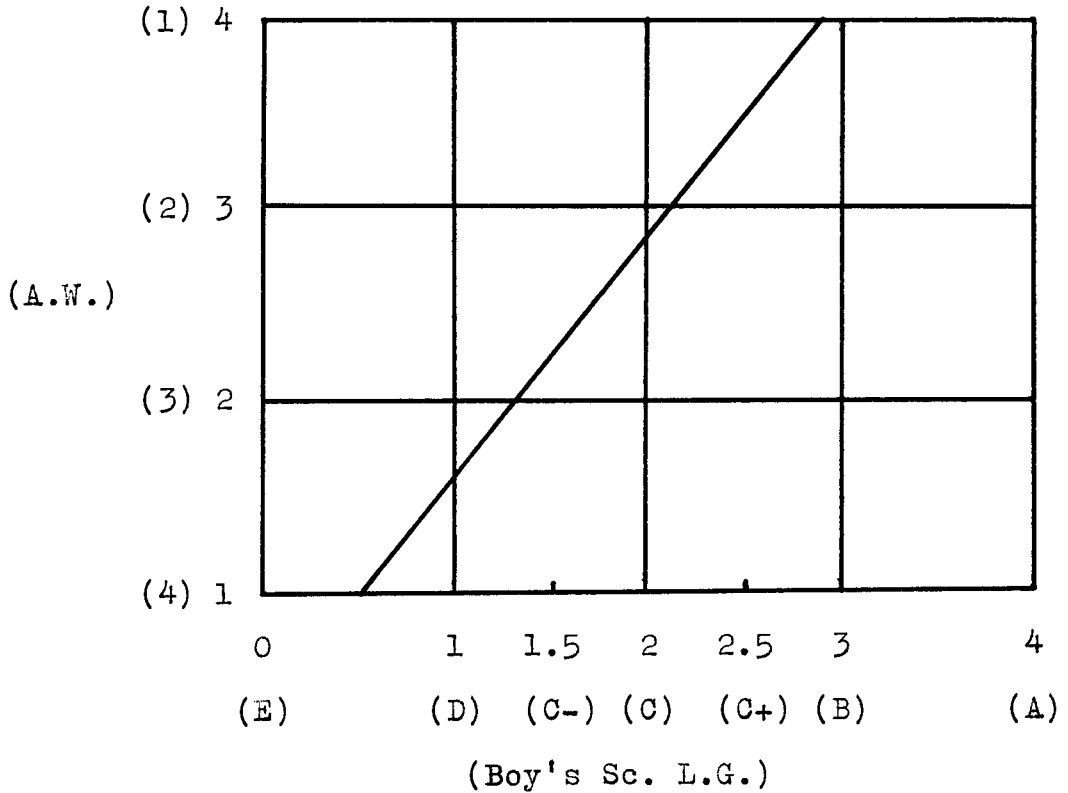


FIGURE 30

PREDICTION LINE
 FOR A BOY'S GRADE 7 SCIENCE LETTER GRADE
 IN THE THIRD REPORT (Boy's Sc. L.G.)
 FROM THE TEACHER'S SUBJECTIVE RATING
 OF THE PUPIL'S ATTITUDE TO WORK
 IN ELEMENTARY SCHOOL (A.W.)

$$\text{Boy's Sc. L.G.} = .8(\text{A.W.}) - .3$$

(I.Q.)

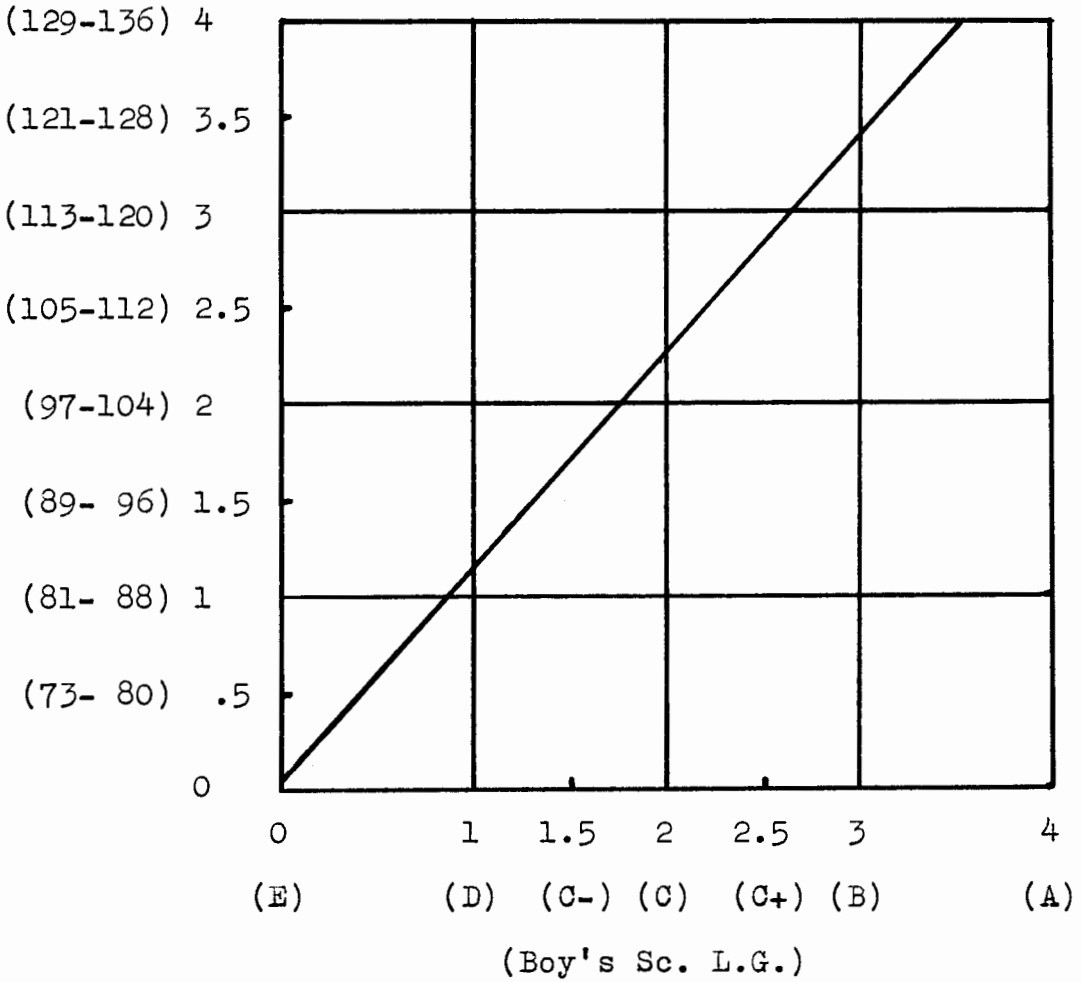


FIGURE 31

PREDICTION LINE
 FOR A BOY'S GRADE 7 SCIENCE LETTER GRADE
 IN THE THIRD REPORT (Boy's Sc. L.G.)
 FROM THE OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY
 (INTERMEDIATE EXAMINATION: FORM A, B, C OR D)
 I.Q. SCORE (I.Q.)

$$\text{Boy's Sc. L.G.} = .9(\text{I.Q.}) - .1$$

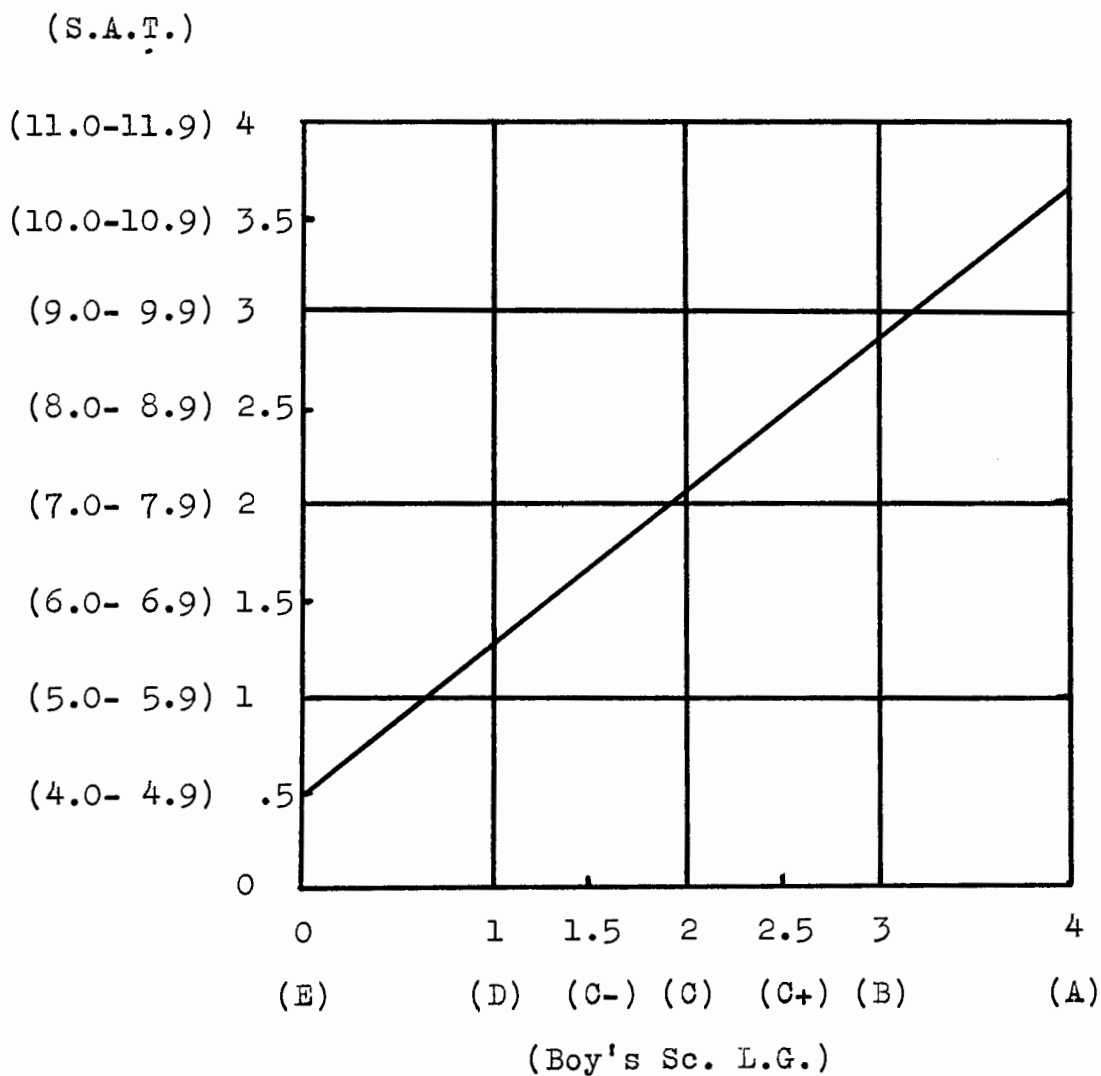


FIGURE 32

PREDICTION LINE
 FOR A BOY'S GRADE 7 SCIENCE LETTER GRADE
 IN THE THIRD REPORT (Boy's Sc. L.G.)
 FROM THE STANFORD ACHIEVEMENT TEST
 (INTERMEDIATE BATTERY PARTIAL: FORM J)
 GRADE EQUIVALENT SCORE (S.A.T.)

$$\text{Boy's Sc. L.G.} = 1.3(\text{S.A.T.}) - .7$$

calculated in this study between elementary and high school ratings were all positive and significant to the 1% level of confidence.

Although the interpretation of r depends very much upon what the correlation coefficients were used for and the reasons for which they were computed, Guilford (11:145) has roughly described the strength of various interpretive relationships of r 's as follows:

- Less than .20 - Slight; almost negligible relationship
- .20- .40 - Low correlation; definite but small relationship
- .40- .70 - Moderate correlation; substantial relationship
- .70- .90 - High correlation; marked relationship
- .90-1.00 - Very high correlation; very dependable relationship

As interpreted by Guilford's table, all of the relations which were computed in this study yielded moderate or high coefficients of correlation.

The correlative results in this investigation are similar to many other educational studies which were executed in somewhat different testing situations.

The teachers' subjective ratings of each student's general academic ability in elementary school appeared to coincide best with Grade 7 achievement for most academic

areas in both the girls' and boys' study samples. Several factors can probably account for the high accuracy of this subjective rating. First, in assessing each pupil's academic ability; the elementary teachers were assisted by the letter grades in each student's Grade 6 report card and Permanent Record Card. Also the two objective standardized test scores which were derived shortly before the teacher's subjective evaluations were assigned could have been used as additional guides. The results from this research coincided closely with the conclusions drawn from an elementary school study which was conducted by E. F. Morgan (17:300-304). He concluded that an experienced first grade teacher could reasonably make competent placement judgments for evaluating the slow, average and high ability pupils with the aid of standardized test scores.

After the teacher's subjective rating of the student's general academic ability in school, the Otis I.Q. test generally showed the next highest relationship with academic ability in both the girls' and boys' study groups. The I.Q. test was followed by the Stanford Achievement which had slightly lower correlations with academic achievement.

The two standardized tests appeared to correlate with English achievement best from among the four academic subject areas. This could probably be expected as most standardized group tests abound in abstractions and verbal

conventions of the English language. The relationships of the two subjects, social studies and science, usually produced the second highest correlations with the standardized tests. Between the objective test scores and academic achievement, the mathematics correlations were generally lowest with the Otis and Stanford test results.

Of the four ratings on the High School Enrolment Application Card, the teachers' subjective ratings of each pupil's attitude to work in elementary school had the lowest correlations with most of the Grade 7 academic subject achievements for both of the girls' and boys' study groups. Similar correlations were found in Norton's investigation (18:211-217). He concluded that study habits as measured by a five point instructor rating were less closely associated with achievement in ninth grade general science than intelligence, reading ability and aptitude scores.

Several psychological factors may lower the reliability of this attitude to work measure. Research by Haron J. Battle (3:27-41) has shown that differences and similarities of child and adult value patterns operate in the interaction of pupils and teachers. This may lead to a distorted view for evaluating a pupil's personal work habits. Ambiguities and uncertainties in the meanings of the numerical ratings may have further added to the formation of low correlations. Limited information and the halo effect

may also obscure the pattern of traits within a pupil.

An interesting side light in the study was that the teachers' ratings on the pupils' attitude to work were more closely aligned to the academic ability of boys than to the girls' achievement in academic subjects. For the poor achievers, teachers tended to assign fewer low ratings to the girls than to the boys. This was partially a result of North American child-rearing practices. In child behaviour these practices tend to make girls more submissive to the demands of parents and teachers than boys. Hence, the teachers would probably favour the girls with generous work habit ratings.

Of the four elementary school ratings, the attitude to work appeared to be the least valuable for predictive purposes than any of the other ratings. However, the attitude to work rating and the other three elementary school ratings have sufficiently high correlations with academic achievement that they may be used as predictors of future Grade 7 students' academic letter grades if used with caution.

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

I. SUMMARY

This study was an attempt to discover how much, and in what proportion, achievement in Grade 7 academic subjects could be predicted by the four elementary school ratings on the High School Application Enrolment Cards. For the purpose of making adequate comparisons, a randomly selected girls' group and a randomly selected boys' group were used. Both groups were selected from the 1960-61 Grade 7 population of the Vancouver Technical Secondary School.

Data relative to this study were collected from the Permanent Record Cards and the High School Application Enrolment Cards at the office of the Vancouver Technical Secondary School. The Grade 7 subject areas considered in this investigation were English language, English literature, English spelling, social studies, mathematics and science.

The Pearson product-moment coefficient correlation formula was used in making comparisons between the elementary school ratings and Grade 7 academic achievement. The coefficients of correlation found in this study have shown that the subjective and objective elementary school ratings are fairly reliable measuring instruments for evaluating Grade 7 academic success.

Also portions of the correlative calculations were used to develop regression equations for finding Grade 7 academic achievement from the elementary school ratings. From these results high positive relationships were shown to exist between Grade 7 academic achievement and the elementary school ratings on the High School Enrolment Application Cards.

II. CONCLUSIONS

From the findings in this study it would seem that the regression equations obtained might profitably be used to predict the academic achievement of future Grade 7 students. These equations could be applied to the promotional and class grouping purposes in schools. Also the prediction formulas could assist the school administrators, counselors, teachers and students in planning a desirable and adequate school program.

In conjunction with the prediction formulas, the tables of correlation could be used to discover those students whose actual performances in Grade 7 academic subjects were markedly deviant from those predicted by the regression equations. This would identify the students who were either over-achievers or under-achievers because of specialization or attitude. Special attention should be given to these cases by the school personnel.

However, the results of this study are only truly representative for the entering group of Grade 7 students at the Vancouver Technical Secondary School during the year, 1960-61. It is possible to project the results of this investigation to other entering Grade 7 classes only to the extent that it may be assumed that the group in this study is representative of another year's group.

III. RECOMMENDATIONS

The findings of this study suggest the possibility that additional research might be conducted, using other variables and regression techniques, in an effort to predict academic achievement in other school situations.

To improve the validity of individual prediction, more verification of this research procedure should be made by other studies at the Vancouver Technical Secondary School since the random sample in this investigation was rather small. It is under such varied conditions that the formulas derived in this study must be tested and compared with other investigative results in order that academic achievement can be confidently predicted.

Besides obtaining various additional Grade 7 student samples at the Vancouver Technical Secondary School, changes in the criterion of academic achievement would be desirable. To depict a student's academic achievement in a subject

more accurately, Final Report letter grades which were based upon progress in the entire course should be used. In this study the Third Report letter grades were used instead of the Fourth or Final Report letter grades. There was a definite reason for this. In grading a student's achievement in the Final Report, some teachers who were following the 1959-60 school policy entirely omitted issuing the "D" letter grades. These "D" letter grades were changed to the definite passing grade of "C-" or to the definite failing grade of "E." Other teachers issued the letter grade of "D" as advocated by the new school policy in 1960-61. This misunderstanding in the Final Report letter grades was caused by a change in school administrative personnel whose new policy was not revealed until after some of the teachers had issued their letter grades for the Final Report.

Prediction would have been somewhat improved by more precise information about grading and testing procedures. To make the research outcomes more reliable, more complete and accurate instructions should have been issued for assigning not only the Grade 7 academic letter grades but also the elementary ratings on the High School Enrolment Application Cards. This was particularly needed for the attitude to work rating which had one word value judgments as guides for assigning this rating.

There is a need for similar studies in other localities to determine whether the results obtained here are peculiar to the Vancouver Technical Secondary School. Generalization of the present results and conclusions should not be made to other institutions without prior investigation to establish similarity. If the results of this research cannot be applied to other situations, each high school should establish its own set of predictive equations so that it may become aware of the meanings for the elementary school ratings as applied to its curricula and students. Possibly this city-wide high school study could base their academic subject results from the Vancouver School Board final exams which are written by all Vancouver Grade 7 students in June.

If the predictions from this study or from recommended future studies are to be used, best results will only be obtained when these formulas are applied by the academic subject and guidance departments in the high schools. Only when a counselor or subject teacher can confidently predict an individual's success in later grades can the formulas have a long range value to the student who is in need of guidance and special instruction.

This study was undertaken as an attempt to locate the relationship between the elementary school ratings on the High School Enrolment Application Cards and Grade 7 academic achievement in English, social studies, mathematics and

science for the Third Report. If the results of this study are not used as a basis for further research, or as a basis for some serious consideration on the part of elementary and secondary school personnel to view academic prediction with a critical eye, then this study will only partially fulfill its purpose. If, on the other hand, new studies are undertaken to evaluate present methods and procedures for predicting academic success, the study will have served its purpose well.

Research activity and experimentation in education are links in the chain of progressive change for a contemporary society. Applying to-day's knowledge of research to the specific field of prediction is a means of uncovering more effective approaches to learning in a broad and continually improving program of education.

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APPENDICES

APPENDIX A

SAMPLE OF THE VANCOUVER HIGH SCHOOL
ENROLMENT APPLICATION CARD
FOR A GRADE SIX FEMALE STUDENT

June, 19.....

V.S.B. ^{S - 1007}
8M-72908-60

GRADE VI PUPILS

Application for Enrolment in:

.....**JUNIOR HIGH SCHOOL**

Pupil's Name
FAMILY NAME **GIVEN NAME**

Pupil's Address

Date of Birth..... Phone.....

Teacher's Rating..... Attitude to Work.....
(USE A, B, C, D, E.) (USE 1, 2, 3, 4.)

I.Q.

TEST	SCORE OR QUOTIENT	NORM
.....
.....
.....

.....
PRINCIPAL'S SIGNATURE.

Remarks:

Name

FAMILY NAME

GIVEN NAME

PRESENT GRADE

PRESENT SCHOOL

APPENDIX B

SAMPLE OF THE VANCOUVER HIGH SCHOOL
ENROLMENT APPLICATION CARD
FOR A GRADE SIX MALE STUDENT

V.S.B. 8-1007
6M-56224-89

GRADE VI PUPILS

June, 19_____

Application for Enrolment in:

_____ JUNIOR HIGH SCHOOL

Pupil's Name _____
Family Name *Given Name*

Pupil's Address _____

Date of Birth _____ Phone _____

Teacher's Rating _____ Attitude to Work _____
(Use A, B, C, D, E.) *(Use 1, 2, 3, 4.)*

I.Q. _____

<i>TEST</i>	<i>Score or Quotient</i>	<i>Norm</i>
_____	_____	_____
_____	_____	_____
_____	_____	_____

Principal's Signature.

