A STUDY OF THE RELATIVE IMPORTANCE OF CERTAIN FACTORS IN PREDICTION OF SUCCESSFUL PERFORMANCE IN SEVENTH GRADE MATHEMATICS

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PREFACE

The writer wishes to express his appreciation to his chairman, Dr. James H. Zant, and members of his committee for their assistance in the formulation and development of this study.

Sincere thanks go, also, to the teachers and administrators of the school systems who provided students, helped in the administration of tests, furnished capable instruction, and assigned grades in numerical form.

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CHAPTER I

INTRODUCTION

Nature of the Problem

The present effort to improve the content and teaching of mathematics in the schools began with the organization of the University of Illinois Committee on School Mathematics in 1952 as a result of the efforts of Max Beberman. The Ball State Program, The Commission on Mathematics of the College Entrance Examination Board, and the University of Maryland Project also had an impact upon the curriculum revision movement; but the primary credit must be given to the School Mathematics Study Group (SMSG) organized in 1958 and supported by the National Science Foundation. This group of mathematicians and educators worked jointly to produce mathematics curriculum materials that were different from the traditional ones in both organization and content.[1] Their intention was to create an interesting and logical sequence of mathematical topics that would challenge secondary students, hoping to give high school graduates a mathematical background to meet the demands which had resulted from scientific developments of recent years.

There were some educators and mathematicians who felt that the lack of interest and success in mathematics at the senior high and college

[1] John R. Mayor and John A. Brown, "New Mathematics in the Junior High School," Educational Leadership, Vol. 18, (December, 1960), pp. 166-167.

level might be due to unhappy experiences in seventh and eighth grade mathematics.[2] The SMSG writers recognized that one of the most difficult problems was the blending of new ideas with old ones to bring about a higher level of understanding. In the choice of material for the junior high school units, in particular, the seventh grade, there was greater departure from traditional material than for other grade levels.[3] For example, consider the course content as outlined by Mayor and Brown:

> In teaching the new mathematics, emphasis is placed on structure and precision of language. In the seventh and eighth grades, and earlier, properties of operations with numbers are studied as properties of a number system such as closure, and the commutative and associative properties. The system of whole numbers has the closure property for addition and multiplication but not for subtraction and division. New numbers in an extended system, fractions for division and negative numbers for subtraction, must be introduced to provide for the closure property. Operations with new numbers are defined so that the operations will satisfy the other properties as well. Elementary notions of probability are introduced in grade seven; negative numbers, even earlier. Notions from topology and number theory first find their places in the junior high school.[4]

Teachers who taught pilot classrooms during the experimental years of the revolution used text materials prepared by the various writing teams. In 1959-60 SMSG furnished experimental texts for approximately 2700 high school students in Oklahoma.[5] During subsequent years the

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[2]Margaret F. Willerding, "A Critical Look at the New Mathematics," School Science and Mathematics, Vol. 62, (February, 1962), p. 215.

[3]Ibid., p. 216.

[4]John R. Mayor and John A. Brown, "Teaching the New Mathematics," School and Society, Vol. 88, (October, 1960), p. 376.

[5]James H. Zant and Roy W. Jones, "Developments in Mathematics and Science Curricula in Oklahoma," The Oklahoma Teacher, Vol. 41, (January, 1960), p. 24.

SMSG texts became the most popular of the revised texts, but in Oklahoma they could not be purchased by school districts with state textbook funds. Parents and administrators in many school districts were anxious for commercial publishers to produce for adoption mathematics textbooks that were similar to the experimental materials.

The Oklahoma State Textbook Adoption Committee was faced with the problem of choosing texts that would be taught by teachers who possessed varied amounts of training and enthusiasm for the revised courses of study. They attempted to solve this problem by placing on the adopted list publications that varied in amounts of modern concepts, thus allowing local committees the opportunity to choose according to their own situations.

Some students who took SMSG mathematics in the early years of the use of these books had earned grades in seventh grade mathematics that were much less satisfactory than marks received in the previous years. Many who had scored in the upper percentile ranks on standardized mathematics tests at the close of the sixth year received marks as low as D's and F's in the seventh grade mathematics when they first encountered the experimental course of study. This author, as a classroom teacher and as a tutor when attending graduate school, has been in personal contact with students of this type.

The teacher, counselor, and parent are confronted with the question of whether or not their students or children will attain an appreciable degree of success while studying these new seventh grade materials. During the first years when children are using these new adoptions there is a need for evaluations of these new programs. There will be periodic evaluations of the course made by the students and the teacher.

Another important phase of evaluation can be obtained by a study of the prediction of probable success of the students in classrooms and school systems for the purposes of guidance and for sectioning of pupils.

The circumstances described in the previous paragraphs justify the formulation of a study to predict success of students in seventh grade mathematics when studying these newly adopted textbooks. In studies of this type it is desirable for the researchers to use scores obtained from an objective type test as a criterion of success, but standardized mathematics tests covering the new concepts of the revised courses of study were not available when the books were adopted and first used. Consequently, teachers' grades for one semester's performance were used as the criterion in the study.

Reasons for Undertaking the Study

Secondary schools throughout Oklahoma started the 1964-65 term using mathematics texts covering topics which were new in various degrees to many students. Educators and parents were anxious to know how they would respond.

Most of the commercial texts were reported by their publishers to contain some concepts similar to those found in the experimental texts. Although many teachers and students were enthusiastic about the new junior high mathematics curricula, there were some who felt that there were areas which were too difficult. For this reason it would seem advisable to design an evaluation of the new program over the first semester of its use. E. J. McClendon encouraged the evaluation of curriculum changes in the following statement at the 1962 winter conference of the Michigan Education Association:

> A major purpose of the conference was to encourage school systems who are making curricular or other program modifications to design studies to test the effectiveness and other outcomes of change. The point was repeatedly made that the current (post-sputnik) pressures on education have resulted in many changes but too often no plan of evaluation has accompanied the new program.[6]

Each teacher and counselor is interested in his students and would like to have evaluations based on rather short periods of time. In fact, periodic evaluations are necessary by the teacher and students as well. Kendrick points out:

> Everything done in guidance involves, in the broadest sense, some kind of prediction. In a narrow sense, it is clear that many situations arise in which guidance workers need to predict the future behavior of students or persons who deal with students.[7]

The foregoing remarks have been presented to justify the need for a study to determine the relative importance of certain aptitudes and achievement in arithmetic and reading in predicting success for students studying a new seventh grade mathematics curriculum.

Statement of the Problem

The problem of this study is to determine the relative importance of the _Academic Promise Tests_, the _Metropolitan Arithmetic Test_, and the _Metropolitan Reading Test_ in prediction of successful performance in seventh grade mathematics as measured by semester grades given by the classroom teachers.

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[6] E. J. McClendon, "An Approach to Practical Research," _Michigan Educational Journal_, Vol. 40, No. 14, (March, 1963), p. 500.

[7] Shildrick Kendrick, "Concepts of Measurement Required for Guidance," _Peabody Journal of Education_, Vol. 28, No. 3, (November, 1950), p. 152.

The following specific outcomes will be obtained for all students of the study group:

A. Correlation coefficients between scores on each test and seventh grade mathematics grade based on one semester's performance.

B. The coefficient of multiple correlation between the optimum combination of tests of the battery and seventh grade mathematics grades.

C. The multiple regression equations for prediction of mathematics grades for schools, for students using the same texts, and for the combined study group.

D. Graphic cutting scores for the predictor variables which are shown by the analysis to contribute significantly to the prediction scheme.

E. The coefficient of correlation between mathematics grades predicted by the obtained multiple regression equations for members of a validation group from certain schools from the same population and the actual grades made by this validation group.

Limitations of the Study

Although this study was undertaken for the purpose of aiding junior high schools in sectioning and in predicting potential failures, one cannot hope to devise a scheme which will function in all cases for individual students. John G. Darley makes this comment concerning prediction:

> By appropriate statistical treatment, the contribution of each separate predictor can be maximized and weighted into a multiple regression equation that gives the best prediction of the criterion measure. This is essentially an actuarial procedure by which the experimenter hopes to

> improve, but cannot make perfect, his selection for success in the criterion task . . . But there are, in addition, factors of maturity, motivation, emotional stability, financial support, and personal adjustment, no one of which is ordinarily itemized in the regression equation and any one of which may determine success or failure of the individual student. Thus the counselor finds himself "shading" the acturial prediction one way or the other, depending upon his assessment of the import of these other factors.[8]

Furthermore, no attempt will be made to apply the findings of this study to individuals other than those who are similar to the population from which the data were obtained. Consequently, the results of this study will be applied only to students in southern Oklahoma schools; and particularly to those schools involved in the study.

It was necessary to establish certain premises at the outset of a study of this type since there was a possibility of differences of opinion concerning values of factors which bear directly upon the outcome of the problem. In studies where instruments are used to measure human behavior, or where devices are contrived to predict behavior, certain foundations of common understanding other than simple definition must be established. The following basic assumptions were, therefore, made for this study:

(a) That no sample can be taken which better represents a population than the population itself. For this reason the entire class in each school was included in the study whenever possible.

(b) That a grade given to a student by his classroom teacher was a satisfactory measure of success in seventh grade mathematics.

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[8] John G. Darley, "The Functions of Measurement in Counseling," <u>Educational Measurement</u>, ed. E. F. Lindquist, (Washington, D. C.), 1951, p. 74.

(c) That scores on educational tests and subject grades were normally distributed.

(d) That the regression equation was a valid predictor for seventh grade mathematics pupils.

Operational Definitions

In order to avoid ambiguity and to discourage repetitious explanation, the following terms and symbols were defined and were used in this context throughout the study:

(a) Subjects, seventh grade students in mathematics in certain Southern Oklahoma Schools.

(b) Study Group was the group of subjects whose test scores and mathematics grades comprised the data for analysis.

(c) Validation Group was the group of subjects whose test scores and mathematics grades were used to determine the efficiency of the prediction during the following year.

(d) Criterion, performance in seventh grade mathematics measured in numerical grades.

(e) Successful, performance in seventh grade mathematics which merited a numerical grade score of three or more on a ten point scale.

(f) Unsuccessful, performance in seventh grade mathematics denoted by a numerical grade of less than three on a ten point scale.

(g) APT, Academic Promise Tests

(h) V, Verbal, a subtest of the Academic Promise Tests.

(i) LU, Language Usage, a subtest of the Academic Promise Tests.

(j) AR, Abstract Reasoning, a subtest of the Academic Promise Tests.

(k) N, Numerical, a subtest of the Academic Promise Tests.

(l) AC, Arithmetic Computation, a subtest of the Metropolitan Arithmetic Test.

(m) AP, Arithmetic Problem Solving and Concepts, a subtest of the Metropolitan Arithmetic Test.

(n) WK, Word Knowledge, a subtest of the Metropolitan Reading Test.

(o) R, Reading test, a subtest of the Metropolitan Reading Test.

(p) SB, Silver Burdett.

(q) LL, Laidlaw.

(r) PH, Prentice-Hall.

(s) HB, Harcourt Brace World.

(t) HRW, Holt Rinehart Winston.

(u) SMSG, School Mathematics Study Group.

(v) Y_c, criterion scores, or numerical grades in seventh grade mathematics, assigned to students by their teacher.

(w) Y, predicted numerical grades in seventh grade mathematics.

(x) X_1, raw score on the Verbal Test.

(y) X_2, raw score on the Language Usage Test.

(z) X_3, raw score on the Abstract Reasoning Test.

(aa) X_4, raw score on the Numerical Test.

(bb) X_5, raw score on the Arithmetic Computation Test.

(cc) X_6, raw score on the Arithmetic Problem Solving and Concepts Test.

(dd) X_7, raw score on the Word Knowledge Test.

(ee) X_8, raw score on the Reading Test, a subtest of the Metropolitan Reading Test.

(ff) Graphic Cutting Score, a raw score, or sum of scores, on certain tests which are derived from the distributions in the various tables of Appendix D. Any student scoring below this indicated score would not be expected to be successful in seventh grade mathematics.

(gg) Metropolitan Reading Test, the Advanced Reading Test of the Metropolitan Achievement Tests, published by Harcourt, Brace, and World, Inc.

(hh) Metropolitan Arithmetic Test, the Advanced Arithmetic Test of the Metropolitan Achievement Tests, published by Harcourt, Brace, and World, Inc.

CHAPTER II

A REVIEW OF THE RELATED LITERATURE

Prediction of Success in Junior High Mathematics

Numerous studies in the prediction of success in ninth grade mathematics have been made; however, none was found to have been conducted for the seventh grade. Many of these studies were conducted to determine the effectiveness of a single predictor, the most popular being intelligence. Douglass reported a survey of prediction studies using intelligence as the single predictor and found correlation coefficients which ranged between .23 and .67, with .44 as the median.[1] Ross and Hooks found correlations between success in ninth grade mathematics and intelligence ranging between .12 and .69, with .48 as the median correlation.[2]

Prognostic tests were considered to be better predictors of success in mathematics than intelligence tests by many experts. Douglass also found correlations between prognostic test scores and achievement test

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[1]Harl R. Douglass, "The Prediction of Pupil Success in High School Mathematics", The Mathematics Teacher, Vol. 28, (May, 1935), pp. 495-496.

[2]C. C. Ross and N. T. Hooks, "How Shall We Predict High School Achievement?", Journal of Educational Research, Vol. 22, (October, 1930), p. 191.

scores and achievement test scores or teachers' marks ranging between .30 and .88, with .53 as the median.[3] Segel reviewed the literature on prediction in 1938 and listed the three best predictors of success in algebra in the following order: first, special algebra aptitudes; second, arithmetic tests; and third, intelligence tests.[4]

Kelley had recommended the use of the regression equation method in guidance and claimed to be the first to use it in prediction research. His statement was as follows:

> As success usually depends upon several factors, partial correlation and the regression equation method are essential in the evaluation of the data. This method will be explained more fully later. The writer is not aware that it has been used before in a guidance problem, but its peculiar adaptability to a problem of this nature insures its extended use in the future.[5]

He reported a correlation of .58 for first year high school mathematics grades with mathematics grades for the fourth, fifth, sixth, and seventh grades.

Ross and Hooks stated that predictive ability might be improved by using several factors and multiple correlation techniques.[6] They favored intelligence quotient and algebraic ability tests as predictors. Douglass concluded that achievement in high school algebra might be

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[3]Douglass, pp. 496-497.

[4]David Segel, "Measurement of Aptitudes in Special Fields," Review of Educational Research, Vol. 11, (February, 1941), pp. 42-56.

[5]Truman Lee Kelley, Educational Guidance, Teachers College, Columbia University Contributions to Education No. 71 (New York: 1914), p. 2.

[6]Ross and Hooks, p. 191.

predicted best by a combination of the following: a good prognostic test, intelligence, and grade averages from the previous year or two years work.[7]

Some of the studies in prediction of success in ninth grade mathematics utilizing multiple regression methods are listed, in order of their publication, in the following table.

TABLE I

STUDIES INVOLVING PREDICTION OF ACHIEVEMENT IN NINTH GRADE MATHEMATICS BY MULTIPLE REGRESSION

Author	Date	Variables of the Multiple Regression Equation	Coefficients of Correlation
May[8]	1923	1. Algebra Achievement Test[a] 2. Algebra Prognostic Test 3. Intelligence	$R_{1(23)} = .65$
Grover[9]	1932	1. Achievement Test 2. Algebra Prognosis 3. Intelligence	$R_{1(23)} = .65$
Dictor[10]	1933	1. Algebra Survey Test 2. Test of Algebraic Ability 3. Arithmetic Grades 4. Intelligence	$R_{1(234)} = .74$

[a]The variable listed first for each study is the criterion variable. All subsequent variables are predictors.

[7]Douglass, p. 492.

[8]M. A. May, "Predicting Academic Success," Journal of Educational Psychology, Vol. 14, (October, 1923), p. 439.

[9]C. C. Grover, "Results of an Experiment in Predicting Success in Two Oakland High Schools," Journal of Educational Psychology, Vol. 23, (April, 1932), p. 313.

[10]M. R. Dictor, "Predicting Algebraic Ability," School Review, Vol. 41, (October, 1933), p. 605.

TABLE I (Continued)

Author	Date	Variables of the Multiple Regression Equation	Coefficients of Correlation
Orleans[11]	1934	1. Grades in Algebra 2. Prognostic Test 3. Arithmetic Grades	$R_{1(23)} = .72$
Ayers[12]	1934	1. Algebra Grades 2. Algebra Prognosis Test 3. Teacher Made Reasoning Test 4. Teacher Estimate 5. Intelligence	$R_{1(234)} = .70$
Dunn[13]	1937	1. Algebra Survey Test 2. Algebra Prognosis Test 3. General Achievement 4. Achievement in Arithmetic	$R_{1(234)} = .44$
Kellar[14]	1939	1. Algebra Survey Test 2. Algebra Computation 3. Ability to do Arithmetic Problems 4. Memory 5. Intelligence	$R_{1(2345)} = .81$

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[11] J. B. Orleans, "A Study of Prognosis of Probable Success in Algebra and Geometry," The Mathematics Teacher, Vol. 27, (May, 1934), p. 226.

[12] G. H. Ayers, "Predicting Success in Algebra," School and Society, Vol. 39, (January, 1934), p. 18.

[13] W. H. Dunn, "The Influence of the Teacher Factor in Predicting Success in Ninth Grade Algebra," Journal of Educational Research, Vol. 30, (April, 1937), p. 581.

[14] W. R. Kellar, "The Relative Contribution of Certain Factors to Individual Differences in Algebraic Problem Solving Ability," Journal of Experimental Education, Vol. 8, (September, 1939), pp. 26-35.

TABLE I (Continued)

Author	Date	Variables of the Multiple Regression Equation	Coefficients of Correlation
Clifton[15]	1941	1. Grades in Algebra 2. Reading 3. Arithmetic Reasoning 4. Dictation 5. Intelligence	$R_{1(2345)} = .57$
Layton[16]	1941	1. Algebra Survey Test 2. Intelligence 3. 8th Grade Arithmetic Grades 4. Achievement Test in Arithmetic 5. Algebra Prognostic Test	$R_{1(2345)} = .76$
Guilder[17]	1944	1. Algebra Survey Test 2. Algebra Aptitude Test 3. Arithmetic Computation 4. Algebra Prognosis Test	$R_{1(234)} = .85$
Shaw[18]	1956	1. Algebra Survey Test 2. Intelligence 3. Algebra Aptitude Test 4. Reading Test	$R_{1(234)} = .77$

[15] L. L. Clifton, "Prediction of High School Marks in Elementary Algebra," Journal of Experimental Education, Vol. 8, (June, 1940), p. 411.

[16] R. B. Layton, "Study of Prognosis in High School Algebra," Journal of Educational Research, Vol. 34, (April, 1941), p. 604.

[17] W. S. Guiler, "Forecasting Achievement in Elementary Algebra," Journal of Educational Research, Vol. 38, (September, 1944), pp. 33-35.

[18] Geraldine Shaw, "Prediction of Success in Elementary Algebra," Mathematics Teacher, Vol. 49, (March, 1956), p. 177.

TABLE I (Continued)

Author	Date	Variables of the Multiple Regression Equation	Coefficients of Correlation
Denkel[19]	1959	1. Algebra Survey Test 2. Algebra Prognosis Test 3. Intelligence 4. Arithmetic Achievement 5. Arithmetic Grades 6. Author-made Test	$R_{1(23456)} = .86$
Duncan[20]	1960	1. Algebra Survey Test 2. Intelligence 3. Interest in Literature and Science 4. Arithmetic Computation	$R_{1(234)} = .76$
Barnes[21]	1962	1. Algebra Grades 2. 8th Grade Math Grade 3. 7th Grade B. E. on Arithmetic Achievement 4. Algebra Prognosis Test 5. G. E. on 7th Grade Reading Test 6. 7th Grade Math Grade	$R_{1(23456)} = .66$

[19] R. E. Denkel, "Prognosis for Studying Algebra," Arithmetic Teacher, Vol. 6, (December, 1959), p. 318.

[20] Roger Lee Duncan, "The Prediction of Success in Eighth Grade Algebra," (unpub. Ed. D. dissertation, University of Oklahoma, 1960), pp. 25-26.

[21] Ward E. Barnes and John W. Asher, "Predicting Students' Success in First-Year Algebra," Mathematics Teacher, Vol. 551, (December, 1962), pp. 651-654.

The trend for recent studies of this type has been to consider a larger set of predictor variables, and use statistical techniques to select the most efficient combination for the regression equation. Barnes selected the five predictor variables listed in the previous table from an original set of ten predictors.[22] Duncan selected four predictors from an initial set of twenty-one.[23]

The Differential Aptitude Tests in Prediction

In recent years the Differential Aptitude Tests have been used in much research at the high school and the college level. Berdie found the Numerical Ability Test, a subtest of the DAT, to be significant in prediction of academic success for engineers.[24] Vineyard reported the correlation of college mathematics grades with Verbal Reasoning, .26; with Numerical Ability, .42; and .31 with Abstract Reasoning.[25] Wolking preferred the DAT to the Primary Mental Abilities Tests in predicting high school grades.[26] Milholland and Fricke indicated that the DAT was

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[22]Barnes and Asher, p. 653.

[23]Duncan, pp. 14-15.

[24]Ralph F. Berdie, "The Differential Aptitudes as Predictors in Engineering," Journal of Educational Psychology, Vol. 42, (March, 1951), pp. 114-123.

[25]Edwin E. Vineyard, "Longitudinal Study of the Relationship of Differential Aptitude Test Scores with College Success," (unpub. Ed. D. dissertation, Oklahoma A. and M. College, 1955), p. 96.

[26]William D. Wolking, "Predicting Academic Achievement with Differential Aptitude and the Primary Mental Abilities Tests," The Journal of Applied Psychology, Vol. 39, (October, 1955), pp. 115-118.

the most favored multiscore instrument in published research.[27] Elton and Morris found the DAT helpful in prediction of success in College Freshman Algebra.[28] Osburn and Melton reported that the DAT predicted efficiency in both traditional and experimental ninth grade algebra equal to that of the Iowa Algebra Aptitude Test and the Orleans Prognosis Test.[29]

Summary

A review of research indicates that scores from prognostic tests and intelligence tests have been the most frequently used predictors of success in junior high mathematics. Next, in order, are previous year's arithmetic grades and scores on arithmetic achievement tests. Certain specific aptitudes, such as verbal and numerical, appear to be good predictors in most areas of study. Abstract reasoning was indicated to have predictive value in some cases. The Differential Aptitude Tests contain subtests for numerical, verbal, and abstract reasoning, but they are designed for the testing of high school and college students. The Academic Promise Tests (APT) are of similar construction and were designed for use at the junior high school level. Intelligence is

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[27]John E. Milholland and Benno C. Fricke, "Development and Application of Tests of Special Aptitude," Review of Educational Research, Vol. 32, (February, 1962), p. 27.

[28]Charles F. Elton and Donald Morris, "The Use of the D.A.T. in a Small Liberal Arts College," Journal of Education Research, Vol. 50, (October, 1956), pp. 139-143.

[29]H. G. Osburn and R. S. Melton, "Prediction of Efficiency in a Modern and Traditional Course in Beginning Algebra," Educational and Psychological Measurements, (1963), Vol. 23, Part I, p. 287.

is considered by most researchers to be one of the best predictors of success in specific areas of study. However, intelligence tests usually offer measurement of verbal and abstract reasoning, or verbal and numerical, although perhaps under other names. Since each of these abilities is measured by the APT, it seemed advisable to use these tests in a prediction study of success in the new mathematics curriculum at the seventh grade level. Furthermore, the giving of a mental ability test along with the Academic Promise Tests would represent needless duplication of measurement.