Remarks:

Name
Family Name
Given Name
Present Grade
Present School

APPENDIX C

SAMPLE OF

THE OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY

(INTERMEDIATE EXAMINATION: FORM B)

OTIS SELF-ADMINISTERING TESTS OF MENTAL ABILITY

By ARTHUR S. OTIS, PH.D.

Formerly Development Specialist with Advisory Board, General Staff, United States War Department

INTERMEDIATE EXAMINATION: FORM B

For Grades 4-9

20

Score.....

Read this page. Do what it tells you to do.

Do not open this paper, or turn it over, until you are told to do so. Fill these blanks, giving your name, age, birthday, etc. Write plainly.

Name..... Age last birthday..... years
First name, initial, and last name

Birthday..... Teacher..... Date..... 19....
Month Day

Grade..... School..... City.....

This is a test to see how well you can think. It contains questions of different kinds. Here is a sample question already answered correctly. Notice how the question is answered:

Sample: Which one of the five words below tells what an apple is?

1 flower, 2 tree, 3 vegetable, 4 fruit, 5 animal..... (4)

The right answer, of course, is "fruit"; so the word "fruit" is underlined. And the word "fruit" is No. 4; so a figure 4 is placed in the parentheses at the end of the dotted line. This is the way you are to answer the questions.

Try this sample question yourself. Do not write the answer; just draw a line under it and then put its number in the parentheses:

Sample: Which one of the five things below is round?

1 a book, 2 a brick, 3 a ball, 4 a house, 5 a box..... ()

The answer, of course, is "a ball"; so you should have drawn a line under the words "a ball" and put a figure 3 in the parentheses. Try this one:

Sample: A foot is to a man and a paw is to a cat the same as a hoof is to a — what?

1 dog, 2 horse, 3 shoe, 4 blacksmith, 5 saddle..... ()

The answer, of course, is "horse"; so you should have drawn a line under the word "horse" and put a figure 2 in the parentheses. Try this one:

Sample: At four cents each, how many cents will 6 pencils cost?..... ()

The answer, of course, is 24, and there is nothing to underline; so just put the 24 in the parentheses.

If the answer to any question is a number or a letter, put the number or letter in the parentheses without underlining anything. Make all letters like printed capitals.

The test contains 75 questions. You are not expected to be able to answer all of them, but do the best you can. You will be allowed half an hour after the examiner tells you to begin. Try to get as many right as possible. Be careful not to go so fast that you make mistakes. Do not spend too much time on any one question. No questions about the test will be answered by the examiner after the test begins. Lay your pencil down.

Do not turn this page until you are told to begin.

EXAMINATION BEGINS HERE.

1. Which one of the five things below does not belong with the others?
1 peach, 2 banana, 3 orange, 4 baseball, 5 plum. (Do not write on these dotted lines.) ()
2. Which one of the five words below tells best what a hammer is?
1 thing, 2 tool, 3 furniture, 4 weapon, 5 machine. ()
3. Which one of the five words below means the opposite of east?
1 north, 2 pole, 3 west, 4 equator, 5 south. ()
4. The peeling is to a banana and the husk is to an ear of corn the same as a shell is to what?
1 an apple, 2 an egg, 3 juice, 4 a peach, 5 a hen. ()
5. If we feel sorry for the suffering of another, we have a feeling of (?)
1 hate, 2 pity, 3 contempt, 4 disdain, 5 eagerness. ()
6. Which one of the five things below is the largest?
1 bud, 2 branch, 3 tree, 4 twig, 5 limb. ()
7. Wool is to a sheep as feathers are to what?
1 a pillow, 2 a rabbit, 3 a bird, 4 a goat, 5 a bed. ()
8. Which word means the opposite of succeed?
1 win, 2 decline, 3 fail, 4 accede, 5 try. ()
9. Which one of the five things below is most like these three: apple, peach, pear?
1 seed, 2 tree, 3 plum, 4 juice, 5 peel. ()
10. Which one of the ten numbers below is the largest? (Tell by letter.)
A 6456, B 8968, C 4265, D 5061, E 4108, F 7549, G 2335, H 9472, J 3286, K 8970 ()
11. Hat is to head as thimble is to what?
1 finger, 2 needle, 3 thread, 4 hand, 5 sewing. ()
12. If the words below were rearranged to make a good sentence, with what letter would the last word of the sentence begin? (Make the letter like a printed capital.)
usually are of made tables wood. ()
13. At 6 cents each, how many pencils can be bought for 48 cents? ()
14. Which statement tells best just what a gate is?
1 a hole in a fence, 2 something to swing on, 3 It has hinges, 4 a door in a fence, 5 It opens and shuts. ()
15. A hand is to an arm the same as a foot is to what?
1 leg, 2 toe, 3 finger, 4 wrist, 5 knee. ()
16. When a new kind of machine is thought of, it is usually called (?)
1 a discovery, 2 an adoption, 3 a creation, 4 a novelty, 5 an invention. ()
17. One number is wrong in the following series. What should that number be? (Just write the correct number in the parentheses.)
5 10 15 20 25 30 35 39 45 50. ()
18. What is the most important reason that automobiles have displaced horses and carriages?
1 Horses were getting scarce. 2 Horses often run away. 3 Autos save time and "time is money." 4 Autos are cheaper than carriages. 5 Autos cost less to repair than carriages. ()
19. Coal is to a locomotive as what is to an automobile?
1 motorcycle, 2 smoke, 3 wheels, 4 gasoline, 5 horn. ()
20. Which one of the words below would come first in the dictionary?
1 tramp, 2 saint, 3 razor, 4 quart, 5 grass, 6 night, 7 paint. ()
21. One number is wrong in the following series. What should that number be?
1 7 2 7 3 7 4 7 5 7 6 7 8 7. ()
22. An automobile is to a wagon as a motorcycle is to what?
1 walking, 2 horse, 3 buggy, 4 train, 5 bicycle. ()
23. A boy who often tells big stories about what he can do is said to (?)
1 lie, 2 fake, 3 cheat, 4 joke, 5 brag. ()
24. Which one of the five words below means the opposite of difficult?
1 hard, 2 quick, 3 soft, 4 easy, 5 common. ()
25. Which one of the five things below is most like these three: snake, cow, sparrow?
1 tree, 2 doll, 3 pig, 4 feather, 5 skin. ()
26. A hospital is to the sick as what is to criminals?
1 doctor, 2 asylum, 3 judge, 4 prison, 5 sentence. ()

Do not stop. Go on with the next page.

27. Which tells best just what a horse is?
 1 It has a tail, 2 a live thing, 3 a thing that works and eats, 4 a large, four-legged animal, 5 something to pull a wagon..... ()
28. Do what this mixed-up sentence tells you to do.
 letter Write the the in A parentheses..... ()
29. Which one of the words below would come first in the dictionary?
 1 brave, 2 burst, 3 broke, 4 build, 5 breadth, 6 brown, 7 bunch, 8 bribe ()
30. Better is to good as worse is to what?
 1 very good, 2 medium, 3 bad, 4 much worse, 5 best..... ()
31. Which tells best just what a lamb is?
 1 an animal with wool, 2 a creature with four legs and a tail, 3 a lively small animal, 4 a young sheep, 5 a young animal that eats grass..... ()
32. If the words below were rearranged to make a good sentence, with what letter would the third word of the sentence begin? (Make the letter like a printed capital.)
 honey bees clover gather red from..... ()
33. There is a saying, "A stitch in time saves nine." This means (?)
 1 A little sewing may save nine dollars. 2 It pays to attend to troubles before they get worse. 3 Work hard and save as much as you can. 4 You can save time by sewing.... ()
34. Grass is to cattle as bread is to what?
 1 butter, 2 flour, 3 milk, 4 man, 5 horses..... ()
35. Which tells best just what a lie is?
 1 mistake, 2 a malicious false statement, 3 an accidental false statement, 4 an exaggeration, 5 a wrong answer..... ()
36. The son of my father's sister is my (?)
 1 brother, 2 nephew, 3 cousin, 4 uncle, 5 grandson..... ()
37. If George is taller than Frank, and Frank is taller than James, then George is (?) James.
 1 taller than, 2 shorter than, 3 just as tall as, 4 (cannot say which)..... ()
38. A king is to a kingdom as a president is to what?
 1 vice-president, 2 senate, 3 republic, 4 queen, 5 democrat..... ()
39. Count each 5 below that has a 7 next after it. Tell how many 5's you count.
 7 5 3 5 7 2 3 7 5 6 7 7 2 5 7 3 4 7 7 5 2 0 7 5 7 8 3 7 2 5 1 7 9 6 5 7..... ()
40. An event which is sure to happen is said to be (?)
 1 probable, 2 certain, 3 doubtful, 4 possible, 5 delayed..... ()
41. Which one of the five things below is most like these three: president, admiral, general?
 1 ship, 2 army, 3 king, 4 republic, 5 soldier..... ()
42. Large is to object as loud is to what?
 1 soft, 2 small, 3 heavy, 4 weight, 5 sound..... ()
43. If the following words were arranged in order, with what letter would the middle word begin?
 Eight Ten Six Nine Seven..... ()
44. A quantity which grows smaller is said to (?)
 1 fade, 2 decrease, 3 dry up, 4 die, 5 sink..... ()
45. In a foreign language, boy = Kolo
 good boy = Kolo Daak
 The word that means *good* begins with what letter?..... ()
46. A captain is to a ship as a mayor is to what?
 1 state, 2 council, 3 city, 4 boss, 5 lawyer..... ()
47. One number is wrong in the following series. What should that number be?
 2 3 4 3 2 3 4 3 2 4..... ()
48. If Harry is older than William and William is just as old as Charles, then Charles is (?) Harry:
 1 older than, 2 younger than, 3 just as old as, 4 (cannot say which)..... ()
49. Do what this mixed-up sentence tells you to do.
 sentence the letter Write first this in..... ()
50. A revolver is to a man as what is to a bee?
 1 wings, 2 honey, 3 flying, 4 wax, 5 sting..... ()
51. If Paul is older than Herbert and Paul is younger than Robert, then Robert is (?) Herbert.
 1 older than, 2 younger than, 3 just as old as, 4 (cannot say which)..... ()

Do not stop. Go on with the next page.

52. What is the most important reason that bright lights are placed in front of theaters?
 1 so that people can see where they are, 2 to attract attention and look inviting, 3 so that
 people can see the advertisements better, 4 Electricity is furnished to theaters cheaply,
 5 to help light up the street. ()
53. If the words below were rearranged to make a good sentence, with what letter would the third
 word of the sentence begin? (Make the letter like a printed capital.)
 boys birch the a canoe made bark ()
54. A person who wishes very much to succeed but fears he will fail is said to be (?)
 1 earnest, 2 anxious, 3 industrious, 4 energetic, 5 cowardly ()
55. If the following words were arranged in order, with what letter would the middle word begin?
 Week Year Hour Second Day Month Minute ()
56. If a man has walked east from his home 7 blocks and then walked west 4 blocks, how many
 blocks is he from home? ()
57. In a foreign language, very hot = Soto Gran
 very cold = Foss Gran
 The word that means *very* begins with what letter? ()
58. Which one of the five things below is most like these three: cannon ball, wire, penny?
 1 dollar bill, 2 bone, 3 string, 4 pencil, 5 key ()
59. There is a saying, "A drowning man will grasp at straws." This means (?)
 1 A man will sink more easily than a straw. 2 Every one should learn to swim.
 3 Desperate people cling to absurd hopes. 4 Those who cannot swim should stay on land. ()
60. Do what this mixed-up sentence tells you to do.
 sum four Write three the one and of ()
61. An object or institution that will not perish or cease is said to be (?)
 1 permanent, 2 stable, 3 stationary, 4 solid, 5 sound ()
62. In a foreign language, some food = Beko Prac
 some milk = Klup Prac
 some food and milk = Beko Otoh Klup Prac
 The word that means *and* begins with what letter? ()
63. Which word means the opposite of pride?
 1 sorrow, 2 humility, 3 miserable, 4 conceit, 5 proud ()
64. If the following words were arranged in order, with what letter would the middle word begin?
 General Lieutenant Private Colonel Sergeant ()
65. There is a saying, "Make hay while the sun shines." This means (?)
 1 Hay made in cloudy weather is poor. 2 Haste makes waste. 3 Make the best of your
 opportunities. 4 Hay grows best in summer. 5 It is easier to work in the sun than in the
 shade ()
66. Which tells best just what a foot is?
 1 to wear a shoe and stocking on, 2 the part of the body on which an animal stands,
 3 It has five toes and a heel, 4 Both feet are the same size, 5 Men have larger feet than
 women ()
67. One number is wrong in the following series. What should that number be?
 1 2 4 8 12 32 64 ()
68. Write the letter that follows the letter that comes next after K in the alphabet ()
69. If the following words were arranged in order, with what letter would the middle word begin?
 Youth Infancy Manhood Childhood Birth ()
70. There is a saying, "All is not gold that glitters." This means (?)
 1 Some gold has a dull finish. 2 Appearances are often deceptive. 3 Diamonds sparkle
 more than gold. 4 Don't wear cheap jewelry. 5 Some people like to make a show of
 wealth ()
71. If I have a large box with 2 small boxes in it and 5 very small boxes in each small box, how
 many boxes are there in all? ()
72. If a boy can run 250 feet in 10 seconds, how many feet can he run in $\frac{1}{2}$ of a second? ()
73. Which one of the following words would come last in the dictionary?
 1 heart, 2 judge, 3 grass, 4 nerve, 5 horse, 6 north, 7 labor ()
74. One number is wrong in the following series. What should that number be?
 1 2 5 6 9 10 13 14 16 18 ()
75. An agreement reached in which both sides yield somewhat in their demands is called (?)
 1 a promise, 2 a compromise, 3 an understanding, 4 a deadlock, 5 an armistice . . . ()

If you finish before the time is up, go back and make sure that every answer is right.

APPENDIX D

THE OTIS SELF-ADMINISTERING TEST OF MENTAL ABILITY
MANUAL OF DIRECTIONS AND KEY
FOR INTERMEDIATE AND HIGHER EXAMINATIONS

OTIS SELF-ADMINISTERING TESTS OF MENTAL ABILITY

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MANUAL OF DIRECTIONS AND KEY (Revised)

For Intermediate and Higher Examinations

KEY
Higher
Form D
Page 2

- 1. (3
- 2. (20
- 3. (2
- 4. (G
- 5. (T
- 6. (4
- 7. (2
- 8. (5
- 9. (540
- 10. (2
- 11. (4
- 12. (3
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- 18. (8
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- 20. (31
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- 23. (2
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INTRODUCTORY

Contents. In this manual will be found the complete directions for administering and scoring the Intermediate and Higher Examinations, directions for interpreting the scores in the light of the educational problems which the tests will help solve, and directions for applying the results of the test to the solution of those problems.

Scope. The Higher Examination together with the Intermediate Examination constitute the Otis Self-Administering Tests of Mental Ability, covering the range from the 4th grade to the university. The Higher Examination is designed for high school students and college freshmen. The Intermediate Examination is designed for Grades 4 to 9. The Higher and Intermediate Examinations are similar in form, but they differ in content and difficulty.

Forms. Each examination is issued in four alternative forms, Forms A, B, C, and D, alike except in content.

SPECIAL FEATURES

Self-administration. In each of these examinations provision is made for the student to read for himself on the first page of the examination booklet all the directions needed for the examination. As the 75 items constituting each examination are in a single list, these are answered by the examinee without interruption. The examiner, therefore, has merely to distribute the blanks, see that all understand the printed directions, and give the signal to begin. He may then leave the class in charge of an assistant. For this reason the tests have been called "self-administering" tests.

Simplified scoring. In addition to the underlining of the correct one of several alternative answers, as is customary in group tests of mental ability, provision is made in these examinations for placing the number of the answer in a single column at the edge of each page. This simplifies the scoring to the extent that the whole examination can be scored in less than one minute.

Variety of test material. The form of the examinations admits of the use of a wide variety of types of questions instead of the limited number of types in the ordinary examination.

Flexible time limit. Provision is made for administering the examinations with a time limit of either 20 or 30 minutes. The 20-minute time limit may be used for general survey purposes or with normal school and college students. The 30-minute time limit should be used when time allows, as it will give a more accurate measure.

Ease of figuring IQ's. A chart is provided by which the IQ of the examinee can be found directly from the score and age in years and months merely by locating a point on the intersection of two lines. No arithmetical calculation or reference to tables is necessary.

Improved Percentile Graph. There is provided in each package of Examinations a new form of percentile graph on which percentile curves may be drawn, if desired, showing vividly the distributions of scores of any group or groups of examinees. With each percentile graph is furnished a scale chart by which the drawing of the percentile curves is reduced to the simplest terms.

Interpretation Chart. A chart is provided upon which the scores of a class or school may be plotted and the pupils divided into fast-moving, regular, and slow-moving groups and regraded within these groups, or otherwise classified, merely by drawing lines on the chart. Account is taken of mental ability, brightness, and chronological age in classifying by this method. It is not necessary to use the Interpretation Chart in order to interpret scores in these tests. However, it will be found a distinct aid and convenience.

HISTORICAL

These examinations are modeled after a group test of mental ability designed by the author in January, 1918, for use in a large commercial establishment in Connecticut. In that test the principle of self-administration was embodied, involving the single list of questions, the printed initial directions, and the provision for answers in single columns.

ACKNOWLEDGMENTS

The author is indebted to many persons for helpful suggestions and criticisms in connection with the Self-Administering Tests of Mental Ability. Special mention is due the following, who gave hearty cooperation in the administration of tests for standardization purposes: Mr. J. C. Amon, Bellevue, Pennsylvania; Mr. H. H. Murphy, Hastings, New York; Mr. T. H. Schutte, State Teachers' College, Moorhead, Minnesota; Dr. John P. Herring, Bloomsburg State Normal School, Bloomsburg, Pennsylvania; Dr. Virgil E. Dickson, Oakland, California; Dr. E. E. Lewis, Rockford, Illinois; Mr. Henry D. Rinsland, Ardmore, Oklahoma; Mr. E. D. Price, Enid, Oklahoma; and Mr. Franklin Thomas, Professor of Civil Engineering, California Institute of Technology, Pasadena, California. Mrs. Otis has devoted many hours to scoring, tabulating, and correlating.

The author is indebted to Dr. E. E. Keener, Director of Instructional Research, Chicago Public Schools, and C. Everett Myers, Research Secretary, Pennsylvania State Education Association, for assistance in standardizing Form C.

DIRECTIONS FOR ADMINISTERING

Who may administer examination. Any teacher after a little preparation can satisfactorily administer either the Intermediate or Higher Examination. The best preparation for administering either is to take it. The principal should invite his teachers to take the examination and score their own papers. Any teacher who is interested in mental-ability testing should welcome the opportunity to experience the taking of an examination, as this will give her the best appreciation of what the examination tests. Those administering an examination should realize that it is very important that conditions be uniform throughout the school and must be the same in the school being tested as in every other school where the examination has been given. For this reason, everything which needs to be said in administering the test is given below in boldface type, and the teacher should give these instructions verbatim, reading if necessary. If one teacher urges the students to work as rapidly as possible and another teacher urges them to work as carefully as possible, the results may be entirely different and not comparable. The teacher, therefore, should say nothing that is not prescribed, except to make clear the meaning of what is on the first page of the examination blank.

When to give examination. The best time to give the examination is probably at the opening of school in the morning, although the time of day probably does not have a serious effect upon the score.

Directions for administering. To administer either the Intermediate or the Higher Examination, Form A, B, C, or D, begin by addressing the students as follows:

"We are going to give you this morning [afternoon] some new and interesting tests. We will now pass the test papers and as soon as you receive a paper you may begin to read the first page and do as it directs, filling the blanks, etc. Do not open or turn over the paper. Part of the test is to see if you can follow directions."

Have monitors pass the papers, one to each student, right side up. See that every student is supplied with two pencils (or a pen) and an eraser.

Allow a reasonable time for all to finish reading the first page and trying the samples. A few laggards may be disregarded. Then say, "Is there any one who does not understand the first page?" Give any explanations necessary to make sure that all understand what is explained on the first page.

If a time limit of 20 minutes is to be used, say, "This will be a short test. You will be told to stop at the end of 20 minutes instead of 30. Find the number 20 in the upper left-hand corner of the page and make a ring around it." Be sure that all do this.

Then say, "Now turn the page and begin," and note the exact time. No further instructions are necessary.

If the principal or superintendent is administering the examination, he may now leave the class in charge of the teacher or an assistant, with instructions to give no further directions and answer no questions; to stop the work at the end of exactly 30 (or 20) minutes and have the papers collected. The person in charge during the examination will do well to move quietly about the room at the beginning of the examination and see that all are indicating the answers in a proper manner. If an examinee is found who is not placing the numbers in the parentheses, he should be told to do so.

DIRECTIONS FOR SCORING

The correct answers to the 75 items of both forms of the Intermediate and Higher Examinations are given on the margins of this manual. To score the examination, open the manual to the pages containing the answers to the form of the examination to be scored, fold open the manual and clip the pages together. Place the manual over the examination paper so that the appropriate Key is adjacent to the answers given on the examination paper. Place a check mark after each correct answer or a cross after each incorrect or omitted answer, or both checks and crosses.

If two answers are given for any one item, count the item wrong. This is quite likely to occur with Item 55 in Form A of the Higher Examination.

Number 37 in Form A and Number 57 in Form B of the Higher Examination count as wrong if the alphabet has been marked in any way.