Prognostic tests and arithmetic achievement tests were not available for the new courses of study. Previous years' grades were based on a different type of course in mathematics. However, a traditional type arithmetic test and an achievement test in reading were included in the predictive battery. Reasons for the inclusion of these tests will be given in a later chapter.

CHAPTER III

PROCEDURE

The purpose of this section is to acquaint the reader with the conditions under which subjects of the study group and the validation group were chosen, the instruments which were used in collecting the data, the statistical procedures which were used to determine the conclusions of the study.

Subjects

The subjects of the study group were seventh grade students in attendance during the 1964 fall semester in certain southern Oklahoma schools. There were sixteen schools which participated in the pretest administration: two rural elementary schools, eight rural high schools, and six systems located in towns which ranged in size from small villages to county seat towns, one of which was over 2500 in population.

Three sections of students from the junior high school in the largest system were selected by the administration to participate. In all other systems, the entire seventh grade class of 1964 was included in the study. When all the pretest scores were available, only students with complete battery scores were included in the research. Two schools failed to return grade sheets at the end of the semester, thus leaving fourteen schools furnishing 508 students with all test scores available.

With one exception, the entire class in each participating school studied the same text. This class of forty-three pupils consisted of a section of twenty-one who studied SMSG materials and twenty-two pupils who used the Silver Burdett text. These students are denoted "Silver Burdett, School No. 2" and "SMSG, School No. 1" in the following table.

Table II lists the subjects by texts studied and number of students in each school in the study group. The table is read as follows: "Silver Burdett school number one had thirty-six students in the study group."

TABLE II

SUBJECTS OF THE STUDY GROUP

SB		LL		PH		HB		HRW		SMSG	
Sch	N	Sch	N	Sch	N	Sch	N	Sch	N	Sch	N
1	36	1	23	1	76	1	22	1	51	1	21
2	22	2	21	2	73	2	16				
3	38	3	15			3	63				
4	19	4	12								
T	115	T	71	T	149	T	101	T	51	T	21

It was decided to use the 1964 students as a study group on which to compute the various statistical measures of relationship, and to use as a validation group a number of students from the 1965 students who would be receiving instruction from teachers who had taught students participating in the 1964 year of the study.

The validation group was chosen from two text-groups. One of the groups was to be chosen who studied the most traditional type and the other, those who studied the text with the most modern content and presentation of materials. The opinions of a consultant in mathematics education and an informal poll of individuals who were active in Oklahoma curriculum improvement were in agreement that students using Harcourt Brace texts and students using Prentice-Hall texts should make up the validation group. These students were 97 and 118 in number, respectively.

Table III gives the number of students who studied Prentice-Hall and Harcourt Brace texts in 1965 under teachers who taught the study group the previous year. The school numbers in Table III represent schools with the same number in Table I.

TABLE III

SUBJECTS OF THE VALIDATION GROUP

PH		HB	
Sch	N	Sch	N
1	92	2	17
2	26	3	80

Conditions of the Test Administration

As in most practical research, the administration of pretests was scheduled according to the desires of the local school administration. Some principals preferred that the tests be administered by local counselors or teachers. In all other cases they were administered by the author. The tests were hand scored and raw scores on all tests were used as the data for the predictive study.

The tests were administered during the first quarter of the term with the exception of two rural schools, which held summer terms; and in these cases the tests were given soon after the fall vacation. This might be considered a source of invalidity, but their scores were included in the study, since predictions were to be made for individual schools as well as for combined data groups.

The Test Battery

The tests which were used in the study were the *Academic Promise Tests*, and the Advanced Arithmetic and Advanced Reading Tests from the *Metropolitan Achievement Tests* battery. The *Academic Promise Tests* consists of four subtests which are entitled *Verbal*, *Language Usage*, *Abstract Reasoning*, and *Numerical*. The Metropolitan Tests each have two subtests; the arithmetic subtests are entitled *Arithmetic Computation*, and *Problem Solving and Concepts*; while the titles of the reading tests are *Word Knowledge* and *Reading*. A brief description of each of these tests including some of the expectations of the test authors concerning them will be given in the following chapter. Excerpts of opinions of the battery written by test experts will also be given along with evidence concerning the reliability and validity data obtained from research with the battery.

The Criterion

If one decides to consider "success" as a type of behavior to be observed in individuals, then it is necessary to agree upon some measure of this criterion.

Since there had been no tests designed to measure achievement in the modern mathematical concepts by the fall of 1964, there needed to be another measure chosen. Ludlow takes this viewpoint:

> . . . About ten years ago, the arithmetic curriculum people began talking and writing about the "meaning theory" of instruction. This approach emphasizes such goals as understanding, quantitative thinking, and number vocabulary in addition to the traditional aims. Obviously, this shift in instructional emphasis calls for action on the part of the test experts in creating new types of items and tests . . . [1]

Course grades, assigned by the teacher, are commonly used as a measure of academic success in predictive studies at both the secondary and college level. Evidence of this practice will be pointed out in a later chapter. However, it was the desire of the author to allow the teachers a grading scale with more than the usual five categories of letter grades. Each teacher was requested to consider a numerical grade from zero through nine, with zero assigned to the lower end of the continuum and nine the higher.

Table IV illustrates the numerical grades with corresponding letter grades.

TABLE IV

NUMERICAL GRADE SCORES

F	D	C	B	A
0	1, 2	3, 4, 5	6, 7	8, 9

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[1] Herbert Glenn Ludlow, "Trends and Issues in Standardized Testing," Journal of Educational Research, Vol. 47, (December, 1953), p. 279.

These numerical grades were given at the end of the fall semester, representing each individual's measure of success in one semester's participation in seventh grade mathematics.

Table V furnishes distributions of the numerical grade scores earned by each group of students studying common text materials and the distribution of the combined group.

TABLE V

NUMERICAL GRADES EARNED BY THE STUDY GROUP

Textbook Used	Criterion Scores 0	1	2	3	4	5	6	7	8	9
SB	14	13	23	8	21	11	5	8	4	8
LL	5	8	11	8	6	5	11	10	5	2
PH	15	12	30	15	17	13	16	17	8	6
HB	5	8	13	12	14	15	13	8	12	1
HRW	1	3	4	6	13	3	5	11	5	0
SMSG	2	0	3	0	1	0	8	4	2	1
Combined	42	44	84	49	72	47	58	58	36	18

Procedure

The purpose of this section is to acquaint the reader with the steps which are taken in obtaining the data for this study and the methods used in processing it.

Arrangements were made with the local administrators for the administration of the tests between September eighth and October fifteenth.

Tests were administered in two schools during the first week in November since they had been dismissed for fall vacation. The same pattern was followed the next year in administering the tests to the validation group.

Each year grade sheets were sent to the teachers of the participants at the end of the first semester so that they could assign numerical grades. To prevent criterion contamination, no teacher was given access to the results of the tests until after they had given the students their semester grades, thus the grades were not influenced by the teacher's knowledge of test scores. When the grades were received, students for whom complete test data and numerical grades were not available were dropped from the list of subjects.

After the data were collected, the next step was processing. A major portion of the analysis was a stepwise procedure for multiple regression analysis which was done by IBM 1410 computer.[2] In the stepwise procedure one variable was entered at a time into the regression equation. The potential variance reduction of all remaining variables was considered and the variable selected which reduced the variance the most in a single iteration.

The analysis was written in two parts by the computer. The first step gave the raw sums, means, sums of squares and cross-products, and simple correlation coefficients for each pair of variables. The second phase was the stepwise procedure of writing the regression equations; selecting for each equation the independent variable which reduced the

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[2]This 1410 program was adapted from the 7070 program entitled "Stepwise Multiple Regression Analysis for the IBM 7070" by Donald G. Wyman. On file at the Oklahoma State University Computing Center.

variance the most by including that particular one into the equation with the variable or variables used in the previous step. Each variable was forced in until the final equation containing all predictor variables was written. For each step the regression equation was given with standard error of the predicted variable, standard error of the regression coefficients, and the F level of the reduction of variance for the predictor variable entered.

The beta coefficients were calculated for the steps which were not printed by the computer so that the contribution to the explained variance of each significant variable could be shown in terms of the beta coefficients and simple correlation coefficients. The equations containing the optimum combination of predictor variables were then determined for each school, each group using the same text materials, and for the combined study group.

From the criterion scores of the study group and their test scores, using the numerical grade of 3 as the minimal successful grade, graphic cutting scores were devised to assist in detecting potential failures (or low grades). Multiple cut-off scores were first established by the first method which Anastasi describes as the multiple-screen method.[3] This involved the establishment of a minimum critical score on each of the significant predictor tests. A student whose score on any one of the tests is exceeded by the cut-off score for that particular test is considered unsuccessful.

The second method was the establishment of a single cut-off score utilizing the sums of each student's scores from the significant

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[3]Anne Anastasi, Principles of Psychological Testing, (New York, 1954), p. 146.

predictor tests. A comparison of the two methods found the second method more efficient in assigning students to their appropriate categories. The tables from which these cutting scores were derived are given in Appendix D.

The regression equations and cutting scores were then used with test scores of the validation group, and the correlation coefficient between the predicted and actual grades was calculated to test the results obtained from the study group.

CHAPTER IV

THE TEST BATTERY

This chapter will be devoted to the presentation of information about the battery of tests used in this research study. An attempt will be made to determine the feasibility of the use of the APT tests by educators in the sectioning and counseling of junior high school students, to present opinions of prominent test experts on the battery, to present data on the reliability of the tests, to give evidence concerning the validity of the tests from research, and to present evidence concerning the diagnostic value of the battery. These viewpoints, however, will be limited in application to the mathematics curriculum.

Although the SMSG and other writing teams had group members who were considered capable of judging the vocabulary level and readability of the concepts and language of the new junior high school texts, there were individuals whose opinions were not in agreement with these writers. Margaret F. Willerding praised the Maryland and SMSG programs for their content and organization but expressed her concern in the area of reading:

> In its present form the material is not easily readable for the average, or the above average seventh-grade student. The use of color, bold type, spacing and other printing techniques would greatly overcome this limitation . . .
>
> The reading of mathematical prose is extremely difficult for students at this level, and verbal problems present a mental block in many instances. Students at the junior high level need a great deal of help and guidance when working word

problems, and a separate section devoted to this topic would greatly strengthen the text.[1]

The change to a more conceptual type of text would be evidence of reason to attempt to determine the relative importance of reading ability in predicting success in this type of mathematics. Neither the reading nor the arithmetic test are recommended by the authors as designed for a contemporary mathematics program, but it is the opinion of this author that they would serve as well as any arithmetic test or reading test available at the time the data were collected. Johnson describes the inadequacy of most arithmetic tests and expresses the feeling that a different type is needed:

> . . . New tests must be devised not only on common topics, but on broad goals such as problem solving; communication skill in reading, writing, and speaking about mathematical ideas; mathematical generalizations; attitudes toward mathematics; applications of mathematics in science, industry, government, and the community; discovery of new mathematical concepts; and creativeness in expression, application, and invention of mathematical ideas.[2]

The fact that the battery contains aptitude tests given concurrently with achievement tests might be justified by a statement made by John E. Milholland and Benno C. Fricke:

> The distinction between aptitude and achievement tests probably has broken down because achievement tests have been found to provide generally better predictions of future achievement than have aptitude tests.[3]

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[1] Margaret F. Willerding, "A Critical Look at the New Mathematics for Seventh Grade," School Science and Mathematics, Vol. 62, (February, 1962), p. 219.

[2] Donovan A. Johnson, "Evaluating a School Mathematics Curriculum," School and Society, Vol. 90, (December, 1962), p. 425.

[3] John E. Milholland and Benno C. Fricke, "Development and Application of Tests of Special Aptitude," Review of Educational Research, Vol. XXXII, No. 1, (February, 1962), p. 25.

The Academic Promise Tests were published in 1961 by The Psychological Corporation and prepared by George K. Bennett and a group of his associates. Bennett was a principal author of the Differential Aptitudes Tests battery which had been favorably received and widely used in high school counseling and guidance. Cronbach describes the DAT as follows:

> The DAT battery was published in 1947, primarily for high school counseling. The eight tests measure aptitudes which previous research had suggested as important in guidance. . . . No attempt is made to isolate simple pure abilities. Instead, the tests aim to measure complex abilities which have a fairly direct relation to job families and curricula. Measures of proficiency are included because of their predictive value . . .
>
> The publication of this integrated collection marked an important forward step in aptitude testing.[4]

The DAT has been widely used in research in predicting success in engineering, high school course grades, and in college success. Vineyard, after searching the literature for facts pertinent to the DAT, states in summary:

> The DAT appeared on the guidance scene in response to a felt need by guidance workers for a series of measures of different abilities based upon a common normative population. In the short time in which the battery has been available, it has attained a high level of popularity among test users. Test experts, in general, feel that the tests have good possibilities. These experts feel that much research needs to be done with the battery, and commend the authors for their encouragement and reporting of this research.
>
> The tests appear to be reliable with the exception of the Mechanical Reasoning test with girls. Considerable long range stability of scores also appears evident. A great number of validity coefficients between test scores and high school grades have been obtained. While some of these are high and others are low, average coefficients while high

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[4] Lee J. Cronbach, Essentials of Psychological Testing, (New York, 1960), p. 269.

> enough to be of predictive value have not been as high as might be desired for accurate individual prediction. The tests have been shown to have definite diagnostic value, in that differences in scores between tests appear to be fairly stable. While correlated with one another, tests do not overlap sufficiently to warrant the exclusion of any from the battery.[5]

The foregoing discussion has been given because of the similarity of the tests in the APT battery to the DAT. The authors of the APT expressed their motives for designing the tests:

> In part, the Academic Promise Tests are an outgrowth of the Differential Aptitude Tests. Almost since the inception of the DAT, the authors and publisher have been urged to make available an earlier-level form of the widely accepted series of tests. However, the attempt of the development of earlier-level forms in every area measured by the DAT appeared unwarranted. Few educational decisions made by or for the sixth or seventh grade students are likely to depend on the appraisals of the students' perception of space relations or their mechanical reasoning ability. This kind of information is needed when educational or vocational planning calls for a forecast of success, in the near future, in technical courses or in the world of work. Since few students are likely to encounter such technical courses, or enter an occupation, below grade eight, the breadth encompassed by the DAT would probably be superfluous. On the other hand, more information than is typically available from scholastic aptitude or mental maturity tests is often useful.[6]

Siegel, in a preliminary review of the APT, stated that he was in agreement with the authors of the tests. His summary statement in the review was:

> APT is designed to assess intellectual talent in grades six through nine. The test authors maintain that under ordinary circumstances it will be unnecessary to supplement APT, by administering other mental ability or

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[5]Edwin E. Vineyard, "A Longitudinal Study of the Relationship of Differential Aptitude Test Scores with College Success," (unpublished Doctoral dissertation, Oklahoma A and M College, 1955), pp. 49-50.

[6]G. K. Bennett, et al., Academic Promise Tests, Manual (New York, 1965), p. 5.

> intelligence tests. In essence, APT was developed in the spirit of the Differential Aptitude Tests but without its breadth. Restricted coverage seemed desirable in the case of younger students.
>
> Judgments about the validity of the battery await publication of the complete manual. However, at this point, there appears to be little doubt that APT will prove to be a very useful battery for counseling junior high students.[7]

A recognized source of expert opinion on published tests is the Sixth Mental Measurements Yearbook,[8] which contains independent reviews of all published tests currently produced and used in this country. Two such reviews are presented in the publication. Portions of these expert evaluations of the APT follow:

> Three subtests, Abstract Reasoning (AR), Numerical (N), and Verbal (V), of the Academic Promise Tests (APT) represent a welcome downward extension of the Differential Aptitude Tests. This reviewer wonders whether the 60-item fourth subtest, Language Usage (LU), containing 24 grammar items, 23 spelling items, 8 capitalization and punctuation items, and 5 correct sentence items in Form A, is as good from the standpoint of content, even though its correlation with school marks is relatively high.
>
> One also would like to know the basis for including at least 15 verb items among the 24 grammatically faulty sentences. Were content specifications drawn up initially and adhered to throughout the tryout phase? Without such information, and on the basis of my content analysis of the Form A language usage items, I would prefer to substitute a reading comprehension test for LU.
>
> The content of the other three subtests (AR, N, and V) seems considerably better. Abstract Reasoning consists of 60 ingenious plane geometry items, for each of which the examinee must decide which one of four "answer figures" goes with the three "problem figures." Inductive reasoning

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[7] Laurence Siegel, "Test Reviews," Journal of Counseling Psychology, Vol. 9, No. 3, 1962, p. 283.

[8] Oscar K. Buros, Sixth Mental Measurements Yearbook (Highland Park, New Jersey, 1965).

and spatial relations ability both seem to play a considerable part in these.

Everything considered, this excellent new battery offers schools convenient, attractive, predictively valid, reliable measurement in four areas.[9]

The new Academic Promise Tests should prove to be a quick and economical way to identify talented students and those who need remedial help. They are well designed and produced. Instructions are clear, the format is attractive, and several features have been introduced to simplify giving, scoring, and interpreting the tests.

* * *

. . . To begin with, the purposes for which the tests are recommended include sectioning and grouping for instructional purposes. For this use, it would seem important to tap at least the student's mathematical achievement (whether "new" or "traditional") and his attainments in science and social studies. These are not separately represented in the battery. . . .

In summary, the Academic Promise Tests are well prepared and produced with a professional touch. Validity data involving predictions over three to four months are encouraging. Generally, the individual scores may be found more revealing than their sums. The usefulness of the Abstract Reasoning is questioned and the view is presented that the APT would be improved by its omission. Overall, however, the tests should have real utility as relatively brief measures of general academic development and promise and should be of supplementary help in sectioning and placement.[10]

The foregoing remarks have presented evidence of the feasibility of their use in predicting the progress of pupils in this new mathematics program. The reviewers approved of their validity and reliability coefficients if subtest scores were used separately.

They also stated that the standardization data, the norms, the manual, and the report of research used by the test authors seemed quite

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[9]Julian C. Stanley, in Buros, pp. 998-999.

[10]William W. Turnbull, in Buros, pp. 999-1001.

satisfactory. However, remarks implied that it might be a wise move to include in the battery a reading and an arithmetic test in the research. The tests chosen for this purpose will be discussed in the following paragraphs.

The Metropolitan Arithmetic Test and Reading Test are subtests of a battery of achievement tests. The publisher[11] also prints these tests in separate booklets which may be obtained and used independently. Excerpts from expert reviews of the arithmetic test are:

> The tests provide two scores: computation and problem solving concepts. The format follows traditional techniques used to measure such skills. Computational problems stay well within the scope of the grade for which each level is intended . . . . About a third of the items in the problems and concepts sections deal with concepts. These range from elementary number concepts to decimal-fraction-percentage relationships, with other terms and concepts appearing appropriately. Word problems are closely associated with computational skills at each level. In general, the tests adhere well to the content of the traditional arithmetic program in the elementary school.
>
> These tests represent a sound measure of traditional arithmetic skills. Content is well suited to the grade level, and the care taken in the development and norming program is evident. Supplementary materials follow good testing practices. The many strong points override the minor reservations expressed in this review.[12]
>
> Materials making up this edition of the Metropolitan Achievement Tests: Arithmetic were copyrighted in 1958-62. As in former editions, the format is attractive and the accompanying manual for interpreting the results is excellent and comprehensive. A person interested in tests, be he teacher, administrator, or college student, could hunt at length for a better summary of the intracacies of test making. . . .
>
> Reliabilities are high (approximately .90) and interesting evidence is presented to support the argument that students really do work honestly even though they use answer sheets and

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[11] Harcourt, Brace and World, Inc., New York, 1959.

[12] O. F. Anderhalter, in Buros, pp. 904-905.

don't have to show their work.

One might wish that the resources and obvious skills of the authors were directed more toward some of the mathematical topics and pedagogical niceties of the last 20 years. It is easy to see why very recent material may be ignored. Much of it hasn't gained wide acceptance or it is so new as to be newer than the tests.[13]

Reviews of the reading test will now be presented:

This test, part of a larger battery is a good survey instrument yielding three scores (Word Knowledge, Word Discrimination, Reading) at the primary level and two scores (Word Knowledge and Reading) at the upper levels. Each score is treated separately although this group of subtests is printed in one booklet. Work Knowledge measures vocabulary and word recognition. . . .

At the upper levels the subtest Reading contains questions aimed at the measurement of just four comprehension skills: main thought, details, inferences, and meaning of words from context. Even though the authors of the test do not provide methods of analyzing strengths and weaknesses in the four skills, the teacher can work out a method for doing this on his own.

Although the advanced forms of the test do not appear to discriminate well among those students reading at ninth grade level or above, the Metropolitan Reading Test is one of the best survey tests of reading achievement on the market today for the elementary grades. It has been carefully tested and well produced. It serves its purpose as a rough measure of reading achievement for comparative purposes and as a tool of identification upon which further evaluation may be based.[14]

In the reading comprehension questions for the later grades, and to some extent for the earlier grades as well, the authors make a deliberate attempt to get at a number of specific elements in the reading process which have been identified in factor studies: ability to recognize the main idea or purpose of a reading passage, ability to draw correct inferences from the material presented, ability to perceive and understand details, ability to recognize the correct meaning of words in the context of the passage. This attempt is laudable. Its execution, however, strikes this reviewer as more than necessarily wooden. There tends to be a sameness in

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[13] I. W. Hamilton, in Buros, p. 905.

[14] H. Alan Robinson, in Buros, pp. 1073-1074.

> the phrasing of the item stems, as one proceeds from one set of questions to the next . . .
>
> The data on the reliability of the tests appear adequate, though the form in which they are reported for the five pre-high school batteries leaves something to be desired. The Manual for Interpreting . . . omits three kinds of information required for interpretation of the reliability coefficients, namely, the raw score range, the mean, and the standard deviation for each of the samples used in estimating the reliabilities. If the publisher was aware of the need for this kind of information in the high school manual, how did he come to overlook it in the pre-high school manual?[15]

Although the reviewers had various criticisms of minor nature directed toward the construction of these tests, they were in agreement that the reliability and validity coefficients were adequate, and that these tests could be appropriately used to check arithmetic and reading ability in a research study such as this one.

The Description of the Tests

The battery consists of eight different tests. Four of these are the subtests of the APT battery, namely, Verbal, Language Usage, Abstract Reasoning, and Numerical. The Metropolitan Arithmetic Test has two subtests, Arithmetic Computation and Arithmetic Problem Solving and Concepts; the Metropolitan Reading Test contains two subtests, Word Knowledge and Reading. A brief description of each of these tests including some of the expectations of the test authors concerning them will be given. A more complete description is found in the APT Manual[16] and the Manual for Interpreting,[17] respectively.

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[15] Henry S. Dyer, in Buros, pp. 60-61.

[16] G. K. Bennett et al., pp. 5-6.

[17] Walter N. Durost, Manual for Interpreting Metropolitan Achievement Tests (New York, 1965), pp. 3-4.

The Verbal test is designed to measure the student's ability to abstract and generalize in a verbal context. It consists of 60 items which are of the analogies type. Not only knowledge of vocabulary, but a kind of reasoning is required in order to make the proper choice for the required response. The authors state that the probability of guessing is reduced to such extent that it is not necessary to use a scoring formula which corrects for guessing.

The Language Usage contains a combination of grammar, spelling, and punctuation items in sentences. The examinee is to detect errors and note the portion of the sentence in which the error occurs. Sentences with no needed corrections are also included thus the student cannot assume that there is a correction needed, and guess accordingly. The authors avoid usages which would not be considered incorrect by both traditional and modern authorities in English.