If a paper is found in which the examinee has omitted to place the numbers in the parentheses but has otherwise indicated the answers, the scorer should write in the parentheses the numbers representing the answers of the examinee so far as these may be determined, and then score accordingly, but deduct one point from the total score for failure to follow the direction to place the numbers in the parentheses.

If the examinee has failed to make all his letters like printed capitals, score the paper as if all letters were printed capitals, but deduct one point for failure to follow the direction.

Whenever an examinee has used an irregular method of taking the examination, score the paper according to the obvious intent of the examinee and then deduct one point for each general direction not followed. Indicate such deduction by placing a -1 with a circle around it opposite the first instance where the direction has not been followed. Let his score represent the fairest measure of his ability that can be estimated.

The score in the examination is the number of correct answers. First, count up the correct answers and write the number on

75 (2)
74 (13)
73 (16)
72 (2)
71 (32)
70 (0)
69 (1)
68 (4)
67 (2)
66 (4)
65 (5)
64 (2)
63 (2)
62 (E)
61 (L)
60 (1)
59 (6)
58 (E)
57 (4)
56 (3)
55 (2)
54 (9)
53 (4)
52 (5)

the margin of the last page. Then verify the score by counting the incorrect and omitted answers. Thus, suppose the number of correct answers counted is 40. Count the incorrect and omitted answers beginning 41, 42, etc., and see that you end with 75. Then enter the score in the space provided on the first page of the blank. Do not trust the counting of correct answers only, as it is very easy to make a mistake. The checking of correct answers should be gone over by a second scorer, for even the best scorers will make mistakes.

RECORDING SCORES

The Class Record. The scores should be entered on the Class Record which is provided with each package of examination blanks. Before entering the scores, arrange the papers of a class either in alphabetical order or in the order of magnitude of the score, according to preference. Next, enter the name of each student and his age in years and months. Then enter his score in the proper column according to the time limit used. Directions for filling the remaining columns will be given under "Interpretation of Results."

20-Minute time limit. If a 20-minute time limit has been used, the scores may be transmuted into terms of 30-minute time-limit scores in order that they may be compared with norms or other 30-minute scores. This may be done by means of Table 1.

TABLE 1¹

20-MIN.	30-MIN.	20-MIN.	30-MIN.	20-MIN.	30-MIN.	20-MIN.	30-MIN.	20-MIN.	30-MIN.
1	1	16	20	31	40	46	59	61	71
2	2	17	22	32	41	47	60	62	71
3	4	18	23	33	43	48	61	63	72
4	5	19	24	34	44	49	62	64	72
5	6	20	26	35	45	50	63	65	73
6	7	21	27	36	46	51	64	66	73
7	9	22	28	37	48	52	64	67	74
8	10	23	30	38	49	53	65	68	74
9	11	24	31	39	50	54	66	69	74
10	13	25	32	40	51	55	67	70	75
11	14	26	33	41	53	56	68	71	75
12	15	27	35	42	54	57	68	72	75
13	17	28	36	43	55	58	69	73	75
14	18	29	37	44	56	59	70	74	75
15	19	30	39	45	58	60	70	75	75

STANDARDIZATION

Selection of items. In selecting items for the Intermediate and Higher Examinations, the Advanced Examination was drawn upon freely. An equal number of items of other types, some of which are new, were included in order that the examination might cover a large variety of questions and therefore afford a more comprehensive measure of mental ability. Preliminary editions containing more than enough items were administered to about 1000 high school students in Oakland, California, and Rockford, Illinois, and to 1000 grammar school

¹ This table was derived from a study of 20- and 30-minute scores in the Higher Examination only. It is therefore only approximate for the Intermediate Examination. It is assumed, however, that the 20-minute time limit will seldom be used with the Intermediate Examination.

pupils in Moorhead, Minnesota. These students were divided in each case into two groups, a "good group" and a "poor group." The same number were taken from each grade for both groups. The good group constituted the young students, and the poor group the old students. These groups had reached the same average educational status, therefore, but at different rates. Now it is the rate at which a student can progress through school that the mental-ability test is chiefly used to predict. Therefore this is believed to be the best criterion by which to judge the validity of each item that goes into the test. The number of times each item was passed by each group was then found and only those items chosen which showed a distinct gain in number of passes by the good group over the number of passes by the poor group in spite of the fact that the median age of the good group was over two years less than that of the poor group. Each item justified its inclusion, therefore, because it distinguished between students who progressed slowly and those who progressed rapidly.

Arrangement in order of difficulty. The items in each form of each examination have been arranged in the order of difficulty, according to the number of passes of each item by the students taking the preliminary editions.

PRACTICE EFFECT

Whenever a second form of a test is given after a first form, especially when the two forms have been made very much alike, students tend to do better on the second test. The effect of the first test is generally termed "practice effect," but it may include a number of effects. Among these is general familiarity with the method, resulting in ability to get under way more quickly, lessened nervousness, memory of mode of attack of certain types of problems, etc.

A study was made of the effect of practice when a second form of the Intermediate or Higher Examination was given the next day after the first form. The average gain in the second score was 4 points in each case. Therefore in such a case 4 points would have to be subtracted from the score in the second test to make allowance for the effect of practice.

INTERPRETATION OF RESULTS

Mental ability and brightness. There are two aspects of the mental quality of an individual which must not be confused. One is his degree of **mental ability** and the other his degree of **brightness**. The term "mental ability" refers to that innate mental quality which increases with age, whereas the term "brightness" refers to that constant quality which determines the rate of growth of the mental ability of an individual and the degree of mental ability which he will eventually reach.

Mental ability is measured by the individual's score in the test. A measure of his brightness is obtained by comparing his score with that of others of his own age. The distinction is best shown by reference to the Interpretation Chart.

The Interpretation Chart. An Interpretation Chart is provided in each package of Examinations to facilitate the interpretation of scores. Interpretation Charts for the Intermediate and Higher Examinations are given on the two sides of the same sheet. In the sample Interpretation Chart shown in Figure 1 (page 9) a point is plotted for each of the 276 pupils in Grades 5 to 8 of a grammar school. The height of each point

- 1. (4)
- 2. (2)
- 3. (3)
- 4. (2)
- 5. (5)
- 6. (3)
- 7. (4)
- 8. (2)
- 9. (1)
- 10. (4)
- 11. (H)
- 12. (2)
- 13. (5)
- 14. (2)
- 15. (1)
- 16. (3)
- 17. (3)
- 18. (9)
- 19. (3)
- 20. (2)
- 21. (6)
- 22. (4)
- 23. (T)
- 24. (2)
- 25. (2)
- 26. (1)

represents the score of an individual in the Intermediate Examination according to the scale at the left. The horizontal position of each point represents the age of the individual according to the scale at the foot of the chart.

The normal or "average" individual of the age of just 10 years is expected to make a score of just 23 points.¹ The normal individual of the age of just 11 years is expected to make a score of just 31 points, etc., as indicated by the heavy curved line through the middle of the chart (best seen in the blank chart). This may be called the normal curve and shows the norm or normal score to be expected from an individual of any given age. The curve becomes level at the age of 18 years, as shown in the Interpretation Chart for the Higher Examination, and may be considered as extending to the right indefinitely beyond 18 years at the same level. The derivation of this curve will be described below.

Mental maturity. A child's mental ability increases from birth, year by year, month by month, just as does his height, until he reaches his maximum, when he is said to have reached mental maturity. The normal curve may be thought of as the curve of growth in mental ability of the hypothetical exactly normal individual.

The age at which mental maturity is reached is difficult to decide, since the amount of mental development during the last year in which there is any development is very slight. In the Interpretation Chart for the Higher Examination the age at which mental maturity is reached is taken to be 18 years.

While individuals may reach mental maturity at about the same age, they nevertheless reach it with widely differing amounts of mental ability, just as they reach mature adult stature at differing heights. The degree of mental ability at which the normal individual reaches mental maturity is also very difficult to determine, since it is not possible to obtain a large group of completely unselected individuals (chosen at random from the whole population) at the various ages between 15 and 18. The norm for adults (persons of 18 years or over), however, has been called 42 in the Higher Examination, as shown by the upper limit of the normal curve. This is the equivalent of 59 points in the Intermediate Examination. The choice of this norm for adults is only an estimate based on all available data.

Derivation of norms. The positions of the normal curves in the two charts were established according to the judgment of the author upon consideration of (1) the median scores of the various age groups among about 120,000 pupils whose scores in the Higher or Intermediate Examinations have been reported to date, (2) the median scores of the several grade groups in relation to the median ages of these grade groups, (3) the norms for the various ages obtained from the norm table for the Advanced Examination by means of tables for converting scores into terms of the Higher and Intermediate Examinations, (4) the correlations between scores in the Higher and Intermediate Examinations and mental ages by the Herring Revision of the Binet-Simon Tests, and (5) correspondence between the Intermediate and Higher Examinations themselves. The position of the normal curve in neither chart accords exactly with any of these data, but it constitutes in either case a sort of average of the various groups of data.

¹ Unless otherwise stated the score referred to is the 30-minute time-limit score.

The aim has been to establish scores which are normal for unselected age groups, not merely for public school pupils. The scores of high school students, therefore, tend to average somewhat higher than the norms.

True mental age. Originally the term "mental age" referred to the degree of mental ability which is normal for a given age. Thus, "having a mental age of 15 years" meant "having a degree of mental ability just normal for the age of 15 years." This degree of mental ability is measured by a score of 36 in the Higher Examination. Having a mental age of 17, according to this definition, meant making a score just normal for 17-year-olds, which is a score of 41. Mental ages so found may be called true mental ages. Since the score of 42 is the norm for adults (taken to mean any person of 18 years or over), there is no age for which a score above 42 is the norm; therefore, of course, no score above 42 can be expressed as a true mental age.

The term "Mental Age" (capitalized), however, has now come to have a special meaning and to denote measures of mental ability — i.e., scores — in the Binet-Simon Tests. Binet Mental Ages below about 13 years are true mental ages. Above that, especially above 16 years, they are merely scores. They are called Mental Ages merely for the sake of consistency. The Binet Mental Age of 17, for example, represents a degree of mental ability considerably above that which is normal for the age of 17 or, indeed, for any age.

The Binet Mental Age of 16 years is generally taken as the norm for adults in figuring IQ's. There is a growing opinion among psychologists, however, that the Binet Mental Age which is the norm for adults is appreciably lower than 16 years.¹ The correlations between the Binet Scale and the Higher Examination confirm this belief. The correspondence between Binet Mental Ages and Scores in the Higher Examination, as indicated in the Interpretation Chart, is based partly upon the correlation between the Higher Examination and the Herring Revision of the Binet-Simon Tests and partly upon the age norms. At any rate, Binet Mental Ages appear to express degrees of mental ability in excess of that normal for the corresponding chronological ages even below the age of 15 years. For this reason IQ's obtained by the method provided herein² may be slightly higher than those obtained by the Binet Scale for the older students, but it is believed that they more nearly correspond with what the Binet IQ's of these students were when they were younger.³

Measures of mental ability. Each of the six scales at the left side of the Interpretation Chart for the Higher Examination is a measure of mental ability. The scales are so placed that values having the same height are corresponding measures of mental ability as far as may be determined. Thus a score of 40 points in the Higher Examination with a 30-minute time limit is the equivalent of a score of 31 in the Higher Examination with a 20-minute time limit, a score of 57 in the Intermediate Examination, a score of 120 in the Advanced Examination, a Binet Mental Age of 15 years 0 months, and a T-score of 62.⁴

¹ See Lewis M. Terman, "Mental Growth and the IQ," *Journal of Educational Psychology*, September, 1921.

² See "Measures of brightness" below.

³ See "Validity of Mental Age equivalents" below.

⁴ For the meaning and significance of a T-score, see William A. McCall, "A Uniform Method of Scale Construction," *Teachers College Record*, January, 1921.

Any individual whose score is plotted above the normal curve may be considered as brighter than normal, and any individual whose score is plotted below the normal curve may be considered as duller than normal.¹ The distance at any point above or below the normal curve is a measure of the brightness of the individual. A 14-year student making a score of 35 in the Higher Examination has a lesser degree of mental ability but a greater degree of brightness than a 15-year student making a score of 37.

Measures of brightness. Brightness is generally measured in terms of the Intelligence Quotient (IQ), which is customarily found by dividing the individual's Binet Mental Age by his chronological age (decimal point dropped). In the case of mental-ability tests other than the Binet Tests it is customary to give Binet Mental Age equivalents of scores in order that these may be used in finding IQ's. It has been found, however, that IQ's so derived have an appreciably wider range than those obtained by means of the Binet Tests and are therefore not comparable with the latter. Now the IQ was invented for use with the Binet Tests and should retain its original significance, or else it will become relatively meaningless. It seems that the term "Intelligence Quotient" is coming to have a legal recognition, but IQ's as sometimes derived from group tests of mental ability bear little relation to IQ's derived by the Binet Tests. It is the purpose of the author to use the term "IQ" only in its original significance.

Unless it is distinctly understood how IQ's were derived in any case, however, they should be designated by some means such as National IQ's, Otis IQ's, or Binet IQ's. The term "IQ," when not so qualified or understood, must be interpreted as referring to actual Intelligence Quotients found by means of the Binet Tests.

Validity of Mental Age equivalents. It follows from the above statements regarding the greater range of IQ's for each age group when obtained by group tests than when obtained by the Binet Tests, that Binet Mental Age equivalents are actual equivalents for normal children only. Thus a score of 38 in the Intermediate Examination corresponds to a Binet Mental Age of 12 years when made by a child of approximately 12 years. But if made by a 10-year child, for example, it represents a Binet Mental Age of only 11½ years, since according to the chart a 10-year child making a score of 38 has an IQ of only 115. This lack of constant correspondence between scores and Binet Mental Ages is inherent in all group tests and is due to the lesser accuracy of group tests. This phenomenon seems not to be generally appreciated, as witnessed by the now prevalent custom of converting scores into Binet Mental Age equivalents. There is no Binet Mental Age equivalent of a score in any group test of mental ability which is valid for all ages of individuals. For that reason it is believed that the most scientific method of obtaining IQ's from scores in group tests, which are comparable with Binet IQ's, is by comparison of the variabilities of scores of individuals of the various age groups in the group test and in Binet Tests, as described below.

Mental Age equivalents as such are not necessary to the use of the Higher or Intermediate Examinations. Scores are quite sufficient as measures of mental ability and IQ's as measures of

¹ Here "normal" means exactly median in brightness. The term "normal," however, is often used to refer to all individuals whose scores are reasonably close to the norms for their respective ages.

brightness. IQ's can be obtained from scores in the Otis Self-Administering Tests without Mental Age equivalents.

In order to compare scores with Mental Age equivalents of scores in other group tests or to find IQ's comparable with those obtained from other group tests, however, Binet Mental Age equivalents are given to scores in both examinations. These may be obtained from the Interpretation Chart for the Higher Examination. Binet Mental Age equivalents of scores in the Intermediate and Higher Examinations are given also in Tables 2 a and 2 b.

TABLE 2 a

BINET MENTAL AGE EQUIVALENTS OF SCORES IN THE INTERMEDIATE EXAMINATION

SCORE	MA	SCORE	MA	SCORE	MA	SCORE	MA	SCORE	MA
1	7-4	16	9-0	31	11-0	46	13-1	61	15-11
2	7-5	17	9-2	32	11-2	47	13-3	62	16-1
3	7-6	18	9-3	33	11-3	48	13-5	63	16-3
4	7-7	19	9-5	34	11-5	49	13-7	64	16-6
5	7-8	20	9-7	35	11-6	50	13-10	65	16-8
6	7-9	21	9-8	36	11-8	51	14-0	66	16-11
7	7-10	22	9-10	37	11-10	52	14-2	67	17-2
8	7-11	23	10-0	38	12-0	53	14-4	68	17-5
9	8-0	24	10-1	39	12-1	54	14-6	69	17-8
10	8-2	25	10-3	40	12-2	55	14-8	70	17-10
11	8-4	26	10-4	41	12-4	56	14-10	71	18-0
12	8-5	27	10-6	42	12-6	57	15-0	72	18-3
13	8-7	28	10-7	43	12-8	58	15-2	73	18-5
14	8-9	29	10-9	44	12-10	59	15-5	74	18-7
15	8-11	30	10-10	45	12-11	60	15-8	75	18-9

TABLE 2 b

BINET MENTAL AGE EQUIVALENTS OF SCORES IN THE HIGHER EXAMINATION

SCORE	MA	SCORE	MA	SCORE	MA	SCORE	MA	SCORE	MA
1	7-10	16	10-8	31	13-5	46	16-0	61	17-11
2	8-0	17	10-10	32	13-7	47	16-2	62	18-0
3	8-2	18	11-0	33	13-10	48	16-3	63	18-2
4	8-4	19	11-3	34	14-0	49	16-5	64	18-3
5	8-6	20	11-5	35	14-2	50	16-6	65	18-5
6	8-9	21	11-7	36	14-4	51	16-8	66	18-6
7	8-11	22	11-10	37	14-6	52	16-9	67	18-8
8	9-2	23	12-0	38	14-8	53	16-10	68	18-9
9	9-4	24	12-2	39	14-10	54	17-0	69	18-11
10	9-7	25	12-4	40	15-0	55	17-2	70	19-0
11	9-9	26	12-6	41	15-2	56	17-3	71	19-2
12	10-0	27	12-8	42	15-4	57	17-5	72	19-3
13	10-2	28	12-10	43	15-6	58	17-6	73	19-4
14	10-4	29	13-0	44	15-8	59	17-8	74	19-5
15	10-6	30	13-3	45	15-10	60	17-9	75	19-6

Age norms. The norms in the Intermediate or Higher Examination for the various ages may be read from the appropriate Interpretation Chart by noting the points at which the normal curve cuts the vertical age lines, or may be taken from Table 3 or Table 4.

TABLE 3

AGE NORMS IN INTERMEDIATE EXAMINATION (30-MINUTE TIME LIMIT)

YEARS	MONTHS										
	8	9	10	11	12	13	14	15	16	17	18 or over
0	7	15	23	31	38	44	49	53	56	58	59
1	8	16	24	32	39	44	49	53	56	58	
2	8	16	24	32	39	45	50	53	56	58	
3	9	17	25	33	40	45	50	54	57	58	
4	10	18	26	34	40	46	50	54	57	58	
5	10	18	26	34	41	46	51	54	57	58	
6	11	19	27	35	41	46	51	55	57	59	
7	12	20	28	35	42	47	51	55	57	59	
8	12	20	28	36	42	47	52	55	58	59	
9	13	21	29	36	43	48	52	55	58	59	
10	14	22	30	37	43	48	52	56	58	59	
11	14	22	30	37	43	49	53	56	58	59	

TABLE 4

AGE NORMS IN HIGHER EXAMINATION (30-MINUTE TIME LIMIT)

YEARS	MONTHS						
	12	13	14	15	16	17	18 or over
0	23	28	32	36	39	41	42
1	24	28	32	36	39	41	
2	24	29	33	37	39	41	
3	25	29	33	37	40	41	
4	25	29	33	37	40	41	
5	25	30	34	37	40	41	
6	26	30	34	38	40	42	
7	26	30	34	38	40	42	
8	27	31	35	38	40	42	
9	27	31	35	38	41	42	
10	27	31	35	39	41	42	
11	28	32	36	39	41	42	

Norms for college students. The scores of 2516 college students in the Higher Examination have been reported to date from 21 colleges and universities. Ten of the 21 used 20-minute time limits. Reducing all the scores to a 30-minute basis, the median score of these 2516 students is 53 points. The median scores of the 21 colleges and universities were as follows (30-minute time limit): 37, 39, 45, 46, 51, 51, 52, 53, 53, 54, 55, 55, 56, 57, 59, 61, 62, 62, 64, and 65.

Various percentile scores of the 2516 college students are shown in Table 5.

TABLE 5

SHOWING VARIOUS PERCENTILE SCORES OF 2516 COLLEGE STUDENTS IN THE HIGHER EXAMINATION

Percentile	(Lowest)			(Median)			(Highest)	
	0	3	10	25	50	75	90	100
20-MINUTE BASIS	16	25	30	36	41	49	55	75
30-MINUTE BASIS	20	32	39	46	53	62	67	75

Derivation of IQ Scale. According to Dr. Terman,¹ IQ's found by the Stanford Revision of the Binet-Simon Tests are distributed very closely in accordance with the law of normal distribution and with the middle 50 per cent falling within the range of IQ's from 92 to 108.

Due partly, no doubt, to the form of the Intermediate and the Higher Examinations, the steps in difficulty between items being smaller in the first part of each examination than in the last part, the distributions of scores of the several age groups have approximately the same variability, as far as can be determined. These distributions tend to be approximately normal, and are such that the middle 50 per cent of scores of each age group tend to fall within 8 points above and below the norm for that age. Fortunately, therefore, each point in the score of an individual above or below the norm for his age represents a point in IQ above or below 100. If an individual's score exceeds the norm for his age by 12 points, his IQ is 112.

How to find the IQ of an individual. The IQ of an individual may be found in either of two ways. One is as follows: Add to 100 the number of points by which a pupil's score exceeds the norm for his age, or subtract from 100 the number of points by which a pupil's score falls below the norm for his age. A simple and easy way to obtain the same result is to add 100 to the score of the individual and subtract from this sum the score which is the norm for his age. (The norm for individuals over 18 years may be taken as 42 points in the Higher Examination and as 59 points in the Intermediate Examination.) Thus, if a 15-year student's score in the Higher Examination is 34, the norm for his age being 36, his IQ is $34 + 100 - 36 = 98$.