The Abstract Reasoning items may be described as two dimensional figure classification problems. The examinee is expected to seek out the principle which provides a common characteristic for a set of three figures, and to recognize the one from four other figures which shares that characteristic. The process is similar to that which is used in some measures of concept formation.

The Numerical test consists of items intended to measure quantitative abilities. The authors' motive is to emphasize understanding of concepts and reasoning rather than computation, although much computation is necessary in order to be able to choose the correct answer. One of the aims of the authors is to present quantitative items with few words used; thus keeping reading at a minimum.

The Arithmetic Problem Solving and Concepts test is a measure of understanding of concepts of the number system, arithmetic processes, vocabulary, mathematical generalizations, and arithmetic relationships. The first part of the test is devoted to concepts and the remainder to the ability of the student to apply numbers in social situations and to quantitative problems.

The Arithmetic Computation test consists of items requiring computation with whole numbers, decimals, reading of graphs, and addition and subtraction of denominate numbers.

The Word Knowledge test is a vocabulary test in which the word to be defined is presented in a very brief sentence. The examinee selects from five choices the word which best completes the sentence, the correct choice most often being a synonym of the stimulus word.

The Reading test consists of a series of reading selections, each followed by several questions designed to measure the various aspects of reading comprehension, inferences, and meaning of words from context.

The Reliability of the Battery

The authors of the APT tests used the method known as the alternate form method to check the consistency or reliability of these tests. They used Forms A and B and administered the tests at one sitting; then from seven to fourteen days later gave the same students the alternate form. Some schools gave Form A first and others administered Form B first. There were 590 seventh grade students who participated. These seventh grade reliability coefficients are given in Table VI.

TABLE VI

RELIABILITY COEFFICIENTS FOR THE APT FOR GRADE SEVEN[18]

Test	Coefficient
Verbal	.82
Language Usage	.88
Abstract Reasoning	.82
Numerical	.87

The authors of the Metropolitan Achievement Tests used the split-half method with four groups of 100 eighth grade students, each group being a random sample from that particular school. The school systems were chosen to typify high, low, and average performance. The median of the reliability coefficients for each of the subtests are given in Table VII.

TABLE VII

RELIABILITY COEFFICIENTS FOR CERTAIN SUBTESTS OF THE METROPOLITAN ACHIEVEMENT TESTS[19]

Test	Coefficient
Arithmetic Problem Solving and Concepts	.91
Arithmetic Computation	.92
Word Knowledge	.92
Reading	.90

[18] G. K. Bennett et al., p. 60.

[19] Walter N. Durost, p. 46.

Consideration must also be given to the reliability to be expected of an individual score. This statistic is the standard error of measurement. The chances are approximately two out of three that an individual's test score does not vary from his true score more than the amount indicated by the standard error of measurement. The standard errors of measurement for the APT for seventh grade are given in Table VIII in points of raw score. These figures are based on the scores of the same subjects as the reliability coefficients reported in Table VI.

TABLE VIII

STANDARD ERRORS OF MEASUREMENT
FOR THE APT FOR GRADE SEVEN[20]

Test	S.E.M.
Verbal	3.6
Language Usage	3.7
Abstract Reasoning	5.1
Numerical	3.4

The median of the standard errors of measurement for the arithmetic tests and subtests of the reading test are given in Table IX in raw score form.

[20] G. K. Bennett et al., p. 61

TABLE IX

STANDARD ERROR OF MEASUREMENT FOR ARITHMETIC AND READING TESTS[21]

Test	S.E.M.
Arithmetic Problem Solving and Concepts	2.4
Arithmetic Computation	2.3
Word Knowledge	3.1
Reading	2.6

The Validity of the Battery

The usefulness of the tests in this study will, of course, depend upon how well they will predict the performance of the persons tested. This means that the test scores must be found to have a high relationship with the performance to be predicted, in this case, success in mathematics grade. Bennett has this to say about the prediction of grades:

> Anyone familiar with the way in which grades are awarded immediately recognizes the difficulties in using this sort of criterion. The predictor tests are designed solely to appraise intellectual abilities; grades often are assigned not only for what the student has learned, but also for effort, diligence, active participation in discussion and less relevant (to actual achievement) personal characteristics. Grades are sometimes unreliable; it is not reasonable to expect any test to predict beyond the reliability of the criterion. Despite these deficiencies, however, grades are the basic currency in which school success is evaluated, and tests should, therefore, be appraised in terms of their effectiveness in forecasting grades.[22]

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[21]Walter N. Durost, p. 46.

[22]G. K. Bennett et al., p. 33.

Validity coefficients for prediction of course grades in seventh grade mathematics are given in Table X. These statistics involved over two thousand students in seventeen schools.

TABLE X

SUMMARY OF VALIDITY COEFFICIENTS BETWEEN APT SCORES AND COURSE GRADES IN SEVENTH GRADE MATHEMATICS[23]

Test	Validity Coefficients		
	Minimum	Maximum	Median
Verbal	-.11	.71	.41
Language Usage	.21	.64	.46
Abstract Reasoning	.23	.62	.38
Numerical	.40	.77	.55

Summary

The APT was designed by its authors to assist counselors in sectioning and placement of students at the junior high level. Test experts, in general, seemed to be satisfied with the design of the tests and express satisfaction in the reliability coefficients stated by the authors of the tests. The predictive validity of the tests of the battery range from .38 to .55 for median coefficients. Although this does not seem too high, certainly these new tests need to be used in research.

The Metropolitan Arithmetic and Reading tests are reported by their authors to have reliability coefficients slightly higher than the APT; but usually coefficients obtained by the split-half method

[23]Ibid., pp. 38-39.

are higher than those obtained by different administrations of the tests.

Although there were no validity coefficients given for predictive value of the Metropolitan tests in predicting grades in mathematics, it would be reasonable to conclude that these tests should test for some of the abilities necessary to read mathematics with understanding, to solve problems, and to do computation.

CHAPTER V

TREATMENT OF THE DATA AND ANALYSIS OF THE RESULTS

This section is devoted to a detailed account of the procedure which was used in the analysis of the data and statements of the results of the research. The basic problem of this study was to determine the relative importance of certain aptitude tests and achievement tests in the areas of arithmetic and reading in the prediction of successful performance in seventh grade mathematics. In addition to the use of regression techniques, cutting scores were devised to assist in producing a scheme to aid in the counseling of students.

The treatment of the data obtained from each combined group of subjects who used the same textbook will be given. Next, the data from each school within each text-group will be examined. Then, the data for all subjects of the study group is combined and the possibility of a scheme for the entire study group is considered.

Tables giving the means and standard deviations of test scores and numerical grades, simple correlations among all variables, regression equations, multiple correlation coefficients, standard error of the predicted grades, and graphic cutting scores are furnished in the Appendix. The simple correlation coefficients were tested for significant difference from zero by the formula[1]

[1]George W. Snedecor, Statistical Methods (Ames, Iowa, 1956), p. 173.

$$t = r\sqrt{\frac{N-2}{1-r^2}} \qquad \text{(N-2 degrees of freedom)} \qquad (1)$$

Multiple correlation coefficients were not given by the computer. These were calculated by first computing the sum of squares for regression using the formula[2]

$$\text{Regression Sum of Squares} = b_1 \Sigma X_1Y_c + b_2 \Sigma X_2Y_c + \ldots + C \ \Sigma Y_c - \frac{(\Sigma Y_c)^2}{N} \qquad (2)$$

The raw sums of squares and cross products were written by the computer. The computation was completed by the formula[3]

$$R = \sqrt{\frac{\text{Regression sum of squares}}{\text{Corrected total sum of squares}}} \qquad (3)$$

The computer program was not designed to write the best combination of variables for any particular number of independent variables. It introduced at each step the variable which contributed the greatest amount to the explained variance of the dependent variable taking into consideration the variables already introduced and their intercorrelations with the variables which had not been introduced. When the stepwise regression equations were examined and found that introducing additional variables did not yield an appreciable increase in multiple R nor decrease in standard error, the equation in the preceding step was considered to contain the optimum combination of variables.

When all predictor variables were not present in the desired equation, a test was made to determine the significance of the loss of regression due to the deletion of the variables not introduced into the

[2]James E. Wert, Charles O. Neidt, and J. Stanley Ahmann, Statistical Methods in Education and Psychological Research, (New York, 1954), p. 240.

[3]Ibid.

equation. This test was made using the formula[4]

$$F_{n,N-m-1} = \frac{\left[R^2_{y(123\ldots m)} - R^2_{y(123\ldots m-n)}\right]}{\left[1 - R^2_{y(123\ldots m)}\right]} \cdot \frac{N-m-1}{n} \qquad (4)$$

where

n = the number of variables deleted

m = the total number of predictor variables

N = the number of subjects in the group

$R_{y(123\ldots m)}$ = the multiple correlation coefficient of the regression equation written for m predictor variables.

The beta weights were only given for the final equation in the stepwise procedure. When a regression equation was chosen which did not use all predictor variables, they were computed by the use of formula[5]

$$\beta_i = b_i \frac{S_i}{S_{y_c}} \qquad (5)$$

where

β_i = the beta weight for the i th predictor variable

b_i = the partial regression coefficient of that variable

S_i = the standard deviation of the i th variable

S_{y_c} = the standard deviation of criterion scores of the subjects for which the equation was written.

The beta weights from formula (5) with the simple correlation coefficients from Appendix A, were used to calculate the multiple R from the formula[6]

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[4] Ibid., p. 247.

[5] Henry E. Garrett, Statistics in Psychology and Education (New York, 1958), p. 418.

[6] Ibid., p. 418.

$$R^2 = \Sigma \beta_i \, r_{yi} \tag{6}$$

giving

$$R = \sqrt{\Sigma \beta_i \, r_{yi}} \tag{7}$$

It should be recognized that it is not actually necessary for the school counselor to predict exact criterion scores for each individual, but only to assign them to two broad categories denoted successful and unsuccessful. A predicted numerical grade of three or more was considered a prediction of successful performance, and a predicted numerical grade of two or less was considered unsuccessful. Since the standard error of predicted scores furnishes an interval, $Y \pm$ (standard error of Y), an individual whose predicted grade was less than 3 + (standard error of Y) would be considered a probable unsuccessful student.

Wesman and Bennett found that the sum of test scores on all tests given were helpful in making predictions.[7] This author found that graphic cutting scores using the sum of each student's scores on the tests which contributed significantly to the regression in the multiple regression equation was more efficient than multiple cut-off scores from each of the tests. The distribution of sums of scores with cut-off scores indicated are found in Appendix D.

Results of the Analysis of the Silver Burdett Data

Using the symbols defined on page 9, the multiple regression equation, selected from Table LVII, Appendix C, for the combined

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[7] Alexander G. Wesman and George K. Bennett, "Multiple Regression vs. Simple Addition of Scores in Prediction of College Grades," Educational and Psychological Measurement, Vol. XIX (1959), pp. 243-246.

Silver Burdett study group was:

$$Y = .07724\,X_1 + .083024\,X_4 + .13246\,X_5 + .05818\,X_7 - 3.48942 \qquad (8)$$

The standard error of y was $\pm$ .51. Multiple R was .824, given by formula (7), utilizing simple correlation coefficients (r_{yi}) from Table XXX, Appendix A, and beta weights from Table XI.

TABLE XI

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(SILVER BURDETT: ALL SCHOOLS)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Computation	β_5	.348
Word Knowledge	β_7	.221
Numerical	β_4	.185
Verbal	β_1	.231

For individual predictions, each student's sum of raw scores on the selected predictor tests were checked against the cutting score from Table LXXVII of Appendix D. If this sum was greater than or equal to 86, he was assigned to category denoted successful. If the sum of the test scores were exceeded by 86, his predicted numerical grade was calculated from the regression equation (8). Since the standard error of y was $\pm$ .51, he was assigned to the successful group if his predicted numerical grade was at least 4.51. Utilizing this procedure, 96 of the 115 subjects of this text-group were correctly assigned to their appropriate categories, thus yielding a predictive efficiency of 83%.