A second method of finding an IQ is to plot the score of the individual in the appropriate Interpretation Chart by placing a dot on the horizontal line representing his score and on the vertical line representing his age. If the dot falls on a curve, the IQ of the individual will be stated at the end of the curve in the IQ column at the right. Thus, if a student of 15 years, 4 months, makes a score of 31 in the Higher Examination, his IQ is 94. If the point falls between two curves, the IQ may be estimated closely enough by noting its position relative to the curve above or below.

The IQ of each student may be entered after his name on the Class Record, in the column headed "IQ."

Index of Brightness. A measure of brightness used in connection with the Otis Group Intelligence Scale is the Index of Brightness. The relation between IQ's obtained by the Higher Examination and the Index of Brightness as found by the Advanced Examination is shown in the IQ and IB columns in the Interpretation Chart. This same correspondence holds good for IQ's obtained by the Intermediate Examination. If IQ's are used, it is not necessary to find IB's. Both IQ's and IB's serve the same purpose.

Percentile Rank. Another measure of brightness is called the "Percentile Rank." If a student exceeds 75 per cent of unselected individuals of his own age in score, he is said to have a Percentile Rank (PR) of 75, and the same for any other per cent. The scale of Percentile Ranks extends, therefore, from 0 to 100. A PR of 50 represents exact normality and corresponds to an IQ or IB of 100.

¹ L. M. Terman, *Measurement of Intelligence* (Houghton Mifflin Company, Boston), page 79.

Assuming distributions of scores for the various age groups to be in accord with the law of normal distribution, the Percentile Rank of an individual may be found from his IQ or IB by reference to the PR column at the right of the Interpretation Chart for the Higher Examination. This correspondence holds also between IQ's, IB's, and PR's for the Intermediate Examination. If desired, the student's PR may be entered also on the Class Record. This is optional.

Grade status. Table 6 shows the grade status corresponding to various 30-minute scores in the Intermediate and Higher Examinations. For example, a score of 11 in the Intermediate Examination is a grade status of 2.8 — that is, it is the norm for the end of the eighth month of the second grade; a score of 30 in

TABLE 6 (Revised)

INTERMEDIATE EXAMINATION						HIGHER EXAM.	
GRADE SCORE	GRADE STATUS	GRADE SCORE	GRADE STATUS	GRADE SCORE	GRADE STATUS	GRADE SCORE	GRADE STATUS
11	2.8	26	4.8	41	6.8	30	8.0
12	3.0	27	4.9	42	7.0	31	8.3
13	3.2	28	5.0	43	7.2	32	8.5
14	3.3	29	5.1	44	7.4	33	8.8
15	3.4	30	5.2	45	7.6	34	9.1
16	3.5	31	5.4	46	7.9	35	9.4
17	3.6	32	5.5	47	8.1	36	9.7
18	3.7	33	5.6	48	8.3	37	10.0
19	3.9	34	5.8	49	8.5	38	10.3
20	4.0	35	5.9	50	8.8	39	10.7
21	4.1	36	6.0	51	9.1	40	11.0
22	4.3	37	6.2	52	9.4	41	11.4
23	4.4	38	6.3	53	9.7	42	11.8
24	4.5	39	6.4	54	10.0	43	12.2
25	4.7	40	6.6	55	10.3	44	12.6

TABLE 7

SHOWING DISTRIBUTION OF SCORES OF 24,724 PUPILS IN THE 6TH GRADE IN THE INTERMEDIATE EXAMINATION

SCORE	AGE								TOTALS
	9 to 9-11	10 to 10-11	11 to 11-11	12 to 12-11	13 to 13-11	14 to 14-11	15 to 15-11	16 or over	
	75			1					
70-74		3	19	8					30
65-69		31	116	49	10	6			212
60-64	1	66	344	193	28	2	3		637
55-59	3	97	551	336	87	24	5	1	1104
50-54	3	142	912	586	197	79	21		1940
45-49	7	183	1130	1084	340	138	34	7	2923
40-44	6	162	1193	1061	491	208	50	11	3182
35-39	6	207	1221	1241	668	280	106	11	3740
30-34	9	155	1003	1180	761	338	150	24	3620
25-29	7	115	784	935	700	360	171	27	3099
20-24		83	457	612	556	328	179	8	2223
15-19	1	34	241	341	353	220	117	26	1333
10-14	1	7	75	134	150	89	58	14	528
5-9		2	11	27	25	31	23	6	125
0-4			6	7	4	4	4	2	27
Totals	44	1287	8064	7794	4370	2107	921	137	24724

Median age: 12 yr. 5 mo. Median score: 41.

the Higher Examination is the norm for the beginning of the eighth grade. These values are based on the tables of norms and Table 31 of *Statistical Method in Educational Measurement* (World Book Company).

Tables 7, 8, and 9 show the distributions of scores in the Intermediate and the Higher Examinations. Similar data have been compiled for the other grades but cannot be given for lack of space.

TABLE 8

SHOWING DISTRIBUTION OF SCORES OF 35,278 PUPILS IN THE 8TH GRADE IN THE INTERMEDIATE EXAMINATION

SCORE	AGE								TOTALS
	11 to 11-11	12 to 12-11	13 to 13-11	14 to 14-11	15 to 15-11	16 to 16-11	17 to 17-11	18 or over	
	75			1	3	6	1				11
70-74	14	96	303	182	48	9			652
65-69	28	324	1177	740	213	50	4		2536
60-64	53	227	1710	1327	432	93	10		3852
55-59	39	426	1828	1753	732	168	16	2	4964
50-54	44	441	1771	1933	1025	219	42	2	5477
45-49	22	313	1468	1822	1102	295	54	2	5088
40-44	28	253	1187	1567	1052	313	38	6	4444
35-39	26	197	790	1122	849	268	50	10	3312
30-34	16	139	513	820	605	237	28	6	2364
25-29	9	76	244	393	423	160	28	2	1335
20-24	9	38	146	242	221	106	28	10	800
15-19	1	17	60	102	63	50	4		297
10-14		7	12	33	28	13	4		97
5-9	2	1	10	5	7	4			29
0-4			2	6	9	3			20
Totals	301	2556	11224	12053	6810	1988	306	40	35278

Median age: 14 yr. 3 mo. Median score: 49.

TABLE 9

SHOWING DISTRIBUTION OF SCORES OF 15,715 PUPILS IN THE 12TH GRADE IN THE HIGHER EXAMINATION

SCORE	AGE								TOTALS
	14 to 14-11	15 to 15-11	16 to 16-11	17 to 17-11	18 to 18-11	19 to 19-11	20 or over		
	75			1					
70-74		5	19	11	5	2			43
65-69	2	31	78	128	43	10	4		296
60-64	4	40	283	312	123	31	11		804
55-59	3	75	465	454	227	62	23		1309
50-54	10	125	628	970	484	147	52		2416
45-49	7	96	770	1247	462	219	76		2877
40-44	4	78	532	1280	750	227	92		2903
35-39		40	415	960	686	268	101		2470
30-34	1	28	211	495	455	172	66		1428
25-29		10	85	213	216	112	43		679
20-24		1	27	85	97	60	17		287
15-19		5	11	31	27	18	5		97
10-14			4	10	5	3	5		27
5-9				5	4	4			13
0-4				1	1	2			4
Totals	32	534	3529	6202	3585	1337	496		15715

Median age: 17 yr. 7 mo. Median score: 44.

1. (3)
2. (30)
3. (4)
4. (2)
5. (1)
6. (2)
7. (14)
8. (4)
9. (3)
10. (2)
11. (5)
12. (6)
13. (3)
14. (1)
15. (240)
16. (4)
17. (1)
18. (4)
19. (5)
20. (4)
21. (8)
22. (2)
23. (2)
24. (5)
25. (2)
26. (2)

APPLICATION OF RESULTS

Purposes of mental-ability tests. The chief administrative purposes for which mental-ability tests are given are: (1) the division of the pupils of a grade or the students of a class into more homogeneous divisions, usually in order that instruction of different degrees of enrichment may be given, (2) the re-grading of pupils so that the pupils of each grade are more homogeneous in mental ability and are therefore more easily taught together, (3) the division of pupils of a school into groups which will progress at different rates.

The reader should consult Intelligence Tests and School Reorganization, by L. M. Terman and others (World Book Company), for a detailed discussion of the purposes and uses of tests of mental ability in regrading and classifying.

Division of classes. If it is desired to divide the students of a class into more homogeneous groups for instruction purposes, this may be done either on the basis of score or on the basis of IQ. Division on the basis of score would be made as follows:

Classification according to score. Find the distribution of the scores of the class. If the scores are plotted on the Interpretation Chart, this may be done by placing in the column under "Totals" at the left the number of dots on each horizontal line. (If desired, the frequencies of the various class intervals, 0-4, 5-9, etc., may be entered in the same column. These will be used in drawing a percentile curve on the Percentile Graph.) By means of this distribution the class may be divided into any number of divisions for differentiated instruction. Thus, let us suppose it is desired to divide a class into three divisions, A, B, and C, on the basis of score. This would be done as follows: Count down the distribution until one third the total number of scores has been counted. At this point draw a line across the distribution to mark the lower limit of score of Group A. Next count down another third and draw another line marking off Group B from Group C. Referring now to the Class Record, where each student's score appears opposite his name, the division designation, A, B, or C, may be placed opposite each student's name in the column headed "Classification."

This method is illustrated in the sample Interpretation Chart in Figure 2. Here 105 9th-year students are divided into three classes of 35 students each on the basis of score.

Classification according to brightness. If it is desired to divide the students of a class into divisions on the basis of brightness, this may be done by dividing the distribution of IQ's in the same way as suggested above for dividing the distribution of scores. To find the distribution of IQ's, count the dots between each two adjacent curves, including those which touch the lower but not the upper curve. Place the number of dots in the column headed "Totals" at the right, as shown in the sample charts. As a check on accuracy in counting the dots, it will be well to add these numbers and see that the sum corresponds to the number of students in the class.

Considerations governing method of classification. Two methods of classification have been described. Which should be used? It will be found that the dispersion of scores of any age group is so great in comparison with the rather narrow range of age norms for high school ages, that the resulting classifications by the two methods are very nearly the same. Even when classified by IQ, the superior division consists of students whose scores are nearly all higher than those of the

next division, etc. It remains for further research to discover which is the better method. It is possible that if the classification is made for the purpose of determining groups which will cover the curriculum of the high school in different amounts of time, classification on the basis of IQ may be the better method, whereas if it is to establish sections which will take work of differing degrees of intensity, classification on the basis of score may be the better.

Regrading. If it is felt that the pupils of a school are very badly graded, so that the 6th grade, for example, is believed to contain some pupils who could do satisfactory work in the 7th or 8th grade and some who should be in the 5th grade to do the best work, the pupils may be regraded on the basis of score in a mental-ability test. The ideal grading would be that in which the pupils of the 6th grade all make scores higher than those in the 5th grade and lower than those in the 7th grade, etc. Practically this is impossible.

The next best procedure is to select those pupils from the 6th grade who make very high or very low scores and to promote or demote these. No hard and fast rule can be laid down for this. The number of pupils to be shifted depends partly on the amount of overlapping of ability between grades and partly on the character of the instruction possible in the school. Where relatively individual instruction is possible, homogeneous grouping is not so essential. It is probably best to begin re-grouping slowly, taking first those whose scores deviate most from the median score of the grade and whose scholarship in the judgment of the teacher accords with their scores, and promoting or demoting these pupils one grade or one-half grade. If conditions warrant or seem to require it, they may be further promoted or demoted later. Later, also, more pupils may be regraded, until by degrees the grades will become more nearly homogeneous.

Multiple-track plan. A plan of school organization called the "multiple-track plan," in use in Oakland, California, and elsewhere, is one in which the pupils of the school are divided into groups (generally three, sometimes five) which progress at different rates. Thus there may be fast-moving, normal, and slow-moving classes, covering the first eight grades in say 7, 8, and 9 years, respectively.

A situation illustrating the need of reclassification is that shown in the sample Interpretation Chart in Figure 1. In this chart are plotted the scores of 276 pupils in Grades 5 to 8 of a grammar school. The scores of the different grades are plotted by different marks. It will be seen that the different grades overlap very markedly. Each grade contains both young pupils making high scores, who are therefore very bright, and old pupils making low scores, who are therefore very dull.

Division of pupils into groups to progress at different rates should be made on the basis of brightness. It is recommended by Terman that the brightest 15 per cent of the pupils of a school be placed in fast-moving classes (where numbers permit) and the duller 15 per cent in slow-moving classes. The selection of these pupils should be made, therefore, on the basis of IQ (or IB or PR). A convenient method of making the division is illustrated in Figure 1 in the case of the 276 pupils. Of this number 15 per cent is about 40. Therefore the brightest 40 (according to IQ) should be placed in the fast-moving group and the duller 40 in the slow-moving group.

The method of making the division by means of the chart

INTERPRETATION CHART. For Intermediate Examination

Grades plotted 5th, 6th, 7th and 8th. Number 276. Form used A. Time limit 30 min. Date Oct. 1, 1922

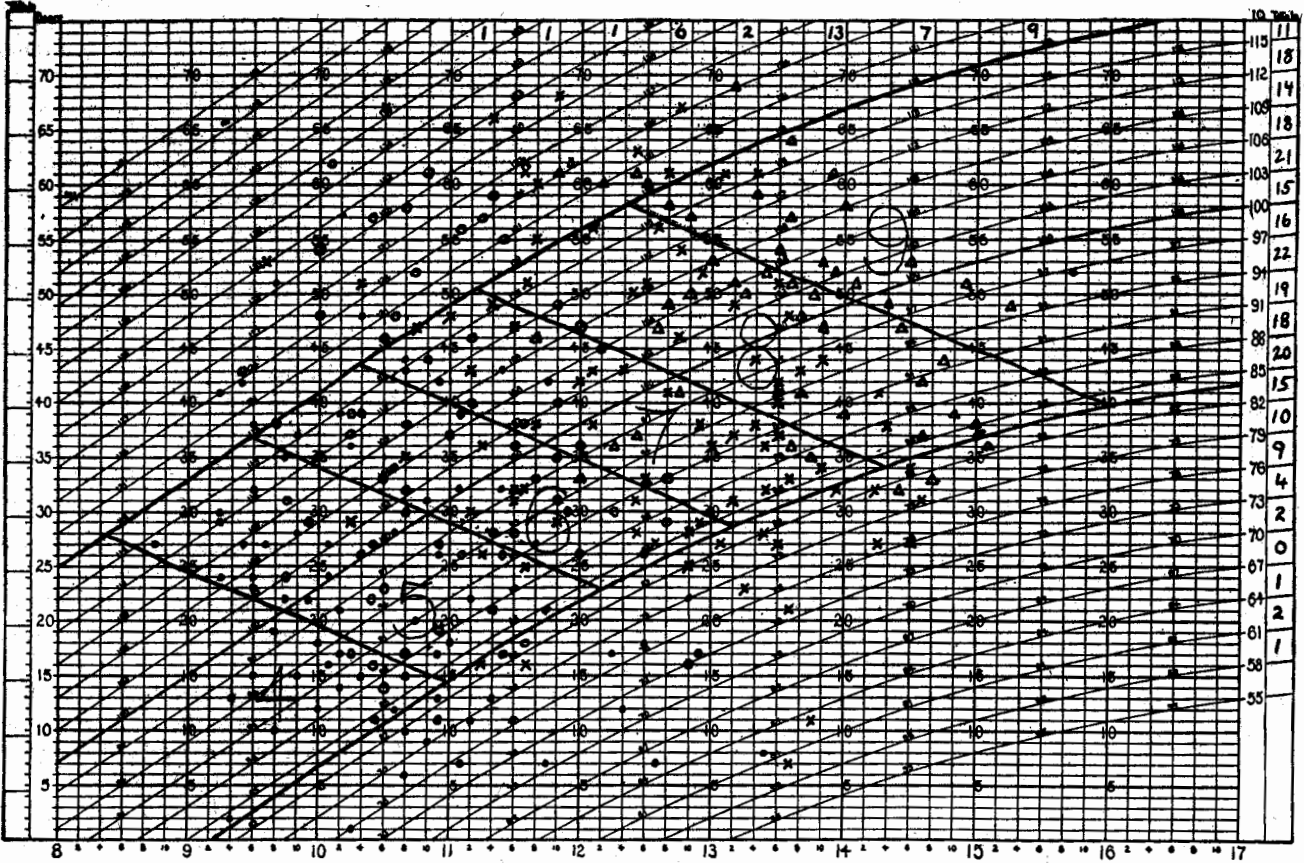


FIG. 1

INTERPRETATION CHART. For Higher Examination

Classes plotted Ninth year. Number 105. Form used A. Time limit 30 min. Date Oct. 1, 1922

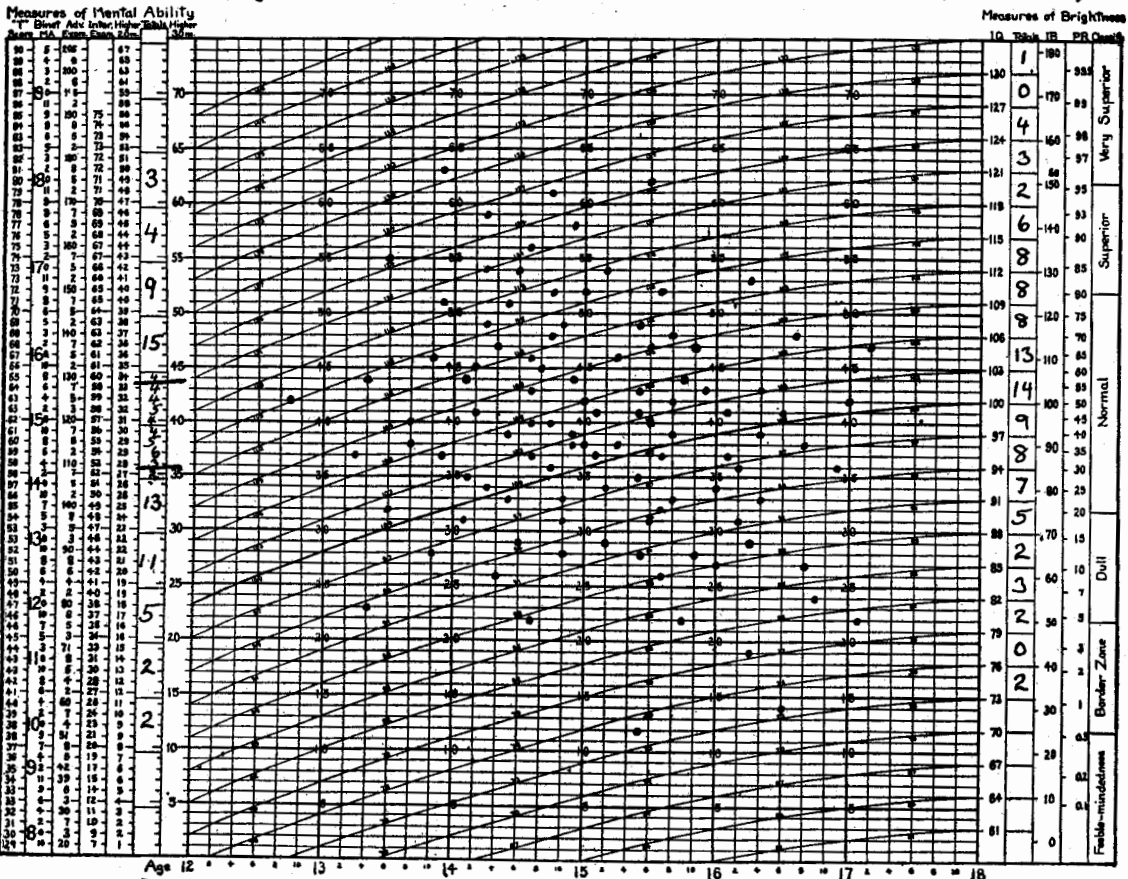


FIG. 2

KEY

Higher Form B Page 2

- 1. (3)
- 2. (20)
- 3. (3)
- 4. (G)
- 5. (T)
- 6. (2)
- 7. (2)
- 8. (2)
- 9. (450)
- 10. (4)
- 11. (4)
- 12. (6)
- 13. (5)
- 14. (3)
- 15. (3)
- 16. (4)
- 17. (3)
- 18. (8)
- 19. (3)
- 20. (17)
- 21. (4)
- 22. (1)
- 23. (2)
- 24. (2)
- 25. (5)

(16) 75
(4) 74
(3) 73
(15) 72
(5) 71
(R) 70
(3) 69
(2) 68
(7) 67
(12) 66
(5) 65
(L) 64
(3) 63
(4) 62
(61) 60
(128) 60
(5) 59
(8) 58
(4) 57
(21) 56
(5) 55
(4) 54
(2) 53

is as follows: Find the curve which separates the upper 40 cases according to IQ. If no curve cuts off approximately 40 cases, draw a curve which does, making it parallel to the printed curves. The pupils whose scores are plotted above this curve should be placed in the fast-moving class. Similarly find or draw a curve which separates the lower 40 cases according to IQ. The pupils whose scores are plotted below this curve should be placed in the slow-moving group.

Grading within the group. The pupils of the three groups, fast-moving, normal, and slow-moving, are still to be graded. Ideally this would be done on the basis of score. Thus, if the 196 pupils in the normal group are to be placed in Grades 5, 6, 7, and 8, the lowest fourth or 49, according to score, would be placed in the 5th grade, the next 49, according to score, would be placed in the 6th grade, etc.