Assignment by the cutting score alone was correct for 78% of these students. If predictions were made by the numerical grades from the regression equation, there would have been 76% correctly assigned.

The procedure described in the preceding paragraph was used in each of the following data groups. The result in each data group is stated as the percentage of prediction, or efficiency.

Silver Burdett: School No. 1

The regression equation for the subjects of School No. 1 was

$$Y = .0561\,X_3 + .10263\,X_5 + .13565\,X_7 - 3.21389 \quad (9)$$

Standard error of y for equation (9) was $\pm$ .91 and multiple R was .940. Since $R^2 = .883$, the predictor tests given in Table XII accounted for approximately 88% of the explained variance of Y.

TABLE XII

PREDICTOR TESTS IN ORDER OF SELECTION WITH BETA NUMBERS AND BETA WEIGHTS (SILVER BURDETT: SCHOOL NO. 1)

Predictor Test Selected	Beta Number	Beta Weight
Word Knowledge	β_7	.560
Arithmetic Computation	β_5	.298
Abstract Reasoning	β_3	.242

A minimum of 70 for the sum of raw scores on the above tests or a numerical grade score of 3.91 predicted successful or unsuccessful performance for 94% of this group.

Silver Burdett: School No. 2

Significant variables for School No. 2 and beta weights are shown in Table XIII.

TABLE XIII

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(SILVER BURDETT: SCHOOL NO. 2)

Predictor Test	Beta Number	Beta Weight
Word Knowledge	β_7	.601
Numerical	β_4	.362

The prediction equation written by the computer was

$$Y = .17217\,X_4 + .20768\,X_7 - 3.98904 \qquad (10)$$

with multiple R of .752 and ± 1.78 for standard error of Y. Since the number of subjects in School No. 2 was less than thirty, $\bar{R} = .737$ was calculated by the formula[8]

$$(\bar{R})^2 = \frac{(N-1)\,R^2 - (m-1)}{(N-m)} \qquad (11)$$

Thus $(\bar{R})^2 = .543$ indicates that approximately 54% of the explained variance in predicted scores are accounted for by the variables above.

A minimum sum of raw scores on the Numerical and Word Knowledge tests greater than 34 predicts <u>success</u> with an efficiency of 77%. The use of the multiple regression equation did not increase the efficiency

[8] Garrett, p. 440.

of prediction above that of the use of the cut-off score alone when tested against the scores of the subjects from which the scheme was devised.

Silver Burdett: School No. 3

Significant predictor variables for this group of 38 students are given in the following table.

TABLE XIV

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(SILVER BURDETT: SCHOOL NO. 3)

Predictor Test	Beta Number	Beta Weight
Arithmetic Computation	β_5	.633
Numerical	β_4	.370

The best prediction equation with $\pm$ 1.26 for standard error of Y and multiple R of .881 was

$$Y = .17902\,X_4 + .24429\,X_5 - 3.20341 \qquad (12)$$

A minimum of 31 for the sum of raw scores or a numerical grade score of 4.26 from equation (12) gave an efficiency of 86% in the prediction of <u>successful</u> performance.

Silver Burdett: School No. 4

The stepwise regression equations for this group of 19 subjects are given in Table LXI, Appendix C. If formula (4) is applied, with $R_{y(12345678)} = .862$, $r_{y6} = .796$, $m = 8$, $n = 7$, and $N = 19$, we have

$$F_{7,10} = \frac{[(.862)^2 - (.796)^2]}{[1 - (.862)^2]} \cdot \frac{10}{7}$$

which yields an F value less than one. This indicates that there is no significant loss of regression when the seven variables are eliminated and we can make the following conclusions:

A. The Arithmetic Problem Solving and Concepts test is the only significant predictor in the scheme.

B. The best equation was

$$Y = .35219 X_6 - 4.34301. \tag{13}$$

C. The correlation coefficient was .796.

D. Standard error of estimate was $\pm$ 1.63.

E. A minimum score of 25 on the test above or a numerical grade score of 4.63 from the regression equation gave a 79% prediction of success.

Results of the Analysis of the Laidlaw Data

The multiple regression equation which gave the best prediction, with $\pm$ 1.47 as standard error of Y, for the combined Laidlaw group of 71 subjects was

$$Y = .09077 X_4 + .13393 X_6 + .8724 X_7 - 2.51414 \tag{14}$$

The beta weights from Table XV and correlation coefficients between each of the variables in the above equation and the criterion scores found in Table XXXV, Appendix A, were used in Formula (7) to give a multiple R of .832.

TABLE XV

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(LAIDLAW: ALL SCHOOLS)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Problem Solving	β_6	.414
Word Knowledge	β_7	.320
Numerical	β_4	.248

A minimum of 56 for the sum of raw scores on the above tests or a numerical grade score of at least 4.47, calculated from the equation, predicts success with an efficiency of approximately 89%.

Laidlaw: School No. 1

The predictor tests selected as the significant variables in the regression equation below are given in Table XVI.

TABLE XVI

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(LAIDLAW: SCHOOL NO. 1)

Predictor Test Selected	Beta Number	Beta Weight
Word Knowledge	β_7	.493
Arithmetic Problem Solving	β_6	.365
Abstract Reasoning	β_3	.195

This combination of variables is contained in the equation

$$Y = .03931\ X_3 + .08714\ X_6 + .10794\ X_7 - .99279 \qquad (15)$$

with a standard error of $Y = \pm .74$ and multiple R of .947. There were only 23 students in this study group, so $(\bar{R})^2 = .887$ was computed from formula (11), indicating that 89% of the variance in predicted Y was accounted for by these variables.

A minimum score of 57 for sum of scores on these tests or 3.74 from the regression equation predicts successful or unsuccessful performance in 87% of the cases for this study group.

Laidlaw: School No. 2

Predictor tests in order of selection and their corresponding beta weights are given in Table XVII.

TABLE XVII

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(LAIDLAW: SCHOOL NO. 2)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Problem Solving	β_6	.463
Arithmetic Computation	β_5	.463

These variables yield the equation

$$Y = .1656\ X_5 + .15875\ X_6 - 2.92508 \qquad (16)$$

with a standard error of ± 1.36 and a multiple R of .87. Since N = 21 for this group, $\bar{R}$ was calculated and found to be .863.

A minimum score of 34 on the sum of these test scores or a grade score of 4.36 from the regression equation predicts successful or unsuccessful performance for 95% of the group.

Laidlaw: School No. 3

The optimum combination of variables chosen in the step-wise regression procedure for this group of 15 subjects are given in Table XVIII.

TABLE XVIII

PREDICTOR TESTS IN ORDER OF SELECTION WITH BETA NUMBERS AND BETA WEIGHTS (LAIDLAW: SCHOOL NO. 3)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Computation	β_5	.470
Arithmetic Problem-Solving	β_6	.433

The regression equation with multiple R of .850 and standard error of Y = $\pm$ 1.84 was

$$Y = .31856\ X_5 + .27282\ X_6 - 7.32996 \qquad (17)$$

Formula (7) yields $\bar{R}$ = .837 indicating that 70% of the explained variance of predicted performance in mathematics can be accounted for by these two tests, since $(\bar{R})^2 = .701$.

For counseling, a minimum score of 37 as the sum of raw scores for the selected tests or a predicted Y of at least 4.84 can be used as an indication of successful performance with an efficiency of 93%.

Laidlaw: School No. 4

Tests whose scores were significant in the prediction scheme for these 12 students, with their corresponding beta weights, are shown in Table XIX.

TABLE XIX

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(LAIDLAW: SCHOOL NO. 4)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Computation	β_5	.826
Abstract Reasoning	β_3	-.246
Reading	β_8	.293

This combination of variables gave the equation

$$Y = -.13233\ X_3 + .31875\ X_5 + .08631\ X_8 - 2.82757 \qquad (18)$$

with $\pm$ .72 as standard error of prediction and R = .976, which converts to $(\bar{R})^2 = .943$ for N = 12, when formula (11) is applied.

Individual predictions, with 91% efficiency, were given by a raw score sum of at least 61 for the significant tests or a predicted numerical grade of 3.72 from the regression equation.

Results of the Analysis of the Prentice-Hall Data

The combined study group using Prentice-Hall texts were 149 subjects. The significant predictor tests and beta weights are given in Table XX.

TABLE XX

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(PRENTICE-HALL: ALL SCHOOLS)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Problem Solving	β_6	.383
Numerical	β_4	.257
Language Usage	β_2	.219

The regression equation with this combination was

$$Y = .06002\, X_2 + .07915\, X_4 + .1149\, X_6 - 1.70051 \qquad (19)$$

with multiple R = .764 and standard error of Y = $\pm$ 1.69, accounting for 58% of the explained variance of Y.

A minimum raw score sum of these tests of 61 or Y = 4.69 calculated from equation (19) indicates successful or unsuccessful performance with approximately 77% efficiency.

Prentice-Hall: School No. 1

The predictor tests which constituted the optimum combination for this group of 76 subjects are given with their respective beta weights in the table below.

TABLE XXI

PREDICTOR TESTS IN ORDER OF SELECTION WITH BETA NUMBERS AND BETA WEIGHTS (PRENTICE-HALL: SCHOOL NO. 1)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Problem Solving	β_6	.456
Language Usage	β_2	.419

The best equation, with ± 1.51 for standard error of Y and multiple R of .759, was

$$Y = .09721\ X_2 + .1284\ X_6 - 1.35046 \qquad (20)$$

accounting for approximately 58% of the explained variance of Y.

A minimum sum of raw scores on the two tests amounting to 50 or a predicted score of 4.51 by the regression equation determines _successful_ or _unsuccessful_ performance for 78% of the group.

Prentice-Hall: School No. 2

Arithmetic Problem Solving and Numerical were the tests which accounted for 61% of the variance in predicted numerical grades for the 73 subjects in this group. Beta numbers and beta weights are given in Table XXII.

TABLE XXII

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(PRENTICE-HALL: SCHOOL NO. 2)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Problem Solving	β_6	.426
Numerical	β_4	.408

Standard error of Y was ± 1.79 and multiple R was .779 for the equation

$$Y = .14491\ X_4 + .14118\ X_6 - 2.0977 \qquad (21)$$

A sum of 38 on raw scores for the two tests as a minimum for the successful performance, or at least 4.79 calculated from the above equation, indicates successful or unsuccessful performance in 79% of the cases.

Results of the Analysis of the Harcourt Brace Data

The predictor tests and corresponding beta weights for the combined study group of 101 students who used this text are given in the following table in order of selection.

TABLE XXIII

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(HARCOURT BRACE: ALL SCHOOLS)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Problem Solving	β_6	.346
Verbal	β_1	.268
Arithmetic Computation	β_5	.246

The regression equation

$$Y = .07172\ X_1 + .07953\ X_5 + .108\ X_6 - 2.82442 \qquad (22)$$

accounts for approximately 56% of the variance in predicted grades since the multiple R was .747. The standard error of predicted scores was $\pm$ 1.59.

For counseling, a minimum raw score sum of 80 on the tests above, or a predicted grade of 4.59 from the equation, indicated <u>successful</u> or <u>unsuccessful</u> performance for 81% of the subjects of the Harcourt Brace study group.

Harcourt Brace: School No. 1

The predictor tests selected for this group of 22 subjects and their respective beta weights are given in Table XXIV.

TABLE XXIV

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(HARCOURT BRACE: SCHOOL NO. 1)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Computation	β_5	.563
Language Usage	β_2	.338

The regression equation written with these variables was

$$Y = .08597\ X_2 + .22519\ X_5 - 2.95337 \qquad (23)$$

with a multiple R of .824 and standard error of predicted Y of $\pm$ 1.62. Since N = 22 for this group, $(\bar{R})^2 = .663$, calculated from formula (11), assures 66% of the variance of predicted grades are furnished by these tests.