This would result, however, in placing in one grade pupils who, although very homogeneous as to score, had a very wide range of ages. The pupils of the 6th grade, for example, according to this plan, might range in age from a little over 9 years to nearly 16 years. Practically, therefore, it may seem more desirable to take some account of the age of the child. A very simple way to do this is by drawing lines across the middle band of the chart at a slight slant instead of horizontally, as shown in Figure 1; in this way age is automatically taken account of. The pupils represented by the dots in each area so marked out, while somewhat less homogeneous as to score, are much more homogeneous as to age. The greater the slant, the more weight is given to age.

In the sample chart provision is made for skipping certain pupils into the 9th grade, demoting others into the 4th grade, and dividing the remaining pupils into four groups of 40 each which would be placed in the 5th, 6th, 7th, and 8th grades.

If the slanting-line method is used, the dots plotted in the Interpretation Chart must be identified, or else it will be necessary to plot the score of each pupil again to determine in what grade he should be. It has been found feasible to do this by numbering the pupils consecutively on the Class Record and writing each pupil's number in small figures near the dot representing his score. If this is done, the pupils whose scores fall within a given area may be identified at once.

The number of cases represented in the sample chart is too small to illustrate the division of the fast- and slow-moving groups into grades — and, indeed, in a school of this size the establishment of fast- and slow-moving classes would doubtless entail grave administrative difficulties; but in a school where there are many more pupils, this would be done in exactly the same way as shown in the case of the normal group.

It must be remembered that the classification which would be effected by any of the above methods is rather in the nature of a goal to be worked toward gradually. It is doubtful whether it would ever be wise to reorganize a school completely on any of these plans at one time, especially on the basis of one test. It would be better, doubtless, to promote or demote extreme cases, as explained above, and as these show themselves to be properly placed others may be shifted. The teachers' independent judgments should weigh equally with the test results in determining which pupils should be regraded or in what grade any individual pupil should be placed. Indeed, the regrading should be done according to the judgment of the teachers *in the light of the test results.*

Educational and vocational guidance. In advising a young high school student regarding his educational future or his vocation, his degree of brightness should be considered. It seems probable that an entering student with a PR of 90 or higher may safely be permitted to attempt to finish high school in 3½ or even 3 years. A student with a PR of 50 or less should certainly be prevented from attempting more than the regular course. Any one interested in research will do well to investigate the degree of brightness necessary to complete successfully the high school in 3½ or 3 years.

A boy or girl having a PR of 75 or over may be safely encouraged to go to college. Doubtless many whose PR's are between 50 and 75 will succeed in college if industrious. A boy or girl whose PR is less than 25 probably should be dissuaded from going to college. Here again there is need of research.

Similarly the degree of brightness of a student should be considered in advising him regarding a vocation. Bright students should be encouraged to enter the professions. Dull ones should be helped to choose a trade. The Stenquist Mechanical Aptitude Tests¹ may help to discover the proper trend of a boy's education.

Classification Test. If it is desired to give a general achievement test in any grade from the fourth to the ninth in addition to the Intermediate Examination, it is recommended that the Classification Test¹ be used. The Classification Test is a combination of the Intermediate Examination and a general achievement test covering reading, arithmetic, spelling, grammar and diction, geography, history and civics, literature, vocabulary, physiology and hygiene, and general information, including music and art. Form A of the Classification Test contains Form A of the Intermediate Examination, and Form B of the Classification Test contains Form B of the Intermediate Examination. The time limit on each of the two parts is one-half hour. The correlation of the Classification Test and the Stanford Achievement Test was found by Dr. E. E. Keener to be .83.

THE PERCENTILE GRAPH

In order to compare the score of any pupil with the scores of the class as a whole or to compare two or more classes, the most effective way is to draw a percentile curve for each grade or class on the Percentile Graph, a copy of which is included in each package of Examinations.

Definition of percentile curve. A percentile curve is a smooth line having a horizontal length representing 100 per cent of the scores of any group of individuals and so drawn that any point on the curve has a height representing the amount of a given score and a horizontal position on the graph representing the per cent of the scores of the group that is exceeded by the given score. The method of drawing a percentile curve is given in full below. One not familiar with percentile curves will appreciate their significance after studying the directions for drawing them.

A percentile curve shows at a glance not only the median score of a class but also the range and variability of the scores. It shows at a glance just what per cent of the scores of the class is exceeded by the score of any given individual and just what per cent of the class attains or exceeds any given score. Two of

¹ Published by World Book Company, Yonkers-on-Hudson, New York.

more curves on the same graph show very vividly the amount of overlapping of the scores of different classes.

DIRECTIONS FOR DRAWING A PERCENTILE CURVE

General procedure. The steps taken in drawing the percentile curve are: (1) distributing the scores, (2) finding the subtotals — number of cases to and including those in each class interval, (3) reducing these subtotals to per cents of the number of cases in the group, (4) locating points in the graph representing these per cents, and (5) drawing a smooth curve through these points.

Provision is made for distributing the scores of two groups of individuals on one Percentile Graph sheet, and from these distributions two percentile curves may be drawn. This does not mean, however, that only two curves may be drawn on one graph. The scores of additional groups may be distributed on other Percentile Graph sheets or any sheet of paper and as many curves drawn on one graph as may be conveniently distinguished.

Distributing the scores. In one of the columns headed "Tallying," distribute the scores of a class by putting a short mark opposite the interval of score within which the score of each individual falls. The sample Percentile Graph (Fig. 3) shows that in the freshman class two individuals had scores between 60 and 64, two had scores between 55 and 59, five had scores between 50 and 54, etc. If the scores of a class have been plotted on an Interpretation Chart, the number of scores falling within each interval of score may be copied directly on to the Percentile Graph sheet in figures, as shown in the sample in the case of the sophomore class. This will save distributing the scores again. The number of tallies or the figure in the Tallying column which tells the number of scores falling within any given interval of scores is called a "frequency." The frequency of freshman scores between 45 and 49, for example, is 8.

Finding the subtotals. Begin at the bottom of the column of frequencies and place in the square to the right of each frequency the sum of the frequencies up to and including those in that group. In the "Subtotal" column, under "Freshman," there is 1 score in the first interval, a subtotal of 2 to and including the second interval, a subtotal of 4 to and including the third interval, etc., and 50 to and including the last interval. This last "subtotal" (50) should equal the number of students in the class, as entered at the top of the column.

Reducing subtotals to per cents. In the column headed "Per cents," write opposite each subtotal the per cent that subtotal is of the whole number of students in the class. In the sample, under Freshman, 1 is 2 per cent of 50, 2 is 4 per cent of 50, 4 is 8 per cent of 50, etc., and 50 is 100 per cent of 50.

It is not necessary to reduce subtotals to per cents when use is made of the Scale Chart printed on the back of the Percentile Graph. The manner of using the Scale Chart is given below.

Locating points in the graph. First place a dot at the left edge of the graph on the horizontal line representing the lower limit of the lowest class interval containing a score. Next, place on the next line above, a dot having a distance to the right of the left margin of the graph equal to the first number in the per cents column, according to the scale at the foot of the graph. (In the sample the second dot in the percentile curve for the freshmen is placed 2 units from the edge of the graph.) Next, place on the next line above, a dot having a distance to

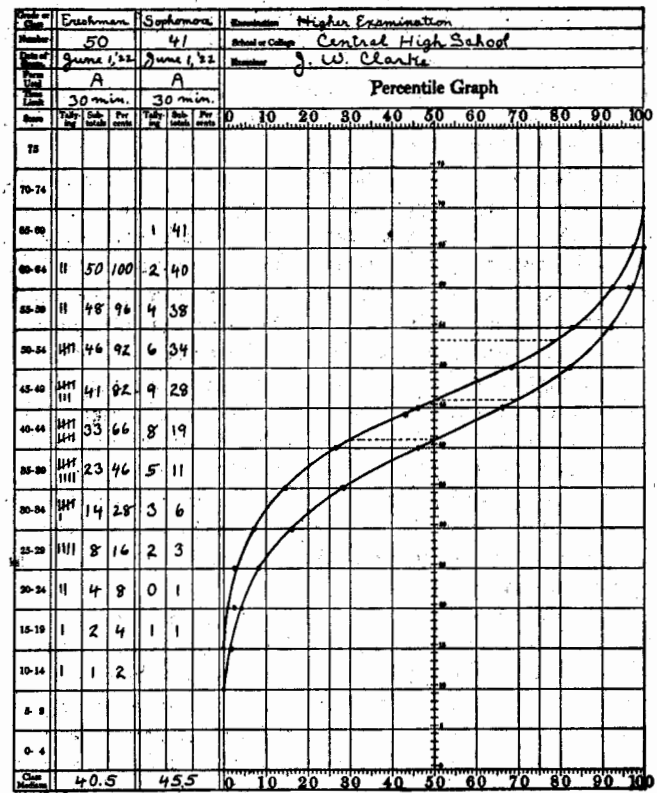


FIG. 3

the right of the margin representing the next per cent, etc. (The third dot represents 4 per cent, etc., and the last dot represents 100 per cent.)

Use of Scale Chart. The Scale Chart on the back of the Percentile Graph is provided to simplify the process of plotting the points in the graph. It is used as follows: Let us take the case of the freshman class, there being 50 students in the class. Find Scale 50 on the Scale Chart according to the numbers at the right. This line is divided into exactly 50 equal parts by the slanting lines in the chart. Each space, therefore, represents $\frac{1}{50}$ or 2 per cent of the width of the graph. The second dot in the freshman percentile curve is to be placed just $\frac{2}{50}$ of the distance to the right of the margin. This is just 1 space on Scale 50. The third dot is to be placed just 2 spaces to the right of the margin, the fourth point just 4 spaces to the right of the margin, etc., according to Scale 50 in the Scale Chart. By the use of Scale 41 the points have been plotted in the same way for the sophomore class.

By folding the Scale Chart on the proper scale and applying it to the Percentile Graph, the width of the graph may be divided into any number of equal parts from 40 to 100. By letting 2 or 4 graduations represent 1 unit or letting 1 graduation represent 2 units, the width of the graph may be divided into any number of equal parts from 10 to 200.

Drawing the curve. Draw a smooth curve through the dots plotted as described above. This is the percentile curve.

Finding median score of class. The point where the percentile curve cuts the 50-percentile line represents the median

¹ If only one Percentile Graph is at hand, the proper distances may be transferred from the Scale Chart on the back by means of a strip of paper.

- 1. (3)
- 2. (15)
- 3. (4)
- 4. (2)
- 5. (3)
- 6. (1)
- 7. (14)
- 8. (2)
- 9. (5)
- 10. (2)
- 11. (3)
- 12. (5)
- 13. (2)
- 14. (2)
- 15. (240)
- 16. (4)
- 17. (3)
- 18. (1)
- 19. (3)
- 20. (2)
- 21. (6)
- 22. (2)
- 23. (4)
- 24. (3)
- 25. (4)
- 26. (2)

score of the group.¹ This may be read on the vertical scale along the 50-percentile line. The median scores of the freshman and sophomore classes in the sample are 40.5 and 45.5, respectively. These medians may be entered at the foot of the data columns as shown.

Finding variability of scores. The points at which the curve cuts the 25 and 75 percentile lines represent the lower and upper quartile scores of a distribution. The interval between these is the interquartile range — a very convenient measure of the scatter of the distributions. In the sample Percentile Graph the interquartile ranges for the two classes are about 14 points each (freshmen, 33.5 to 47, and sophomores, 39 to 53).

Overlapping of classes. It will be seen by a glance at the percentile curves that the sophomore class is only slightly better than the freshman class and that the distributions of scores of the two classes overlap very markedly. A convenient way to express this overlapping is to say that 30 per cent of the sophomore class fall below the median of the freshman class, or that 30 per cent of the freshman class exceed the median of the sophomore class.

Percentile rank in class. If an individual makes a score exceeding 25 per cent of the scores of his class, he is said to have a percentile rank of 25 in his class; and the same for other percentages. The percentile rank of any individual among the members of his class may be found from the percentile curve representing the scores of his class as follows: Suppose an individual in the sophomore class has made a score of 53. Find the point 53 on the vertical scale in the Percentile Graph and move the pencil horizontally to the point at the same height on the percentile curve. This point represents on the horizontal scale a percentile rank of 79. The percentile rank of the individual among the members of his class is, therefore, 79, which means that his score exceeds the scores of 79 per cent of his class. A score of 53 represents a Percentile Rank of 89 among the members of the freshman class.

In so far as mental ability, as measured by this examination, is an indication of the scholarship to be expected from a student, the percentile rank of a student in class may be taken as showing how he should stand in this regard to the class as a whole.

The meaning of "percentile rank in class" must be distinguished from that of "Percentile Rank," a measure of brightness, referring to the rank of an individual among a large unselected group of his own age.

RELIABILITY AND VALIDITY

Reliability. By "reliability" is meant the degree to which the scores of the test are consistent in measuring whatever the test measures. Reliability is determined by means of correlation between different forms of the same test. The coefficients of correlation were found between Forms A and B of both examinations as follows:

Higher Examination, Grades 7 to 12:
 Group I, Form A first, 128 cases, $r = .917 \pm .009$
 Group II, Form B first, 125 cases, $r = .925 \pm .009$ } avg. .921
 Intermediate Examination, Grades 4 to 9:
 Group I, Form A first, 215 cases, $r = .953 \pm .006$
 Group II, Form B first, 212 cases, $r = .943 \pm .007$ } avg. .948

¹ The value so found may not be exactly the same as the median found in the usual way by counting to the middle paper in order of score, but if not, the median score found by means of the curve is considered to represent the distribution better and to be in that sense more accurate.

The values of the probable error of a score determined from these groups were respectively 2.56 and 2.68 points for the Higher Examination and 2.85 and 2.78 for the Intermediate Examination. The probable error of a score in either examination, therefore, is slightly over 2½ points. This means that the score in either examination will be correct within about 2½ points in half the cases. As has been shown, this means also that the probable error of an IQ is about 2½ points.

Validity. There is no direct method, of course, of finding the true validity of the tests — the degree to which they measure the hypothetical quality we call mental ability. The method of standardization is perhaps the best assurance as to the validity of the tests. Various other indications are available, however. The coefficient of correlation between the Higher Examination and the Advanced Examination taken two years earlier was .889 for 180 cases in Grades 7 to 12. The average of four coefficients of correlation between the Higher and Intermediate Examinations, averaging about 100 cases each in groups covering Grades 7 to 9, was .842. The correlation between scores in the Higher Examination and "scholarship" is reported by Clarence W. Proctor, Principal of High School, Bangor, Maine, as follows:

Grade 11, number of cases 240, $r = .55$
 Grade 12, number of cases 204, $r = .57$

The correlation between scores in the Higher Examination and scholarship as reported by the teachers of 157 high school freshmen in Oakland, California, was .59.

The correspondence between scores in the Higher Examination and letter ratings used in connection with Alpha is shown in Table 10.

TABLE 10

ALPHA RATINGS	ALPHA SCORES	SCORES IN HIGHER EXAMINATION
A	135-212	58-75
B	105-134	49-57
C+	75-104	39-48
C	45-74	28-38
C-	25-44	20-27
D	15-24	15-19
E	0-14	0-14

A high score. One student has been reported to have made a perfect score of 75 points in the Higher Examination in 20 minutes. This student is characterized by the professor of educational psychology of the college as follows:

"The person is a young man just past 21 years of age. He had very poor high school training due to the fact that the schools in his section of North Carolina are not what they should be. He is finishing college in 3½ years with about 8 quarter-hours to spare. I have looked up his college record and find that he has grades of A's or B's. There are no C's, D's, or F's. He won the scholarship medal at college before he came to this institution. (He entered here as a senior.) He is a good mixer, and I do not believe that he puts in very many hours on his studies.

"The father is a rather successful farmer. In fact, from what I can gather, he is the best farmer in his neighborhood. An older brother is a professor in a college. I have had this young man in several classes. It is my firm conviction that he could finish the average college course in two years."

Test Service Bulletins. The reader is invited to send to the World Book Company for free copies of the Test Service Bulletins for further information about testing.

(3) .54
 (4) .74
 (3) .73
 (5) .72
 (62) .71
 (2) .70
 (J) .69
 (24) .89
 (3) .79
 (H) .66
 (06) .59
 (9) .64
 (5) .63
 (49) .29
 (3) .19
 (4) .09
 (9) .69
 (J) .58
 (W) .57
 (4) .66
 (3) .55
 (2) .54
 (I) .53
 (1) .52

APPENDIX E

SAMPLE OF

THE STANFORD ACHIEVEMENT TEST
(INTERMEDIATE BATTERY PARTIAL:

FORM J)

STANFORD ACHIEVEMENT TEST

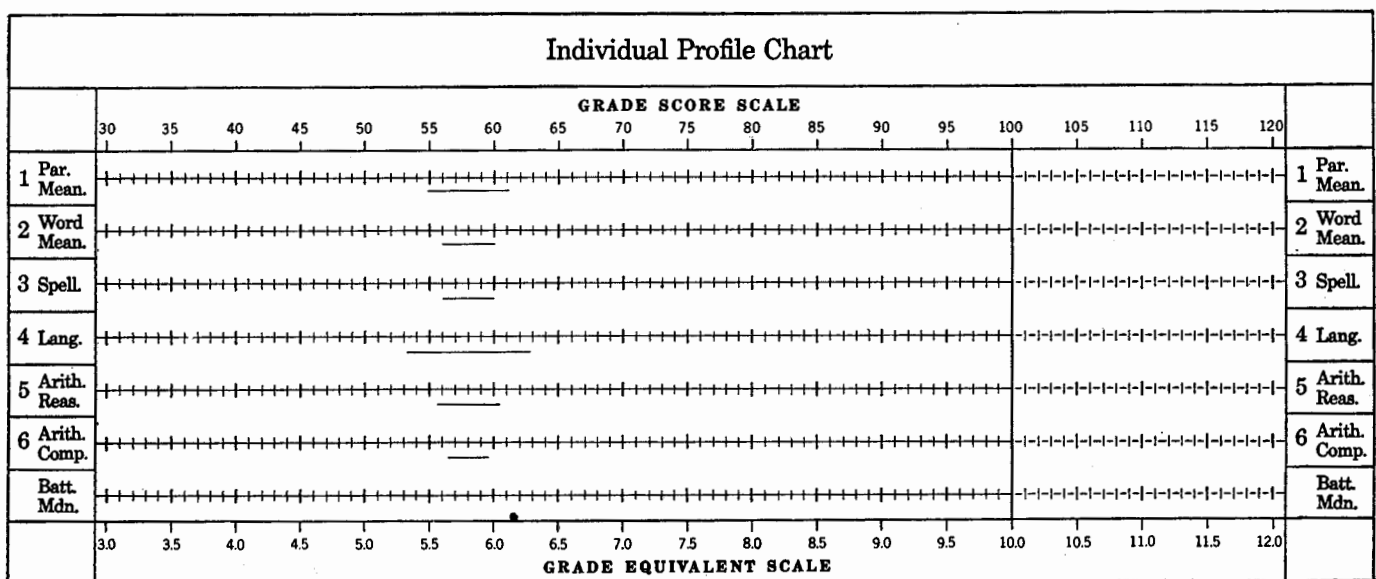
TRUMAN L. KELLEY • RICHARD MADDEN • ERIC F. GARDNER • LEWIS M. TERMAN • GILES M. RUCH

Name _____ Age _____ Grade _____ Boy or girl _____

Teacher _____ School _____ Date of birth _____
Year _____ Month _____ Day _____

City or Town _____ State _____ Date _____

	1 PAR. MEAN.	2 WORD MEAN.	AVER. READ.	3 SPELL.	4 LANG.	5 ARITH. REAS.	6 ARITH. COMP.	AVER. ARITH.	BATTERY MEDIAN
Grade Equiv.									
Age Equiv.									
%-ile Rank									



Grade equivalent values above 10.0 are extrapolated values and not to be interpreted as signifying the typical performance of pupils of the indicated grade placement. (See Directions for Administering.)

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TEST 1 Paragraph Meaning

DIRECTIONS: Read each paragraph below. Decide which of the numbered words at the right is best for each blank, and then mark the answer space which is numbered the same as the word you have chosen. Study the sample below, and answer the other questions in the same way.

SAMPLE: I am shorter than my sister and taller than my brother. This morning we stood beside one another. I looked down at my 51 and 52 at my sister.

- | | | | | | | |
|----|----------------------|---------------------|---------|--------|--------|--------|
| 51 | 1 friend
3 sister | 2 brother
4 feet | 1
51 | 2
█ | 3
: | 4
: |
| 52 | 5 around
7 up | 6 back
8 down | 5
52 | 6
: | 7
: | 8
: |

1-2 Dick and Ann had for a pet a white mouse called Mickey. The children were fond of Mickey and took him on their vacation trips. They both took care of him. It was Dick's job to keep the cage nice and clean, and it was 1 duty to see that the 2 got plenty of the right kind of food.

- | | | | | | | |
|---|---------------------|------------------------|--------|--------|--------|--------|
| 1 | 1 his
3 Mickey's | 2 their
4 Ann's | 1
1 | 2
: | 3
: | 4
: |
| 2 | 5 mouse
7 mice | 6 children
8 kitten | 5
2 | 6
: | 7
: | 8
: |

3-4 We went up in an airplane. At first we flew near the 3 where we could see people and animals. Later we could not see them. Our plane was flying too 4.

- | | | | | | | |
|---|--------------------|---------------------|--------|--------|--------|--------|
| 3 | 1 houses
3 town | 2 ground
4 hills | 1
3 | 2
: | 3
: | 4
: |
| 4 | 5 high
7 far | 6 low
8 fast | 5
4 | 6
: | 7
: | 8
: |

5-6 A long time ago farmers used sharp sticks instead of plows to dig up the earth. Now they have steel 5 pulled by horses or tractors. They can cultivate large fields and raise big 6.

- | | | | | | | |
|---|-----------------------|---------------------|--------|--------|--------|--------|
| 5 | 1 tools
3 machines | 2 plows
4 forks | 1
5 | 2
: | 3
: | 4
: |
| 6 | 5 tomatoes
7 corn | 6 plants
8 crops | 5
6 | 6
: | 7
: | 8
: |

7-8 Insects that fly at night often make mistakes. They cannot tell the light of the moon from that given by an open fire. Sometimes these 7 fly into a 8 and are killed.

- | | | | | | | |
|---|----------------------|----------------------|--------|--------|--------|--------|
| 7 | 1 animals
3 moths | 2 birds
4 insects | 1
7 | 2
: | 3
: | 4
: |
| 8 | 5 flame
7 window | 6 house
8 car | 5
8 | 6
: | 7
: | 8
: |

9-10 The so-called falling stars that we see are not really stars at all but are meteors. Occasionally they fall all the way to our earth, and sometimes they may be picked up. By far the greater number of these 9, however, never reach the 10 because they are burned up or broken into dust by the friction of the earth's atmosphere.

- | | | | | | | |
|----|----------------------------------|---------------------|---------|--------|--------|--------|
| 9 | 1 planets
3 meteors | 2 stars
4 comets | 1
9 | 2
: | 3
: | 4
: |
| 10 | 5 solar system
7 stratosphere | 6 air
8 earth | 5
10 | 6
: | 7
: | 8
: |

11-12 Here is the way to lay a brick walk in a garden. Dig a path 4 inches deep. Pack and roll down 2 inches of sand. Lay in place 11 2½ inches thick. Your finished walk will be just a little 12 ground level.

- | | | | | | | |
|----|----------------------|----------------------|---------|--------|--------|--------|
| 11 | 1 cement
3 bricks | 2 boards
4 dirt | 1
11 | 2
: | 3
: | 4
: |
| 12 | 5 above
7 nearer | 6 below
8 beneath | 5
12 | 6
: | 7
: | 8
: |

13-14 When we become angry or afraid, our hearts begin to beat rapidly. Our muscles feel tight. Our bodies get ready to fight or run, even though we do not really need to do either. Afterward, we feel as tired as though we had actually 13 or 14.

- | | | | | | | |
|----|---------------------|-----------------------|---------|--------|--------|--------|
| 13 | 1 rested
3 slept | 2 fought
4 read | 1
13 | 2
: | 3
: | 4
: |
| 14 | 5 slept
7 run | 6 eaten
8 awakened | 5
14 | 6
: | 7
: | 8
: |

TEST 1 *Paragraph Meaning* (Continued)

15-16-17 Wool is clipped from live sheep by a process called shearing. The entire mat of fleece from each animal comes off in one piece. With electric clippers one man can 15 from 150 to 200 16 a day. After shearing, the 17 is rolled up and sent to the mill.

15	1 clip	2 run	1	2	3	4
	3 kill	4 feed	15	16	17	18
16	5 pounds	6 lambs	5	6	7	8
	7 pelts	8 sheep	16	17	18	19
17	9 skin	10 hide	9	10	11	12
	11 fleece	12 cotton	17	18	19	20

18-19-20 A bottle used to be made by a glass blower with a long pipe through which he blew air into a bubble of hot liquid glass. Now the work is done by a machine which revolves over a pot of melted 18, sucks up the amount needed, shapes it on a mold, and blows it out. A workman operating a 19 can produce ten times as many 20 in an hour as an old-fashioned glass blower.

18	1 metal	2 iron	1	2	3	4
	3 glass	4 ice	18	19	20	21
19	5 blower	6 machine	5	6	7	8
	7 factory	8 pipe	19	20	21	22
20	9 pipes	10 balls	9	10	11	12
	11 bottles	12 glasses	20	21	22	23

21-22-23-24 A few years ago most freight was carried by railroad trains. Now such things as furniture and automobiles are sent across country on trucks. Goods sent by 21 can go only where 22 have been laid, but goods sent by 23 can reach any point to which a 24 runs.

21	1 truck	2 rail	1	2	3	4
	3 freight	4 express	21	22	23	24
22	5 roads	6 paths	5	6	7	8
	7 tracks	8 highways	22	23	24	25
23	9 truck	10 freight	9	10	11	12
	11 rail	12 express	23	24	25	26
24	13 drive	14 trail	13	14	15	16
	15 track	16 road	24	25	26	27

25-26-27 The principal diamond fields of the world are in Africa, Brazil, and Australia. Few people know that 25 are also found in Arkansas. More than 20,000 of these stones have been taken from the soil of that state. Experts have pronounced the gems from 26 to be equal to the finest 27 found elsewhere.

25	1 diamonds	2 jewels	1	2	3	4
	3 pearls	4 emeralds	25	26	27	28
26	5 Brazil	6 Arkansas	5	6	7	8
	7 Africa	8 Australia	26	27	28	29
27	9 pearls	10 diamonds	9	10	11	12
	11 jewels	12 rocks	27	28	29	30

28-29-30 In certain parts of Mexico one finds maguey, a tall shrub with large spreading leaves. Fibers of the plant are used to make paper and rope. The leaves become roofs of houses. The juice is made into a fermented drink. The 28 grows 29. It is of particular value because it can be used in 30.

28	1 tree	2 grass	1	2	3	4
	3 shrub	4 grape	28	29	30	31
29	5 rapidly	6 widely	5	6	7	8
	7 tall	8 everywhere	29	30	31	32
30	9 many ways	10 business	9	10	11	12
	11 trans- portation	12 building	30	31	32	33

31-32 A long time ago the people of Peru did not know how to write. In order to count, they tied knots in threads of different colors. Each color meant a different kind of thing. The 31 in a thread stood for the things being 32.

31	1 knots	2 colors	1	2	3	4
	3 loops	4 twists	31	32	33	34
32	5 counted	6 named	5	6	7	8
	7 written	8 used	32	33	34	35

33-34-35 In the 1840's and the 1850's, slavery was the leading question of the day. To keep the balance in Congress, states were often admitted in pairs, one slave and one free. The South desired the extension of the 33 region. Southern statesmen wished the territory gained by the war with Mexico to become 34 states, while Northern statesmen, on the other hand, worked to have it become 35 states.

33	1 slave	2 free	1	2	3	4
	3 Mexican	4 Indian	33	34	35	36
34	5 plantation	6 territorial	5	6	7	8
	7 slave	8 cotton- growing	34	35	36	37
35	9 slave	10 Mexican	9	10	11	12
	11 free	12 Indian	35	36	37	38

TEST 1 *Paragraph Meaning* (Continued)

36-37-38 When traveling in China, I came upon an old fort with a stone and earth wall that was twenty-four feet high and twelve feet thick. The 36 was therefore twice as 37 as it was 38.

- | | | | | | | |
|----|---------|----------|----|----|----|----|
| 36 | 1 fort | 2 earth | 1 | 2 | 3 | 4 |
| | 3 stone | 4 wall | 36 | 36 | 36 | 36 |
| 37 | 5 high | 6 wide | 5 | 6 | 7 | 8 |
| | 7 long | 8 thick | 37 | 37 | 37 | 37 |
| 38 | 9 high | 10 wide | 9 | 10 | 11 | 12 |
| | 11 long | 12 thick | 38 | 38 | 38 | 38 |

39-40 Ventriloquism is the art of making sounds so that they appear to come from a distance rather than from the speaker's own mouth. It is an ancient 39, and many authorities believe that various phenomena such as the Greek oracles and the Egyptian speaking statues owe their explanation to the practice of 40 by the priests.

- | | | | | | | |
|----|------------|-----------------|----|----|----|----|
| 39 | 1 science | 2 event | 1 | 2 | 3 | 4 |
| | 3 custom | 4 art | 39 | 39 | 39 | 39 |
| 40 | 5 deceit | 6 mystery | 5 | 6 | 7 | 8 |
| | 7 prophecy | 8 ventriloquism | 40 | 40 | 40 | 40 |

41-42 Crude oil from wells in Texas and other Western states is now transported in pipes to refineries in such distant states as California, Illinois, and Pennsylvania. Pumping stations are located 25 to 40 miles apart along each pipe line. From storage tanks near the wells the oil passes into the 41 and is 42 to the refineries.

- | | | | | | | |
|----|-------------|--------------|----|----|----|----|
| 41 | 1 tankers | 2 pipe lines | 1 | 2 | 3 | 4 |
| | 3 tank cars | 4 oil trucks | 41 | 41 | 41 | 41 |
| 42 | 5 shipped | 6 trucked | 5 | 6 | 7 | 8 |
| | 7 hauled | 8 pumped | 42 | 42 | 42 | 42 |

43-44-45 A common example of a chemical reaction is the rusting of iron. A gas called oxygen which is present in the air combines with the silvery metal iron to form a reddish brown substance known in chemistry as ferrous oxide, but commonly called 43. This substance is quite different from either the 44 or the 45 which combined to form it.

- | | | | | | | |
|----|----------|------------|----|----|----|----|
| 43 | 1 iron | 2 oxygen | 1 | 2 | 3 | 4 |
| | 3 copper | 4 rust | 43 | 43 | 43 | 43 |
| 44 | 5 oxide | 6 oxygen | 5 | 6 | 7 | 8 |
| | 7 air | 8 moisture | 44 | 44 | 44 | 44 |
| 45 | 9 iron | 10 copper | 9 | 10 | 11 | 12 |
| | 11 rust | 12 gas | 45 | 45 | 45 | 45 |

46 During the French and Indian War more than one hundred English colonists were captured by the Indians at Deerfield, Massachusetts, and taken into the forest. Later, some were ransomed but many refused to return to 46.

- | | | | | | | |
|----|----------------|----------------|----|----|----|----|
| 46 | 1 captivity | 2 custody | 1 | 2 | 3 | 4 |
| | 3 Pennsylvania | 4 civilization | 46 | 46 | 46 | 46 |

47-48 In speaking of gold, the term "carat" is used to indicate the proportion of gold in a given article. A carat is one twenty-fourth of the whole mass. Thus, a fourteen-carat ring is one with fourteen parts of pure gold and ten parts of some other metal, usually copper. A 47-carat watch chain is pure gold. A bracelet that is half gold and half copper would be called 48 gold bracelet.

- | | | | | | | |
|----|-----------------|------------------|----|----|----|----|
| 47 | 1 one hundred | 2 twenty-four | 1 | 2 | 3 | 4 |
| | 3 fifty | 4 ten | 47 | 47 | 47 | 47 |
| 48 | 5 a gold-copper | 6 a twelve-carat | 5 | 6 | 7 | 8 |
| | 7 an imitation | 8 a half-pure | 48 | 48 | 48 | 48 |

Stop.

No. right	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Gr. score	16	17	18	20	22	23	24	25	26	28	30	31	32	34	35	37	38	39	41	42	43	44	46	47	48	50	51	53	56	58	60	62	64	66	69	72	75	78	81	85	89	93	97	101	105	108	111	113

TEST 2 *Word Meaning*

DIRECTIONS: In each exercise decide which of the four numbered words will complete the sentence best. Look at the number of this word. Mark the answer space at the right which is numbered the same as the word you have chosen. Study the samples.

SAMPLES:

- 51 The day that comes after Friday is — 1 Monday 2 Tuesday 3 Saturday 4 Sunday 51

1	2	3	4
⋮	⋮	■	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 52 To draw on a blackboard, use a piece of — 5 pencil 6 straw 7 eraser 8 chalk 52

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮

- 1 A sawmill makes — 1 wire 2 boots 3 needles 4 lumber.....1

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 2 A pair means — 5 many 6 one 7 two 8 three.....2

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 3 Mary Smith and John Doe are cousins if they have the same —
1 grandmother 2 mother 3 sister 4 daughter.....3

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 4 To receive a letter means to — 5 mail it 6 get it 7 write it 8 see it.....4

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 5 To vanish is to — 1 disappear 2 examine 3 shape 4 paint.....5

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 6 Marvelous means — 5 pleasant 6 distant 7 wonderful 8 great.....6

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 7 A customer is one who — 1 plants 2 works 3 buys 4 learns.....7

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 8 The person who dances with another is his —
5 guest 6 helper 7 prisoner 8 partner.....8

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 9 Something made of iron is — 1 silver 2 metal 3 copper 4 gold.....9

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 10 If you save things carefully, you are — 5 nasty 6 mean 7 selfish 8 thrifty 10

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 11 To learn is the same as to — 1 try 2 teach 3 find out 4 look for.....11

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 12 Anyone over 21 years old is — 5 a graduate 6 an adult 7 a major 8 a patriot 12

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 13 A wide city street lined with trees is often called —
1 an avenue 2 a highway 3 a route 4 a railway.....13

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 14 A word that means to throw is — 5 bask 6 blast 7 cast 8 glare.....14

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 15 A river three miles across is — 1 swift 2 narrow 3 broad 4 shallow.....15

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 16 If you can identify a butterfly, you can —
5 exhibit it 6 stuff it 7 mount it 8 recognize it.....16

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 17 If things are going well, they are going — 1 fiercely 2 grimly 3 smoothly 4 generously 17

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 18 News tells about something which happened —
5 yesterday 6 recently 7 once 8 long ago.....18

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 19 An answer is — 1 a question 2 an argument 3 a reply 4 an agreement...19

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 20 If you put all your stamps together by countries, you —
5 exchange them 6 arrange them 7 display them 8 harm them.....20

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 21 Something you must do, like paying taxes, is —
1 a custom 2 a sacrifice 3 a duty 4 an opportunity.....21

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 22 A thing is gigantic if it is — 5 very important 6 huge 7 exploded 8 far away 22

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮
- 23 A person who is suddenly surprised is — 1 calm 2 amused 3 startled 4 savage 23

1	2	3	4
⋮	⋮	⋮	⋮
5	6	7	8
⋮	⋮	⋮	⋮

TEST 2 *Word Meaning* (Continued)

24	A breed of dog that follows game by smelling is a —	5 hound	6 cur	7 mongrel	8 brute	24	5	6	7	8
25	Height, weight, and temperature are all —	1 distances	2 visible	3 feelings	4 measurements	25	1	2	3	4
26	An exceptional student is —	5 outstanding	6 typical	7 quaint	8 delicate	26	5	6	7	8
27	A car that has all the necessary things is fully —	1 modeled	2 streamlined	3 equipped	4 guaranteed	27	1	2	3	4
28	Groceries arranged to attract customers are —	5 displays	6 campaigns	7 evidence	8 bargains	28	5	6	7	8
29	To attempt a job is to —	1 condemn it	2 oppose it	3 imagine it	4 undertake it	29	1	2	3	4
30	Things you can see with your eyes are —	5 necessities	6 transparent	7 novelties	8 visible	30	5	6	7	8
31	Animals that dig tunnels in the ground —	1 bellow	2 harrow	3 whittle	4 burrow	31	1	2	3	4
32	Trying to find out what makes things work is —	5 conscience	6 curiosity	7 position	8 motion	32	5	6	7	8
33	Things which are much alike are —	1 equal	2 handsome	3 similar	4 opposite	33	1	2	3	4
34	The growth and progress of a town is its —	5 development	6 vicinity	7 standard	8 founding	34	5	6	7	8
35	A person elected to a class office should be —	1 confused	2 pitied	3 capable	4 noble	35	1	2	3	4
36	A diagram is a kind of —	5 illustration	6 incident	7 monster	8 narrative	36	5	6	7	8
37	When you don't sense anything that is going on about you, you are —	1 unconscious	2 sensible	3 sullen	4 prosperous	37	1	2	3	4
38	The greatest load an elevator can carry is its —	5 frontier	6 margin	7 capacity	8 dividend	38	5	6	7	8
39	The group of men who run a business are its —	1 managers	2 customers	3 salesmen	4 engineers	39	1	2	3	4
40	If nine tenths of the people in your town came from Ireland, your town is —	5 anti-Irish	6 slightly Irish	7 largely Irish	8 completely Irish	40	5	6	7	8
41	Saving some money for a "rainy day" is —	1 likable	2 industrial	3 fearful	4 advisable	41	1	2	3	4
42	People who write letters to each other —	5 correspond	6 translate	7 interrupt	8 interview	42	5	6	7	8
43	A very large ravine is called —	1 a channel	2 an elevation	3 a basin	4 a canyon	43	1	2	3	4
44	The dead body of a wild animal is a —	5 vestige	6 carcass	7 corpuscle	8 corruption	44	5	6	7	8
45	Something written about or talked about is —	1 a token	2 a topic	3 a title	4 an article	45	1	2	3	4
46	You would not expect a courteous person to be —	5 civil	6 abrupt	7 refined	8 congenial	46	5	6	7	8
47	To take a thing for granted is to —	1 apply it	2 assume it	3 approve it	4 assure it	47	1	2	3	4
48	Supplies, particularly food, are called —	5 preparations	6 subscriptions	7 substances	8 provisions	48	5	6	7	8

No. right	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Gr. score	16	18	20	22	23	25	27	29	30	32	33	34	35	37	38	39	40	41	42	43	44	45	46	47	48	49	51	52	54	55	56	58	59	61	63	65	67	68	70	72	75	77	80	83	89	95	103	115

Stop.

TEST 3 Spelling

← 7^a

← 7^b

DIRECTIONS: In each exercise below, one of the words is spelled in three different ways. If the correct spelling is there, mark the answer space which has the same number as the correct spelling. If the correct spelling is **not** given as one of the three spellings, mark the answer space under NG as the right answer; NG stands for not given.

SAMPLES:

- 91 The color is 1 rid. 1 2 3 NG
 2 red. 91
 3 rud.
 4 eg 4 5 6 NG
 92 an 5 egge for breakfast. 92
 6 eeg

- 1 Mary is writing a 1 letter. 1 2 3 NG
 2 lettre. 1
 3 leter.
 4 easy 4 5 6 NG
 2 The work is very 5 ezey today. 2
 6 esy
 3 She is the teacher of our 1 clas. 1 2 3 NG
 2 class. 3
 3 clase.
 4 smock 4 5 6 NG
 4 Sam saw the 5 smok from the fire. 4
 6 smoak
 1 snoing 1 2 3 NG
 5 It was 2 snowing this morning. 5
 3 snoeing
 4 hurry 4 5 6 NG
 6 You must 5 hurey to school. 6
 6 hurry
 1 ground. 1 2 3 NG
 7 Leaves covered the 2 grownd. 7
 3 grond.
 4 agian. 4 5 6 NG
 8 They will come 5 agen. 8
 6 agan.
 1 narrow. 1 2 3 NG
 9 The space is very 2 narrow. 9
 3 narroe.
 4 elefant 4 5 6 NG
 10 An 5 elefant is strong. 10
 6 elephant
 1 airplan. 1 2 3 NG
 11 Dan rode in an 2 airplane. 11
 3 aerplane.
 4 durt 4 5 6 NG
 12 There is 5 drite on his hands. 12
 6 dirte
 1 else. 1 2 3 NG
 13 You may bring anyone 2 elce. 13
 3 els.
 4 mist 4 5 6 NG
 14 Father 5 mised the train. 14
 6 missed
 1 name 1 2 3 NG
 15 The dog was 2 namd Sport. 15
 3 named
 4 sevral 4 5 6 NG
 16 Fred turned 5 several pages. 16
 6 severl

- 17 The 1 famley 1 2 3 NG
 2 famly is at home. 17
 3 famley
 4 potatos 4 5 6 NG
 18 Baked 5 potatoes are good. 18
 6 potatose
 1 packege. 1 2 3 NG
 19 He carried the 2 package. 19
 3 pakage.
 4 realey 4 5 6 NG
 20 We 5 realy liked it. 20
 6 reelly
 1 national 1 2 3 NG
 21 We will sing the 2 national anthem. 21
 3 nasional
 4 paragraf 4 5 6 NG
 22 the last line in the 5 parragraph. 22
 6 paragraf
 1 nephue. 1 2 3 NG
 23 My aunt has one 2 nephew. 23
 3 nefue.
 4 television 4 5 6 NG
 24 We have a 5 telavision set. 24
 6 tellevision
 1 touch 1 2 3 NG
 25 Don't 2 tutch the paint. 25
 3 tuch
 4 berres 4 5 6 NG
 26 The 5 berrys are ripe. 26
 6 beries
 1 nauty. 1 2 3 NG
 27 Only one child was 2 noughty. 27
 3 naughty.
 4 piano. 4 5 6 NG
 28 Sally plays the 5 peano. 28
 6 paino.
 1 hugh 1 2 3 NG
 29 It was a 2 huge mountain. 29
 3 huje
 4 cartune 4 5 6 NG
 30 The 5 cartoon was funny. 30
 6 carton
 1 furnitur 1 2 3 NG
 31 bedroom 2 furnituer. 31
 3 furniture
 4 lawyer 4 5 6 NG
 32 A 5 lauyer defended him. 32
 6 lawer
 1 prittiest 1 2 3 NG
 33 We saw the 2 prittest flowers. 33
 3 prettest
 4 tennis. 4 5 6 NG
 34 The girls are playing 5 teniss. 34
 6 tenis.
 1 terratory 1 2 3 NG
 35 in friendly 2 teritory. 35
 3 teratory
 4 explore 4 5 6 NG
 36 Let's 5 exsplore the cave. 36
 6 explor
 1 medicene. 1 2 3 NG
 37 He took the doctor's 2 medicene. 37
 3 medicen.