A sum of raw scores on these tests of at least 45 or a predicted numerical grade of 4.62, calculated from the regression equation, furnishes a prediction scheme with an efficiency of 86% for this group.

Harcourt Brace: School No. 2

Language Usage and Word Knowledge were the best predictor tests for this group of 16 subjects. Beta weights are given in Table XXV.

TABLE XXV

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(HARCOURT BRACE: SCHOOL NO. 2)

Predictor Test Selected	Beta Number	Beta Weight
Language Usage	β_2	.577
Word Knowledge	β_7	.377

The standard error of predicted Y was $\pm$ 1.24 and multiple R was .822 for the regression equation

$$Y = .13814\ X_2 + .07858\ X_7 + .10360 \qquad (24)$$

$(\bar{R})^2 = .653$ was calculated using formula (11) with N = 16, indicating that 65% of the variance in predicted scores were accounted for by these two predictor tests.

Prediction of <u>successful</u> and <u>unsuccessful</u> performance for 81% of this group was possible by using a sum of the predictor test scores of at least 38 or a predicted numerical grade of at least 4.24 as an indication of <u>success</u>.

Harcourt Brace: School No. 3

The best predictor tests for this group of 63 subjects and their corresponding beta weights are found in the following table.

TABLE XXVI

PREDICTOR TESTS IN ORDER OF SELECTION WITH BETA NUMBERS AND BETA WEIGHTS (HARCOURT BRACE: SCHOOL NO. 3)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Problem Solving	β_6	.478
Numerical	β_4	.234
Arithmetic Computation	β_5	.234

Multiple R was .907 and the standard error of predicted Y was ± .98 for the best equation

$$Y = .07278\ X_4 + .08721\ X_5 + .15594\ X_6 - 4.82576 \qquad (25)$$

A raw score sum of at least 73 on the above tests or at least 3.98 calculated from the regression equation predicts successful or unsuccessful performance for 89% of this group of subjects.

Results of the Analysis of the Holt Rinehart Winston Data

There were 51 subjects, representing one school, who used the Holt Rinehart Winston text materials. The predictor tests selected are shown in Table XXVII, with their corresponding beta weights.

TABLE XXVII

PREDICTOR TESTS IN ORDER OF SELECTION
WITH BETA NUMBERS AND BETA WEIGHTS
(HOLT RINEHART WINSTON GROUP)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Computation	β_5	.237
Arithmetic Problem Solving	β_6	.242
Numerical	β_4	.212
Reading	β_8	.203

The regression equation for these tests was

$$Y = .05647\ X_4 + .06256\ X_5 + .06972\ X_6 + .05146\ X_8 - .86203 \qquad (26)$$

with standard error of predicted Y equal to ± 1.38 and multiple R of .794. This combination of variables accounted for 63% of the variance in predicted grades.

If the sum of raw scores on these tests was at least 59 or a predicted numerical grade of at least 4.38 for an individual student, he could be considered a probable successful student in mathematics. A raw score sum of less than 59 and a predicted numerical grade less than 4.38 indicated unsuccessful performance. These criteria held for 87% of the cases in the group.

Results of the Analysis of the SMSG Data

The regression equations for this group of 21 subjects are given in Table LXXV, Appendix C. If formula (4) is applied, with $R_{y(12345678)} = .822$, $r_{y5} = .685$, $m = 8$, $n = 7$, and $N = 21$, we have

$$F_{7,12} = \frac{[(.822)^2 - (.685)^2]}{[1 - (.822)^2]} \cdot \frac{12}{7} = 1.09$$

Since tabular F for 7 and 12 degrees of freedom is 2.94 at the 5% level, there was no significant loss of regression when the other seven variables were eliminated. Hence, the following conclusions were made:

A. Arithmetic Computation was the only significant predictor test in the scheme.

B. The best equation was

$$Y = .25516\ X_5 - .07276. \qquad (27)$$

C. The correlation coefficient was .685.

D. A minimum score of 15 on the Arithmetic Computation test or 4.94 from equation (27) gave an 86% prediction of success.

Results of the Analysis of Data of the Combined Study Group

The predictor tests selected for the entire study group of 508 subjects are given in Table XXVIII below with their respective beta weights.

The regression equation for this combination of tests, with multiple R of .743 and standard error of predicted Y of ± 1.71 was

$$Y = .12582\ X_2 + .15536\ X_4 + .14938\ X_5 + 18206\ X_6 + .04424\ X_8 - 1.64466 \qquad (28)$$

with these tests accounting for 55% of the variance in predicted numerical grades.

TABLE XXVIII

PREDICTOR TESTS IN ORDER OF SELECTION WITH BETA NUMBERS AND BETA WEIGHTS FOR THE COMBINED STUDY GROUP (ALL TEXTS)

Predictor Test Selected	Beta Number	Beta Weight
Arithmetic Problem Solving	β_6	.268
Reading	β_8	.158
Numerical	β_4	.174
Arithmetic Computation	β_5	.157
Language Usage	β_2	.096

A minimum raw score sum of 95 on the selected tests or a numerical grade score of at least 4.71, calculated from the regression equation, predicted successful or unsuccessful performance for 82% of the combined study group.

Cross Validation

After the multiple regression equations and cutting scores for the sums of raw scores for the selected variables were developed, the test data for the members of the validation group were substituted into their respective "text group" equations and numerical grades were predicted. Coefficients of correlation between the predicted grades and the actual grades were computed by the Pearson product-moment method. Probable successful or unsuccessful performance was calculated using the cutting scores and the regression equations, then checked against their actual grades to discern the efficiency of the prediction scheme. Justification of this procedure is made by Vineyard:

> However, when a researcher finds that relationships found between variables within one group or sample tend to hold fairly constant in a subsequent sample from the same population, he feels much more confident about his findings. If it is found that the coefficient of correlation between actual and predicted grades for the validation group does not differ significantly from the coefficient of multiple correlation between the test variables of the criterion, then we feel that we are dealing with relationships which remain fairly stable from sample to sample within the population. If the two coefficients of correlation differ significantly, then we may assume that we are dealing with relationships which vary, for reasons which may be known, suspected, or unknown from sample to sample within the same population.[9]

The validation group consisted of 215 subjects; 118 of these students studied the Prentice-Hall text, and 97 used the Harcourt Brace text. They studied under teachers who had taught subjects of the study group during the previous year.

The test scores of the 118 subjects of the Prentice-Hall validation group were substituted into regression equation (19), and the correlation coefficient between these predicted grades and actual grades earned was .807. This correlation coefficient compared favorably with the multiple R of .764 given by the regression equation from the study group, indicating that the prediction of grades by this regression equation was consistent enough to be considered satisfactory. Sums of raw scores on the Language Usage, Numerical and Arithmetic Problem Solving tests and their predicted grade were used to assign each individual subject of this group to hypothetical sections denoted

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[9] Vineyard, pp. 25-26.

successful and unsuccessful. These lists were then checked against their actual grades and it was found that 91 out of 118 had been correctly assigned, giving an efficiency of 77% which corresponded to the efficiency of the scheme when the data of the study group was used.

Raw scores on the Verbal, Arithmetic Computation and Arithmetic Problem Solving tests of each of the 97 subjects who had studied Harcourt Brace text materials during the 1965-66 term were substituted into regression equation (22) to find their individual predicted grades. The correlation between these and their actual grades was found to be .753 as compared with .747 for the study group which studied these same materials. The cutting score and predicted grades were then used to assign individuals into successful and unsuccessful categories, and 70 of the 97 subjects, or 72% of them, were correctly assigned.

The data for the combined validation group were then used to calculate individual predicted grades, using equation (28). The correlation coefficient between grades predicted by this equation and actual grades was .788, while the multiple R for this equation developed from the combined study group data was .743. The cutting score developed for the combined group, assisted by predicted grades from equation (28), gave correct predictions of successful and unsuccessful performance for 163 of the 215 subjects of the combined validation group. This gave a prediction efficiency of 76% as compared with 82% for the combined study group.

Since the results of this cross validation procedure were fairly consistent with the results of the analysis of the study group data, and since the validation group consisted of students who studied text materials which were considered to contain the least and the greatest amount of modern concepts, it would be reasonable to conclude that the techniques developed should be fairly consistent with other samples of this same population.

CHAPTER VI

SUMMARY AND CONCLUSIONS

General Summary of the Investigation

With the inception of curriculum changes in seventh grade mathematics, it is desirable that a study be made to evaluate the degrees of success made by various students when studying these new texts. The purpose of this study was to devise such a scheme.

At the end of the first semester 508 students enrolled in seventh grade mathematics were each given a numerical grade ranging from zero through nine, which was to serve as the criterion of success in this study. These grades and eight predictor variables selected for the study were utilized to develop multiple regression equations which might be used to predict grades in seventh grade mathematics for similar pupils. A computer programmed stepwise regression procedure was used to develop the multiple regression equations with this data. Graphic cutting scores, using numerical grades and sums of the test scores of the selected predictor tests, were developed to assist in predicting probable successful or unsuccessful performance.

Intercorrelations of the predictor variables with grades earned in seventh grade mathematics are given in the right hand column of the tables for each subject group in Appendix A. The correlations from these tables which were not significantly different from zero at the

.05 level are given in Table XXIX. Predictor tests which gave these coefficients are also stated in the table.

TABLE XXIX

CORRELATION COEFFICIENTS FOR TEST SCORES VS. MATHEMATICS GRADES WHICH WERE BELOW THE .05 LEVEL

Subject Groups	.05 Level of r	Tests and Correlation Coefficients	
Silver Burdett			
School No. 4	.454	Abstract Reasoning	.131
Laidlaw			
School No. 3	.510	Verbal	.430
		Abstract Reasoning	.308
School No. 4	.571	Abstract Reasoning	.122
Harcourt Brace			
School No. 1	.422	Abstract Reasoning	.211
School No. 2	.495	Abstract Reasoning	.165
		Numerical	.459
		Arithmetic Computation	.345
		Arithmetic Problem Solving	.322
		Reading	.371
SMSG			
Combined	.435	Verbal	.385
		Language Usage	.207
		Abstract Reasoning	.070
		Reading	.055

The intercorrelations between the various predictor tests, shown in the tables of Appendix A, were fairly high in most cases. It is reasonable to assume that this condition might justify the fact that not all of the predictor tests were used in the multiple regression equations which were selected from Appendix C. The various data groups are listed below with the selected regression equation (symbols defined, page 9), multiple R (or r), and prediction efficiencies for individuals (denoted P.E.):