TEST 3 *Spelling* (Continued)

← 8^a

← 8^b

38	The	4 entyre 5 intire 6 entier	room was filled.....	38	4	5	6	NG
39	The guards moved	1 quitly. 2 quietly. 3 quitely.	.....	39	1	2	3	NG
40	Don was	4 anxous 5 anxeous 6 anxious	for his safety....	40	4	5	6	NG
41	I heard the	1 speech. 2 spech. 3 speach.	.....	41	1	2	3	NG
42	Joe studies	4 geogrophy. 5 geography. 6 geogerphy.	.....	42	4	5	6	NG
43	wired for	1 electrizity 2 electrecity 3 electrizity	.....	43	1	2	3	NG
44	His	4 perpose 5 purpose 6 perpuse	was good.....	44	4	5	6	NG
45	Pedro lives in a	1 forren 2 foreign 3 foriegn	land.....	45	1	2	3	NG
46	Bob plays the	4 roll 5 roal 6 role	of the hero....	46	4	5	6	NG
47	The sand slowly	1 setteld 2 settled 3 settled	in the jar..	47	1	2	3	NG
48	Sue was	4 chossen 5 choosen 6 chosn	first.....	48	4	5	6	NG
49	The road rises	1 gradually. 2 gradually. 3 graduly.	.....	49	1	2	3	NG
50	Milk has many	4 vitamins. 5 vitamens. 6 vitemins.	.....	50	4	5	6	NG
51	Don't be	1 impatient. 2 impateint. 3 impatient.	.....	51	1	2	3	NG
52	We nearly froze in the	4 blizzerd. 5 blissard. 6 blizard.	.....	52	4	5	6	NG
53	a basketball	1 tournament 2 torniment 3 tornament	.....	53	1	2	3	NG
54	John's voice is	4 horse. 5 hourse. 6 hoarse.	.....	54	4	5	6	NG
55	Jim ate a hot	1 biscut. 2 bisciut. 3 basket.	.....	55	1	2	3	NG

56	It was an	4 unfortunat 5 unfortunat 6 unfortunette	mistake.....	56	4	5	6	NG
57	We read good	1 literiture. 2 literure. 3 literature.	.....	57	1	2	3	NG
58	Ruth is	4 genrally 5 generally 6 generally	here.....	58	4	5	6	NG
59	It rains	1 freequently. 2 frequently. 3 frequently.	.....	59	1	2	3	NG
60	The cost of	4 admition 5 admission 6 admission	is low.....	60	4	5	6	NG
61	George	1 rarly 2 rarley 3 rarely	goes hunting.....	61	1	2	3	NG
62	Bill will pay the	4 expence. 5 expents. 6 expens.	.....	62	4	5	6	NG
63	No chairs were	1 avalable. 2 avialable. 3 available.	.....	63	1	2	3	NG
64	My uncle studies	4 philosophy. 5 filosophy. 6 philosofy.	.....	64	4	5	6	NG
65	The answer is	1 logicle. 2 lodgical. 3 lojicle.	.....	65	1	2	3	NG
66	Anne has a	4 magority 5 majority 6 majorety	votc.....	66	4	5	6	NG
67	the	1 ofensive 2 offensive 3 offensive	team.....	67	1	2	3	NG
68	He is	4 ignorrent 5 ignorent 6 ignorant	of the facts.....	68	4	5	6	NG
69	The moon enters a new	1 phaze. 2 phase. 3 fase.	.....	69	1	2	3	NG
70	Jane is respected for her	4 sincerity. 5 sincirety. 6 sinserity.	.....	70	4	5	6	NG
71	The meeting is	1 adjuorned. 2 adjorned. 3 adjurned.	.....	71	1	2	3	NG
72	The scene is	4 picheresque. 5 picturesque. 6 picherest.	.....	72	4	5	6	NG

Stop.

No. RIGHT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Gr. score	14	15	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	52	53	
No. RIGHT (Cont'd)	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72								
Gr. score	54	55	56	58	59	60	61	62	63	64	65	67	68	69	71	72	74	76	78	79	81	83	85	88	91	95	98	102	106	109	113	117								

DIRECTIONS: In each pair of words in heavy type there is an error in either capitalization or punctuation. You are to decide which one of each pair has the correct capitalization and punctuation. Then mark the answer space at the right that has the same number as the correct form.

- SAMPLES: This is ¹ mr. Jones. 1 2
² Mr. Jones. 3 4
³ St. Louis, Missouri 5 6
⁴ St. Louis Missouri 7 8

A BIRTHDAY PARTY

- My ¹ cousin ² Cousin is having a birthday party. 1 2
 Can you come? ³ we ⁴ We will have lunch and 3 4
 listen to his new record, ⁵ "treasure island." ⁶ "Treasure Island." 5 6

AT SCHOOL

- I like ¹ social studies ² Social Studies and English best. 1 2
 Yesterday morning Mr. ³ Miles ⁴ Miles, our 3 4
⁵ teacher ⁶ teacher, gave us a new book. 5 6
 "All of you," he said, ¹ "will" ² "Will" like this book." 1 2
 It told about the ³ Union of South Africa. ⁴ Union of south Africa. 3 4
 Today I gave a report on ⁵ lake Nyasa. ⁶ Lake Nyasa. 5 6

THE ZOO

- Aunt Anna ¹ said, ² said "Let's go to. 1 2
 the ³ zoo." ⁴ zoo. When we got there, 3 4
 we saw some ⁵ deer, ⁶ deer a large herd of. 5 6
¹ Buffaloes, ² buffaloes, and several bears. The buffaloes 1 2
 have hairy ³ shoulders. ⁴ shoulders I tried to feed. 3 4
⁵ them, ⁶ them but they were afraid and would not eat. 5 6

DIRECTIONS: Each exercise below has two numbered parts. One part is well written and makes good sense. The other is poorly written. Choose the good one and mark the answer space that has the same number as your choice.

SAMPLE :

- 1 We'll go when you are ready. 1 2
 2 We'll go. When you are ready. 3 4

A STROLL

- 1 Yesterday I took a long walk. To get some leaves for my collection. 1 2
 2 Yesterday I took a long walk to get some leaves for my collection. 3 4
 3 First I went to the park by the river. 5 6
 4 First down to the park by the river. 7 8
 5 Where I found some willow trees. 9 10
 6 There I found some willow trees. 11 12
 1 They had long narrow drooping leaves. 13 14
 2 Which had long narrow drooping leaves. 15 16
 3 Oak trees grew on the hill above. 17 18
 4 Oak trees growing on the hill above. 19 20
 5 With leaves that had a scalloped edge. 21 22
 6 Their leaves had a scalloped edge. 23 24
 1 I gathered a basketful then I came home. 25 26
 2 I gathered a basketful. Then I came home. 27 28

THE TALKING BIRD

- 1 Jim has a bird that knows how to talk. 1 2
 2 Jim has a bird. That knows how to talk. 3 4
 3 He bought it from a sailor it is called a myna bird. 5 6
 4 He bought it from a sailor. It is called a myna bird. 7 8
 5 It can say "Hello," call people by name, and answer questions. 9 10
 6 It can say "Hello." Call people by name. And answer questions. 11 12
 1 It calls "Hello, Bobby." Whenever I come in. 13 14
 2 It calls "Hello, Bobby," whenever I come in. 15 16
 3 "What does the cat say?" asks Jim the bird answers, "Meow!" 17 18
 4 "What does the cat say?" asks Jim. The bird answers, "Meow!" 19 20

TEST 4 *Language* (Continued)

◀ 10^a

▶ 10^b

DIRECTIONS: In each sentence, decide which of the numbered words is correct. Then mark the answer space at the right which has the same number as the word you have chosen.

SAMPLE: Apples ¹ is	2 are	good.....	1	2	1
Yesterday John ¹ came	2 come	home early.....	1	2	28
³ Let	⁴ Leave	me have a turn now.....	3	4	29
Sam ⁵ ain't	⁶ isn't	here today.....	5	6	30
Give Tom ¹ that there	² that	sandwich.....	1	2	31
I used to ³ could	⁴ be able to	sing better.....	3	4	32
I ⁵ said	⁶ says	to him, "Let's go.".....	5	6	33
We all ¹ clumb	² climbed	over the fence.....	1	2	34
Don't you want ³ no more	⁴ any more	ice cream?.....	3	4	35
Sally ⁵ drew	⁶ drew	a picture of a cow.....	5	6	36
My aunt gave me ¹ a	² an	apple.....	1	2	37
How many of ³ we	⁴ us	Scouts do you need? ...	3	4	38
Will you ⁵ teach	⁶ learn	me to jump rope?.....	5	6	39
Where ¹ are	² is	my books?.....	1	2	40
The grass has ³ grown	⁴ grew	an inch.....	3	4	41
We have already ⁵ choosed	⁶ chosen	sides.....	5	6	42
I might ¹ have	² of	gone if I'd been asked.....	1	2	43
Let's ³ bring	⁴ take	these flowers to school.....	3	4	44
I've ⁵ did	⁶ done	my arithmetic.....	5	6	45
All of us wanted to go ¹ bad.	² badly.	.....	1	2	46
³ Hadn't you ought to	⁴ Shouldn't you	use a broom?.....	3	4	47

The girls made the pie ⁵ themselves.	⁶ theirselves.	.....	5	6	48
The baby had ¹ fallen	² fell	down the stairs.....	1	2	49
Mary can certainly read ³ good.	⁴ well.	.....	3	4	50
The children have done ⁵ there	⁶ their	jobs.....	5	6	51
Both the cat and the dog ¹ has	² have	fleas.....	1	2	52
They fought a ³ strange	⁴ funny	battle.....	3	4	53
Have you ⁵ written	⁶ wrote	to Nancy?.....	5	6	54
There ¹ were	² was	five cookies in the jar.	1	2	55
This cake ³ sure	⁴ surely	tastes good.....	3	4	56
There ⁵ wasn't	⁶ was	no money left.....	5	6	57
The captain ¹ led	² lead	his men to victory.....	1	2	58
Tell Billy and ³ I	⁴ me	where to go.....	3	4	59
I ⁵ suppose	⁶ reckon	they will serve refreshments.....	5	6	60
Our team will win this game ¹ easy.	² easily.	.....	1	2	61
My kitten was ³ drowned.	⁴ drownned.	.....	3	4	62
Have you ever ⁵ shook	⁶ shaken	apples from a tree?.....	5	6	63
The birds have all ¹ flew	² flown	South.....	1	2	64
³ We	⁴ Us	boys went to the show.....	3	4	65
I ⁵ can	⁶ can't	hardly wait to see him.....	5	6	66
Tell me when ¹ your	² you're	ready.....	1	2	67
Most people like to eat ³ regular.	⁴ regularly.	.....	3	4	68
He won the race ⁵ with	⁶ without	no effort.....	5	6	69
Miss Martin is ¹ too	² to	busy to see us.....	1	2	70

Stop. No. right () × 2 ()
 No. omitted or double-marked ()

DIFFERENCE (R-W)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Gr. score	below 10				11	12	14	15	17	18	19	21	22	23	25	26	27	29	30	31	33	34	36	37	38	40	41	43	44	45	47	48	50	51	53	54	56	58	60	61
DIFFERENCE (R-W) (Cont'd)	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70										
Gr. score	63	65	66	68	70	71	73	74	75	76	78	80	82	84	85	86	88	90	92	96	99	101	104	107	112	118	122	126	129	129										

Sum ()
 Subtract 70

TEST 5 *Arithmetic Reasoning* PART I

DIRECTIONS: Work an example, and then compare your answer with the answers which follow it. If your answer is one of those given, mark the answer space that has the same letter as your answer. Sometimes the correct answer is not given. If you do not find the correct answer, mark the space under the letter for not given.

SAMPLES: ⁵¹ How many balls are 3 balls and 4 balls? a b c d e
 a 3 b 4 c 7 d 12 e not given.....⁵¹

⁵² How many books are 3 books and 2 books? f g h i j
 f 2 g 3 h 4 i 6 j not given.....⁵²

¹ There are 8 apples on the table. If we eat 3 of them, how many will be left? a b c d e
 a 3 b 5 c 8 d 24 e not given.....¹

² Helen's mother has 28 cookies in the oven. There are 35 more to be baked. How many cookies will there be all together? f g h i j
 f 7 g 35 h 63 i 100 j not given.....²

³ Jane has 13 coloring pencils and Dot has 5. If Sue buys a box of 12 pencils, how many pencils will all three girls have? a b c d e
 a 6 b 20 c 25 d 28 e not given.....³

⁴ Judy has 16 jacks and Hazel has 9. How many more jacks has Judy than Hazel? f g h i j
 f 7 g 9 h 16 i 25 j not given.....⁴

⁵ Mother bakes 24 rolls at a time. How many pans will she need if she bakes 6 in a pan? a b c d e
 a 4 b 18 c 24 d 30 e not given.....⁵

⁶ Father drives 18 miles each day. How many miles will he travel in 5 days? f g h i j
 f 5 g 18 h 80 i 180 j not given.....⁶

⁷ Dick bought some fruit for his sister. How much did he pay for all of it if the oranges cost 37¢, the apples 28¢, and the grapes 25¢? a b c d e
 a 80¢ b 88¢ c 90¢ d \$1.00 e not given.....⁷

⁸ Jean saw 4 butterflies and 7 bees yesterday. Today she saw 9 butterflies and 8 bees. How many butterflies did she see in both days? f g h i j
 f 13 g 15 h 17 i 28 j not given.....⁸

⁹ In order to raise money for a church picnic, 6 girls agreed to sell 144 boxes of candy. How many boxes must each girl sell if each one sells the same number? a b c d e
 a 6 b 24 c 144 d 864 e not given.....⁹

¹⁰ A rancher wants to divide his herd of 184 cows into two equal groups. How many cows will he put in each group? f g h i j
 f 82 g 92 h 184 i 368 j not given.....¹⁰

¹¹ The temperature was 62° at noon and dropped to 28° by 6 o'clock. How many degrees did it fall in that time? a b c d e
 a 28 b 32 c 34 d 62 e not given.....¹¹

¹² Ruth weighs 78 pounds, Helen weighs 54, and Ann weighs 67. How many pounds will Ann have to gain to weigh as much as Ruth does now? f g h i j
 f 11 g 13 h 24 i 78 j not given.....¹²

¹³ The 6 members of a stamp club have 432 stamps in all. What is the average number of stamps each member has? a b c d e
 a 6 b 70 c 72 d 432 e not given.....¹³

¹⁴ A strip of paper 19 inches long is to be cut so that one piece will be a foot long. How long will the other piece be? f g h i j
 f 5 in. g 12 in. h 19 in. i 31 in. j not given.....¹⁴

TEST 5 *Arithmetic Reasoning* (Continued)

- 15 Bob's coin book holds 48 coins on each page. How many coins will it hold on all 24 pages? *a* 2 *b* 24 *c* 48 *d* 1152 *e* not given 15

RADIO PROGRAMS		
Time	KVVV	KZZZ
5:00	Music	Circus
5:15	Mystery	Sports
5:30	Jones	Band
5:45	News	Play

- 16 Here is part of the radio program that appears in the paper. At what time might one hear the latest baseball scores on KZZZ?
f 5:00 *g* 5:15 *h* 5:30 *i* 5:45 *j* not given 16

- 17 Ben can buy a new bicycle for \$49.50 and a second-hand one for \$22.95. How much less does the second-hand one cost?
a \$22.95 *b* \$26.55 *c* \$49.50 *d* \$72.45 *e* not given 17

- 18 A cake costs 73 cents. How much change will Mother get back if she gives the baker two half dollars?
f 23¢ *g* 27¢ *h* 37¢ *i* \$1.00 *j* not given 18

- 19 A lock for the clubhouse will cost \$1.35. What will be each boy's share if 9 boys share equally?
a 9¢ *b* 14¢ *c* 15¢ *d* \$12.15 *e* not given 19

- 20 You know how much a man is paid per hour. You know how many hours he worked in a week. To find his earnings for the week, what would you do?
f add *g* subtract *h* multiply *i* divide *j* not given 20

- 21 Jim bought 6 yards of ribbon to tie two packages. For one package he used 3 yards and 2 feet. How much ribbon was left for the other package?
a 3 yd. *b* 3 yd. 1 ft. *c* 3 yd. 2 ft. *d* 9 yd. 2 ft. *e* not given 21

- 22 How much would Steve get in all for selling 11 papers at 7¢ each and 3 magazines at 20¢ each?
f 27¢ *g* 77¢ *h* \$1.27 *i* \$1.37 *j* not given 22

- 23 Candy eggs are 2 for 5¢. How many can be bought for 50¢?
a 10 *b* 20 *c* 25 *d* 30 *e* not given 23

- 24 Each class in a school agreed to collect $\frac{1}{6}$ of 300 cans of food for Thanksgiving baskets. How many cans would that be for each class to collect?
f 50 *g* 60 *h* 180 *i* 240 *j* not given 24

- 25 For a picnic, a club bought 4 dozen buns at 22¢ a dozen and 3 packages of marshmallows at 32¢ a package. How much did the buns and marshmallows cost all together?
a 88¢ *b* 96¢ *c* \$1.74 *d* \$1.84 *e* not given 25

- 26 Tom runs errands for 15¢ each. If he averages 15 errands a month, what is his monthly income?
f 15¢ *g* 30¢ *h* \$1.50 *i* \$2.25 *j* not given 26

- 27 A sidewalk is to be made in two parts. One part is to be 4 feet wide and 50 feet long. The other part is to be 2 feet by 12 feet. How many square feet will there be in all of the sidewalk?
a 24 *b* 68 *c* 200 *d* 214 *e* not given 27

- 28 Pine City is 120 miles from Milton. To go from Pine City to Milton by bus takes 4 hours and by train only $2\frac{3}{4}$ hours. How many hours less does it take to go by train?
f $1\frac{1}{4}$ *g* $1\frac{3}{4}$ *h* $2\frac{1}{4}$ *i* $6\frac{3}{4}$ *j* not given 28

- 29 How many 1-inch by 2-inch pieces of candy can be cut in a pan which is 8 inches by 10 inches?
a 20 *b* 36 *c* 50 *d* 80 *e* not given 29

- 30 Dan says there are 2 quart and 2 pint packages of ice cream for the party. How many people will all of it serve if a pint serves 4 people?
f 4 *g* 12 *h* 16 *i* 24 *j* not given 30

TEST 5 *Arithmetic Reasoning* PART II

DIRECTIONS: The answers to these examples can be thought out without doing any figuring on paper. You are to think out the answer and mark the answer space that is lettered the same as your choice.

31 Which is the largest of these numbers?
 a 402 b 89 c 346 d 19831

32 The cost of cheese is usually based on —
 e count f volume g area h weight32

33 Which number is thirty thousand five hundred sixty?
 a 30,056 b 30,506 c 30,560 d 35,00633

34 A gallon is how many quarts?
 e 2 f 4 g 6 h 834

MAY						
Sun.	Mon.					Sat.
a	b	c	d			

35 In which space should Thursday be? 35



36 What part of the square is black?
 e $\frac{1}{8}$ f $\frac{1}{4}$ g $\frac{1}{3}$ h $\frac{1}{2}$ 36

37 Which of these fractions has the smallest value?
 a $\frac{1}{2}$ b $\frac{1}{10}$ c $\frac{1}{3}$ d $\frac{1}{9}$ 37



38 How many minutes until 9 o'clock is it by this clock?
 e 7 f 17 g 24 h 3638

39 Without working the examples, choose the one in which the quotient will be largest.
 a $19\overline{)938}$ b $19\overline{)940}$ c $19\overline{)934}$ d $19\overline{)937}$ 39

40 The value of the Roman numeral XIV is —
 e 9 f 14 g 16 h 1840

41 In which of these numbers does the 7 occupy the place of greatest value?
 a 723 b 1427 c 8371 d 947041

42 Without measuring, tell how many inches long this line is. _____
 e 1 f 2 g 3 h 442

43 The perimeter of the top of a box is the —
 a distance across it b length of its longest side
 c distance from corner to corner d distance around it.43

44 $1\frac{1}{5} =$ e 1.20 f $.1\frac{1}{5}$ g $.001\frac{1}{5}$ h $1.001\frac{1}{5}$ 44

45 How much is 42.968 rounded off to the nearest tenth?
 a 42 b 42.9 c 42.97 d 43.045

NO. RIGHT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Gr. score	17	20	22	23	25	27	29	31	32	33	34	36	37	38	39	40	42	43	44	45	46	47	48	49	51	52	53	55	56	58	60	62	64	66	68	70	73	75	78	81	84	89	95	101	107

Stop.

TEST 6 Arithmetic Computation

DIRECTIONS: Work each example. Then compare your answer with the answers given at the right of the example. If your answer is one of those given, mark the answer space that has the same letter as your answer. Sometimes the correct answer is not given. If the correct answer is not given, mark the answer space under the letter for **not given**. Look carefully at each example to see what it tells you to do. If you need to do any figuring, use a separate sheet of paper.

SAMPLES:

A Add $\begin{array}{r} 3 \\ 2 \\ \hline \end{array}$	<i>a</i> 2	<i>b</i> 3	<i>c</i> 4	<i>d</i> 5	<i>e</i> not given.....	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
B Subtract $\begin{array}{r} 6 \\ 1 \\ \hline \end{array}$	<i>f</i> 1	<i>g</i> 2	<i>h</i> 3	<i>i</i> 4	<i>j</i> not given.....	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
1 Add $\begin{array}{r} 63 \\ 54 \\ \hline \end{array}$	<i>a</i> 97	<i>b</i> 107	<i>c</i> 117	<i>d</i> 127	<i>e</i> not given.....	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
2 Subtract $\begin{array}{r} 128 \\ 96 \\ \hline \end{array}$	<i>f</i> 32	<i>g</i> 33	<i>h</i> 42	<i>i</i> 52	<i>j</i> not given.....	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
3 Add $\begin{array}{r} \$4.80 \\ 9.65 \\ \hline \end{array}$	<i>a</i> \$13.45	<i>b</i> \$13.55	<i>c</i> \$14.55	<i>d</i> \$15.45	<i>e</i> not given.....	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
4 Multiply $\begin{array}{r} 450 \\ 7 \\ \hline \end{array}$	<i>f</i> 3050	<i>g</i> 3100	<i>h</i> 3150	<i>i</i> 3157	<i>j</i> not given.....	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
5 $6 \div 2 =$	<i>a</i> 3	<i>b</i> 6	<i>c</i> 8	<i>d</i> 12	<i>e</i> not given.....	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
6 Add $\begin{array}{r} 854 \\ 759 \\ 47 \\ 36 \\ \hline \end{array}$	<i>f</i> 1686	<i>g</i> 1696	<i>h</i> 1706	<i>i</i> 1796	<i>j</i> not given.....	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
7 Subtract $\begin{array}{r} 407 \\ 384 \\ \hline \end{array}$	<i>a</i> 13	<i>b</i> 23	<i>c</i> 123	<i>d</i> 183	<i>e</i> not given.....	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
8 Multiply $\begin{array}{r} 697 \\ 3 \\ \hline \end{array}$	<i>f</i> 1991	<i>g</i> 2061	<i>h</i> 2071	<i>i</i> 2091	<i>j</i> not given.....	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
9 Subtract $\begin{array}{r} \$5.00 \\ 4.48 \\ \hline \end{array}$	<i>a</i> \$.52	<i>b</i> \$.62	<i>c</i> \$1.48	<i>d</i> \$1.52	<i>e</i> not given.....	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
10 Subtract $\begin{array}{r} 422 \\ 385 \\ \hline \end{array}$	<i>f</i> 37	<i>g</i> 47	<i>h</i> 57	<i>i</i> 137	<i>j</i> not given.....	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
11 Add $\begin{array}{r} 4538 \\ 7979 \\ 7908 \\ \hline \end{array}$	<i>a</i> 20,325	<i>b</i> 20,425	<i>c</i> 21,325	<i>d</i> 21,425	<i>e</i> not given.....	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
12 $466 + 4557 + 89 =$	<i>f</i> 4912	<i>g</i> 5012	<i>h</i> 5102	<i>i</i> 5112	<i>j</i> not given.....	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
13 $43 \overline{)86}$	<i>a</i> 2	<i>b</i> 3	<i>c</i> 11	<i>d</i> 20	<i>e</i> not given.....	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>

TEST 6 *Arithmetic Computation* (Continued)

14 Multiply $\begin{array}{r} 75 \\ 14 \end{array}$. f 89 g 1040 h 1050 i 10,520 j not given...14 f g h i j

15 $4 \times \frac{3}{8} =$ a $\frac{3}{32}$ b $\frac{3}{8}$ c 1 d $1\frac{1}{2}$ e not given.....15 a b c d e

16 $2 \div \frac{1}{3} =$ f $\frac{1}{6}$ g $\frac{2}{3}$ h 3 i 6 j not given.....16 f g h i j

17 Add $\begin{array}{r} 667.55 \\ 786.68 \\ 99.64 \end{array}$ a 1542.87 b 1543.86 c 1552.77 d 1552.87 e not given.....17 a b c d e

18 Subtract $\begin{array}{r} 14,710 \\ 5,974 \end{array}$ f 8736 g 8744 h 8746 i 8836 j not given...18 f g h i j

19 $34 \overline{)748}$ a $19\frac{2}{34}$ b 22 c $24\frac{15}{17}$ d 112 e not given.....19 a b c d e

20 Subtract $\begin{array}{r} 871,653 \\ 396,785 \end{array}$ f 474,868 g 475,868 h 484,968 i 485,868 j not given.....20 f g h i j

21 Multiply $\begin{array}{r} 808 \\ 590 \end{array}$ a 112,700 b 474,950 c 478,550 d 496,550 e not given 21 a b c d e

22 $52 \overline{)2236}$ f 43 g $44\frac{23}{26}$ h 403 i $441\frac{1}{13}$ j not given.....22 f g h i j

23 Add $\frac{1}{6} + \frac{1}{6}$ a $\frac{1}{12}$ b $\frac{1}{3}$ c 1 d 2 e not given.....23 a b c d e

24 $\frac{3}{5} \times 6 =$ f $\frac{3}{5}$ g 3 h $3\frac{3}{5}$ i $6\frac{3}{5}$ j not given.....24 f g h i j

25 Multiply $\begin{array}{r} 310 \\ 203 \end{array}$ a 613 b 7130 c 62,930 d 64,960 e not given...25 a b c d e

26 Subtract $\begin{array}{r} 8\frac{1}{10} \\ 7\frac{5}{6} \end{array}$ f $1\frac{4}{15}$ g $1\frac{7}{10}$ h $1\frac{14}{15}$ i $15\frac{14}{15}$ j not given.....26 f g h i j

Summer Earnings of Six Boys

Bob	\$\$\$\$\$
Dick	\$\$\$
Tom	\$\$\$\$\$\$\$\$\$
Ted	\$\$\$\$\$
Bill	\$\$\$\$\$\$\$\$\$
Joe	\$\$\$\$\$

Each \$ represents 5 dollars earned last summer.

27 Which boy earned the least money last summer?
 a Dick b Tom c Ted d Bill e not given 27 a b c d e

28 Which boy earned \$10 less than Tom?
 f Dick g Ted h Joe i Bill j not given...28 f g h i j

29 $\frac{1}{4} \times \frac{3}{4} =$ a $\frac{1}{4}$ b $\frac{1}{3}$ c $\frac{3}{8}$ d $\frac{3}{4}$ e not given.....29 a b c d e

TEST 6 *Arithmetic Computation* (Continued)

30 Multiply $\begin{array}{r} 2.2 \\ \underline{3} \end{array}$ *f* .066 *g* .66 *h* 6.6 *i* 66 *j* not given.....30 *f* *g* *h* *i* *j*

31 $\frac{3}{4} \div \frac{1}{2} =$ *a* $\frac{3}{8}$ *b* $\frac{2}{3}$ *c* $\frac{3}{4}$ *d* $1\frac{1}{2}$ *e* not given.....31 *a* *b* *c* *d* *e*

32 $4\overline{)16.48} =$ *f* .0412 *g* .412 *h* 4.12 *i* 41.2 *j* not given.....32 *f* *g* *h* *i* *j*

33 Add $\begin{array}{r} 4\frac{3}{4} \\ \underline{7\frac{1}{2}} \end{array}$ *a* $4\frac{5}{8}$ *b* $4\frac{5}{6}$ *c* $5\frac{1}{4}$ *d* $5\frac{3}{4}$ *e* not given.....33 *a* *b* *c* *d* *e*

34 Subtract $\begin{array}{r} 4 \text{ ft. } 2 \text{ in.} \\ \underline{10 \text{ in.}} \end{array}$ *f* 3 ft. *g* 3 ft. 2 in. *h* 3 ft. 4 in. *i* 4 ft. 8 in. *j* not given.....34 *f* *g* *h* *i* *j*

35 Subtract $\begin{array}{r} \frac{1}{2} \\ \underline{\frac{1}{6}} \end{array}$ *a* $\frac{1}{8}$ *b* $\frac{1}{6}$ *c* $\frac{1}{4}$ *d* $\frac{2}{3}$ *e* not given.....35 *a* *b* *c* *d* *e*

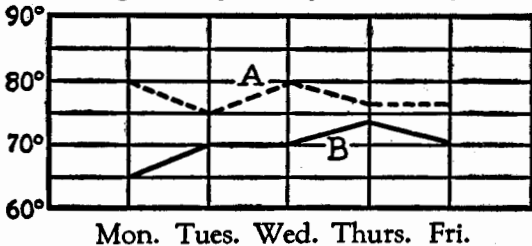
36 $2\overline{)1.28} =$ *f* .064 *g* .64 *h* 6.4 *i* 64 *j* not given.....36 *f* *g* *h* *i* *j*

37 $4\overline{)1220}$ *a* 35 *b* 305 *c* 315 *d* 350 *e* not given.....37 *a* *b* *c* *d* *e*

38 $.2 \times .12 =$ *f* .024 *g* .06 *h* .6 *i* 24 *j* not given.....38 *f* *g* *h* *i* *j*

39 $3\frac{1}{8} \div 5 =$ *a* $\frac{3}{8}$ *b* $\frac{3}{5}$ *c* $\frac{5}{8}$ *d* $1\frac{3}{5}$ *e* not given.....39 *a* *b* *c* *d* *e*

Average Daily Temperatures for Monday through Friday in City A and City B



40 On which day was the average temperature just 10° higher in City A than in City B?
f Mon. *g* Tues. *h* Wed. *i* Thurs. *j* not given.....40 *f* *g* *h* *i* *j*

41 On which day were the average temperatures in the two cities most nearly equal?
a Mon. *b* Tues. *c* Wed. *d* Fri. *e* not given.....41 *a* *b* *c* *d* *e*

42 Add $\begin{array}{r} 5 \text{ lb. } 9 \text{ oz.} \\ 3 \text{ lb. } 9 \text{ oz.} \end{array}$ *f* 8 lb. 2 oz. *g* 8 lb. 9 oz. *h* 9 lb. 2 oz. *j* not given.....42 *f* *g* *h* *i* *j*

43 6% of \$300 = *a* \$18 *b* \$180 *c* \$50 *d* \$306 *e* not given.....43 *a* *b* *c* *d* *e*

44 $8\overline{).16}$ *f* .002 *g* .2 *h* 2 *i* 20 *j* not given.....44 *f* *g* *h* *i* *j*

45 Find the average $\begin{array}{l} 12 \text{ ft.} \\ 20 \text{ ft.} \\ 17 \text{ ft.} \\ \underline{11 \text{ ft.}} \end{array}$ *a* 11 ft. *b* 15 ft. *c* 20 ft. *d* 60 ft. *e* not given.....45 *a* *b* *c* *d* *e*

Stop.

APPENDIX F

PROCEDURES FOR COMPUTING THE CORRELATION COEFFICIENTS

In using this formula:

$$r = \frac{N\sum X_1 Y_1 - (\sum X_1)(\sum Y_1)}{\sqrt{[N\sum X_1^2 - (\sum X_1)^2][N\sum Y_1^2 - (\sum Y_1)^2]}}$$

the final correlation figure is computed in the following manner. For the sake of explanation X_1 will be assumed to be the assigned values of each elementary school rating. Y_1 will be the assigned value of each Grade 7 letter grade. $\sum X_1$ in this instance will represent the total of the assigned values for an elementary school rating. $\sum Y_1$ is the accumulation of assigned values for a study group's letter grades of a Grade 7 academic subject.

When multiplied together, X_1 and Y_1 produce the cross product $X_1 Y_1$. The sum of $X_1 Y_1$ ($\sum X_1 Y_1$) is multiplied by N , the total number in the study sample. From $N\sum X_1 Y_1$ is subtracted the product of $\sum X_1$ and $\sum Y_1$. This produces the final dividend in the space above the division line.

In the divisor the sum of the individually squared assigned values ($\sum X_1^2$) is multiplied by N . From this product is subtracted the sum of the ($\sum X_1$) values for which the total has been squared ($\sum X_1$)². Similar calculations are performed on the Y_1 values in the divisor. The two resulting

X_i and Y_i differences are then multiplied together. Next the square root is found for this answer. The square root answer then acts as the divisor for dividing the dividend. The final answer or quotient in this division is the correlation coefficient of r .

So that the reader may better understand the formula and how each part operates, a problem which shows the various steps is calculated on the following page.

APPENDIX G

AN EXAMPLE OF THE COMPUTATION OF r

$$\begin{aligned}
 r &= \frac{N\sum X_1 Y_1 - (\sum X_1)(\sum Y_1)}{\sqrt{[N\sum X_1^2 - (\sum X_1)^2][N\sum Y_1^2 - (\sum Y_1)^2]}} \\
 &= \frac{50(231.65) - (101.0)(95.1)}{\sqrt{[50(252.5) - 10201.0][50(232.59) - 9044.01]}} \\
 &= \frac{11582.5 - 9605.1}{\sqrt{[12625.0 - 10201.0][11629.5 - 9044.01]}} \\
 &= \frac{1977.4}{\sqrt{[2424.0][2585.49]}} \\
 &= \frac{1977.4}{\sqrt{6267227.76}} \\
 &= \frac{1977.4}{2503.4} \\
 &\approx .79
 \end{aligned}$$

APPENDIX H

TABLE SHOWING THE FACTORS CONSIDERED
IN THIS INVESTIGATION FOR THE GIRLS' STUDY GROUP*

No.	T.R.	A.W.	I.Q.	S.A.T.	En. Lan.	En. Lit.	En. Sp.	S.S.	Ma.	Sc.
1	A	1	126	10.0	A	A	C+	A	A	A
2	A	1	128	9.8	B	A	B	B	B	B
3	C+	1	121	9.0	C+	B	C	C+	C	B
4	B	1	120	9.3	C+	C+	B	C	C	C
5	A	1	133	10.7	B	A	B	A	A	A
6	B	2	125	9.6	C+	B	C+	C+	C+	B
7	B	1	122	9.9	B	C	C-	C+	C	C+
8	A	1	127	10.6	B	C	C	C+	C	C
9	A	1	129	11.0	A	A	A	B	C+	B
10	A	1	116	9.7	C+	C+	B	B	B	A
11	B	1	135	8.7	A	B	B	B	A	B
12	C	2	125	8.5	B	C+	C	C	C-	C+
13	B	1	124	8.9	B	A	C+	B	B	B
14	A	1	123	8.6	B	C+	A	C	A	C
15	A	1	123	8.5	B	B	C	B	B	C+
16	B	2	136	8.7	A	B	B	B	B	A
17	B	1	120	8.8	A	A	A	B	C	B
18	A	1	123	8.6	A	A	B	A	B	A
19	A	1	118	8.4	B	B	A	B	B	B
20	C+	3	130	8.7	B	B	A	B	C	B
21	C	1	107	7.5	C+	C+	C	C	C	C+
22	D	2	113	7.6	C	B	B	C	C-	C-
23	C	1	110	7.6	C+	C	C	C	D	C-
24	C	2	108	7.2	C-	C+	C	C+	D	C-
25	D	2	100	7.4	C	C-	C-	C-	D	C-
26	B	1	115	7.7	C+	C	C+	C	C	C
27	C	2	102	7.3	C+	D	C+	C-	C	C-
28	C	1	113	7.3	B	C	C+	C	C	C-
29	D	2	107	7.4	C	C	C	C-	C	D
30	D	3	97	7.6	C	C	C-	C+	C	C
31	C-	2	115	6.8	C	C-	D	D	D	C-
32	D	3	99	6.9	C-	C-	D	D	D	C+
33	E	2	106	6.9	C	D	C-	E	C-	D
34	D	2	98	7.0	C	D	C	D	C-	D
35	D	3	103	7.0	C	D	C-	D	D	C
36	D	2	106	6.8	C-	C-	C+	D	D	C
37	C-	2	102	7.0	D	C-	C+	E	D	C-

APPENDIX H (continued)

No.	T.R.	A.W.	I.Q.	S.A.T.	En. Lan.	En. Lit.	En. Sp.	S.S.	Ma.	Sc.
38	C	2	120	6.9	C	C	C+	C	C	B
39	D	2	103	6.9	D	D	C-	E	D	C-
40	D	2	95	7.0	C+	D	A	D	C-	D
41	D	2	85	5.5	C	C	C-	C-	C-	C-
42	C-	3	101	5.9	C	D	C-	C	D	C-
43	C-	3	105	6.3	D	D	D	C-	D	D
44	D	2	81	6.0	C-	D	D	C-	D	D
45	E	2	89	6.2	D	D	C	E	E	C-
46	D	2	92	6.4	C-	D	D	C-	D	D
47	E	2	92	6.1	C	C-	D	C-	D	D
48	E	2	98	6.7	D	D	C	D	D	C
49	C-	3	101	5.9	C	D	C-	C	D	C-
50	D	2	105	6.2	C-	C-	C-	C-	C-	D

*Key to the abbreviations follows Appendices H and I.

APPENDIX I

TABLE SHOWING THE FACTORS CONSIDERED
IN THIS INVESTIGATION FOR THE BOYS' STUDY GROUP*

No.	T.R.	A.W.	I.Q.	S.A.T.	En. Lan.	En. Lit.	En. Sp.	S.S.	Ma.	Sc.
51	B	2	133	9.0	B	C+	B	B	B	B
52	A	1	123	10.2	A	B	A	A	A	B
53	B	2	129	8.7	B	B	C+	B	B	B
54	B	1	127	8.8	B	C+	A	B	A	B
55	C	2	124	8.4	B	C+	C+	C	B	C+
56	B	2	124	8.8	B	C+	A	A	B	C+
57	A	1	125	9.0	A	A	B	A	A	A
58	B	2	120	8.6	B	B	A	B	B	B
59	B	1	120	8.9	B	B	A	B	B	C+
60	B	2	131	7.9	B	C+	C+	C+	B	C+
61	B	2	116	8.5	C	B	C	B	C+	B
62	B	2	115	8.2	C-	C+	D	C	C	C
63	C+	2	117	8.0	D	B	D	B	D	A
64	C	1	120	8.5	B	B	A	B	C+	C+
65	B	1	110	9.0	C+	C	D	C+	C	B
66	C	2	119	8.7	C+	B	C	B	C-	B
67	B	2	119	8.9	C+	C	C-	B	C+	C
68	C+	2	111	8.4	C+	C	C+	C	C+	C+
69	C	2	116	8.2	C	B	C-	B	C	B
70	C	1	113	7.4	C+	C	B	B	C	B
71	B	2	109	9.3	C-	C-	C-	C+	C	B
72	C+	3	115	7.3	D	C	C+	C-	C-	C+
73	C-	3	105	6.6	D	D	D	D	D	C-
74	C+	2	107	7.3	C	C	C	C	C+	C
75	C+	1	107	7.6	C	C	A	C+	C+	B
76	C-	3	113	7.8	C-	C-	C-	C	C+	C
77	B	2	110	8.5	B	C+	C	C+	C	B
78	D	2	116	8.2	C-	C	C	C-	B	B
79	C	2	89	7.0	D	D	D	C-	C	D
80	C	2	110	8.0	C-	C-	C-	C	C	C
81	D	2	103	7.0	C-	C-	C-	D	C-	E
82	C	2	104	8.0	C+	B	B	C+	C+	C+
83	C	2	104	7.0	C-	C	C-	C+	D	C
84	D	3	108	7.3	C-	C	D	D	D	D
85	C	1	104	8.1	C-	C	E	C-	C	C-
86	C+	1	100	8.2	B	B	B	B	C+	B
87	C	2	102	7.4	C-	D	C	D	E	D

APPENDIX I (continued)

No.	T.R.	A.W.	I.Q.	S.A.T.	En. Lan.	En. Lit.	En. Sp.	S.S.	Ma.	Sc.
88	C	1	105	7.9	C+	B	C+	C+	B	C+
89	C-	1	105	6.9	C+	C+	B	A	B	B
90	D	4	104	6.7	D	C	D	D	D	D
91	D	2	86	6.3	D	D	E	D	D	D
92	D	4	89	7.1	D	D	E	D	C-	D
93	E	4	88	6.2	E	D	E	E	D	E
94	D	3	87	6.7	C-	C-	C-	D	D	C-
95	D	2	88	6.2	E	D	E	D	C-	D
96	E	3	72	5.2	E	E	E	E	E	E
97	D	3	88	5.7	E	D	D	D	B	D
98	E	3	74	4.4	E	E	E	E	E	E
99	C-	3	88	6.5	E	E	E	E	C-	D
100	E	4	84	4.5	E	E	E	E	E	E

*Key to the abbreviations follows Appendix I.

APPENDICES H AND I (continued)

TABLE SHOWING THE FACTORS CONSIDERED
IN THIS INVESTIGATION FOR THE GIRLS' STUDY GROUP
AND THE BOYS' STUDY GROUP

KEY TO THE ABBREVIATIONS

Abbreviation	Meaning
No.	= code number representing the student's name
T.R.	= teacher's subjective rating of the student's general academic ability in elementary school
A.W.	= teacher's subjective rating of the pupil's attitude to work in elementary school
I.Q.	= Otis Self-Administering Test of Mental Ability (Intermediate Examination: Form A, B, C or D) I.Q. score
S.A.T.	= Stanford Achievement Test (Intermediate Battery Partial: Form J) grade equivalent score
En. Lan.	= Grade 7 English language letter grade in the Third Report
En. Lit.	= Grade 7 English literature letter grade in the Third Report
En. Sp.	= Grade 7 English spelling letter grade in the Third Report

APPENDICES H AND I (continued)

KEY TO THE ABBREVIATIONS

Abbreviation	Meaning
S.S.	= Grade 7 social studies letter grade in the Third Report
Ma.	= Grade 7 mathematics letter grade in the Third Report
Sc.	= Grade 7 science letter grade in the Third Report