A. Silver Burdett, Combined Group

$$Y = .07724\ X_1 + .08302\ X_4 + .13246\ X_5 + .05818\ X_7 - 3.48942$$

$R = .824$

P.E. = 83%

B. Silver Burdett: School No. 1

$$Y = .0561\ X_3 + .10263\ X_5 + .13565\ X_7 - 3.21389$$

$R = .940$

P.E. = 94%

C. Silver Burdett: School No. 2

$$Y = .17217\ X_4 + .20768\ X_7 - 3.98904$$

$R = .752$

P.E. = 77%

D. Silver Burdett: School No. 3

$$Y = .17902\ X_4 + .24429\ X_5 - 3.20341$$

$R = .881$

P.E. = 86%

E. Silver Burdett: School No. 4

$$Y = .35219\ X_6 - 4.36301$$

$r = .796$

P.E. = 80%

F. Laidlaw: Combined Group

$$Y = .09077\ X_4 + .13393\ X_6 + .08724\ X_7 - 2.51414$$

R = .832

P.E. = 89%

G. Laidlaw: School No. 1

$$Y = .03931\ X_3 + .08714\ X_6 + .1079\ X_7 - .99279$$

R = .947

P.E. = 87%

H. Laidlaw: School No. 2

$$Y = .1656\ X_5 + .15875\ X_6 - 2.92508$$

R = .87

P.E. = 95%

I. Laidlaw: School No. 3

$$Y = .31856\ X_5 + .27282\ X_6 - 7.32996$$

R = .85

P.E. = 93%

J. Laidlaw: School No. 4

$$Y = -.1322\ X_3 + .31875\ X_5 + .08631\ X_8 - 2.82757$$

R = .976

P.E. = 91%

K. Prentice-Hall: Combined Group

$$Y = .06002\ X_2 + .07915\ X_4 + .1149\ X_6 - 1.70051$$

R = .764

P.E. = 77%

L. Prentice-Hall: School No. 1

$Y = .09721\ X_2 + .12824\ X_6 - 1.35046$

$R = .759$

P.E. = 78%

M. Prentice-Hall: School No. 2

$Y = .14491\ X_4 + .14118\ X_6 - 2.0977$

$R = .779$

P.E. = 79%

N. Harcourt Brace: Combined Group

$Y = .07172\ X_1 + .07953\ X_5 + .108\ X_6 - 2.82442$

$R = .747$

P.E. = 81%

O. Harcourt Brace: School No. 1

$Y = .08597\ X_2 + .22519\ X_5 - 2.95337$

$R = .824$

P.E. = 86%

P. Harcourt Brace: School No. 2

$Y = .13814\ X_2 + .07858\ X_7 + .1036$

$R = .822$

P.E. = 81%

Q. Harcourt Brace: School No. 3

$Y = .07278\ X_4 + .08721\ X_5 + .15594\ X_6 - 4.82576$

$R = .907$

P.E. = 89%

R. Holt Rinehart Winston: Combined Group

$$Y = .15647\ X_4 + .06256\ X_5 + .06972\ X_6 + .05146\ X_8 - .86203$$

$$R = .794$$

$$P.E. = 87\%$$

S. SMSG: Combined Group

$$Y = .25516\ X_5 - .07276$$

$$r = .685$$

$$P.E. = 86\%$$

T. Combined Study Group

$$Y = .02582\ X_2 + .05536\ X_4 + .04938\ X_5 + .08206\ X_6 + .04424\ X_8 - .164466$$

$$R = .743$$

$$P.E. = 82\%$$

The reader will note that all predictor variables are found in at least two of the various regression equations, with Language Usage, Numerical, Arithmetic Concepts, Arithmetic Problem Solving and Word Knowledge occuring more frequently than the others.

The cut-off scores given in the tables of Appendix D furnished a scheme for sectioning the subjects into successful and unsuccessful categories with prediction efficiencies ranging from 77% to 95% for the various groups.

When the data for the validation group was substituted into their respective multiple regression equations, the correlation with actual grades earned was slightly higher than the multiple R of the regression equation used in each case. The use of cutting scores for sectioning the validation group was consistent for the Prentice-Hall subjects, but the efficiency of this scheme was slightly less efficient for the

Harcourt Brace and the Combined groups. From the consistency of the results of the validation procedure and the fact that this group was chosen because they were students who attended schools which taught the most traditional and the most modern text materials available, it would seem reasonable to assume that these relationships may be expected to remain fairly stable from sample to sample within the population from which the data were obtained.

Summary of Results

The results of the study may be summarized as follows:

(1) The multiple correlation coefficients of the regression equations were large enough to indicate that pretest scores on the Academic Promise Tests, the Metropolitan Arithmetic Test, and the Metropolitan Reading Test may be used to predict success in seventh grade mathematics.

(2) Graphic cutting scores developed from the sums of scores of the predictor tests for each regression equation give a practical method which may be used in the selection of individual students for counseling and sectioning.

(3) For practical purposes, multiple regression equations developed for schools within text-groups involve fewer predictor tests, hence individual predictions would require less cumbersome calculations than from combined group equations. Furthermore, in most cases, the multiple correlation coefficients were slightly higher for the school equations.

(4) The results of the validation procedure were such that it is justifiable to recommend that these techniques be used by the school

systems from which the data were obtained.

Recommendations

It is recommended that the multiple regression equations and cutting scores developed in this study be used by the counselors of students in seventh grade mathematics for the purpose of sectioning and for locating students who need special attention in order to succeed in the course. It should be realized, however, that these techniques should not be used alone but in conjunction with other factors including teacher estimate of the student's ability, motivation, and emotional maturity. It would be well that occasional validity checks of these techniques be made with the passage of time.

More research of the same nature as that of the present study is needed and recommended. Although the computer selected the Metropolitan Arithmetic Tests and the Word Knowledge Test more consistently in the stepwise procedure, a close examination of Appendix A reveals that the scores on these tests correlated fairly well with the scores on the Numerical and the Verbal subtests of the Academic Promise Tests. A prediction study using the Academic Promise Tests along with other measures such as interest, attitudes, or personality traits might prove to be profitable in other academic areas as well as in mathematics.

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APPENDIX A

INTERCORRELATIONS AMONG ALL VARIABLES

TABLE XXX

INTERCORRELATIONS AMONG ALL VARIABLES
(SILVER BURDETT: ALL SCHOOLS)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.646	.530	.428	.556	.634	.811	.739	.683
X_2		.445	.406	.525	.536	.674	.649	.611
X_3			.402	.376	.497	.445	.458	.474
X_4				.595	.637	.509	.526	.604
X_5					.743	.619	.631	.723
X_6						.705	.712	.677
X_7							.802	.718
X_8								.686

r = .239 at the 1% level

TABLE XXXI

INTERCORRELATIONS AMONG ALL VARIABLES
(SILVER BURDETT: SCHOOL NO. 1)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.580	.669	.377	.580	.702	.732	.779	.780
X_2		.527	.375	.531	.569	.660	.731	.682
X_3			.382	.399	.609	.575	.640	.681
X_4				.634	.683	.651	.614	.689
X_5					.810	.651	.670	.757
X_6						.796	.767	.841
X_7							.818	.889
X_8								.806

r = .329 at the 5% level

TABLE XXXII

INTERCORRELATIONS AMONG ALL VARIABLES
(SILVER BURDETT: SCHOOL NO. 2)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.527	.560	.376	.370	.143	.612	.480	.539
X_2		.501	.199	.422	.409	.660	.584	.429
X_3			.588	.605	.462	.625	.551	.544
X_4				.415	.441	.163	.435	.461
X_5					.541	.509	.660	.637
X_6						.286	.473	.500
X_7							.646	.662
X_8								.626

r = .422 at the 5% level

TABLE XXXIII

INTERCORRELATIONS AMONG ALL VARIABLES
(SILVER BURDETT: SCHOOL NO. 3)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.731	.468	.508	.587	.713	.857	.628	.616
X_2		.348	.521	.563	.577	.659	.564	.600
X_3			.374	.273	.477	.330	.308	.377
X_4				.512	.565	.468	.450	.694
X_5					.643	.568	.503	.822
X_6						.652	.627	.634
X_7							.692	.595
X_8								.559

r = .319 at the 5% level

TABLE XXXIV

INTERCORRELATIONS AMONG ALL VARIABLES
(SILVER BURDETT: SCHOOL NO. 4)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.521	.339	.506	.555	.728	.893	.881	.642
X_2		.257	.393	.483	.521	.610	.598	.563
X_3			.116	.159	.227	.126	.082	.131
X_4				.550	.661	.454	.406	.625
X_5					.770	.579	.590	.734
X_6						.780	.746	.796
X_7							.935	.687
X_8								.718

r = .454 at the 5% level

TABLE XXXV

INTERCORRELATIONS AMONG ALL VARIABLES
(LAIDLAW: ALL SCHOOLS)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.670	.508	.560	.622	.625	.841	.796	.627
X_2		.407	.534	.621	.574	.636	.643	.638
X_3			.413	.450	.548	.498	.382	.474
X_4				.661	.641	.486	.552	.667
X_5					.826	.609	.592	.723
X_6						.571	.516	.754
X_7							.870	.676
X_8								.633

r = .304 at the 1% level

TABLE XXXVI

INTERCORRELATIONS AMONG ALL VARIABLES
(LAIDLAW: SCHOOL NO. 1)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.699	.462	.628	.727	.744	.895	.925	.838
X_2		.395	.405	.471	.528	.559	.612	.583
X_3			.590	.513	.653	.524	.350	.693
X_4				.757	.643	.621	.630	.673
X_5					.893	.782	.756	.807
X_6						.798	.682	.887
X_7							.902	.887
X_8								.773

r = .412 at the 5% level

TABLE XXXVII

INTERCORRELATIONS AMONG ALL VARIABLES
(LAIDLAW: SCHOOL NO. 2)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.588	.806	.636	.575	.699	.757	.652	.578
X_2		.580	.456	.676	.662	.624	.641	.653
X_3			.563	.593	.685	.722	.655	.623
X_4				.612	.766	.475	.455	.676
X_5					.770	.663	.540	.819
X_6						.694	.590	.819
X_7							.891	.617
X_8								.587

r = .546 at the 5% level

TABLE XXXVIII

INTERCORRELATIONS AMONG ALL VARIABLES
(LAIDLAW: SCHOOL NO. 3)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.760	.418	.330	.548	.459	.827	.773	.430
X_2		.391	.622	.788	.680	.793	.741	.741
X_3			.296	.359	.410	.293	.370	.308
X_4				.589	.498	.292	.264	.607
X_5					.663	.648	.559	.776
X_6						.524	.391	.774
X_7							.811	.629
X_8								.529

r = .510 at the 5% level

TABLE XXXIX

INTERCORRELATIONS AMONG ALL VARIABLES
(LAIDLAW: SCHOOL NO. 4)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.771	.059	.557	.624	.499	.944	.815	.704
X_2		.361	.694	.791	.634	.769	.713	.724
X_3			.316	.381	.376	.234	.185	.122
X_4				.818	.793	.551	.743	.817
X_5					.869	.561	.638	.917
X_6						.438	.508	.807
X_7							.890	.641
X_8								.776

r = .571 at the 5% level

TABLE XL

INTERCORRELATIONS AMONG ALL VARIABLES
(PRENTICE-HALL: ALL SCHOOLS)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.740	.515	.600	.620	.646	.784	.744	.558
X_2		.467	.590	.623	.631	.751	.689	.614
X_3			.393	.488	.519	.411	.461	.453
X_4				.714	.749	.563	.589	.675
X_5					.863	.637	.674	.677
X_6						.650	.705	.715
X_7							.863	.576
X_8								.610

r = .210 at the 1% level

TABLE XLI

INTERCORRELATIONS AMONG ALL VARIABLES
(PRENTICE-HALL: SCHOOL NO. 1)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.738	.439	.699	.632	.646	.828	.781	.652
X_2		.458	.614	.640	.604	.784	.702	.675
X_3			.436	.481	.495	.391	.427	.516
X_4				.761	.762	.642	.638	.630
X_5					.847	.547	.569	.666
X_6						.571	.631	.697
X_7							.829	.561
X_8								.602

r = .304 at the 1% level

TABLE XLII

INTERCORRELATIONS AMONG ALL VARIABLES
(PRENTICE-HALL: SCHOOL NO. 2)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.660	.504	.486	.535	.581	.674	.629	.472
X_2		.347	.567	.547	.603	.649	.596	.571
X_3			.312	.417	.472	.312	.387	.375
X_4				.702	.749	.472	.547	.726
X_5					.861	.652	.703	.685
X_6						.672	.728	.731
X_7							.868	.585
X_8								.618

r = .304 at the 1% level

TABLE XLIII

INTERCORRELATIONS AMONG ALL VARIABLES
(HARCOURT BRACE: ALL SCHOOLS)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.700	.489	.652	.535	.572	.828	.759	.596
X_2		.413	.698	.618	.687	.766	.759	.618
X_3			.579	.543	.600	.493	.576	.424
X_4				.702	.768	.680	.697	.676
X_5					.778	.556	.669	.657
X_6						.611	.686	.689
X_7							.823	.595
X_8								.575

r = .256 at the 1% level

TABLE XLIV

INTERCORRELATIONS AMONG ALL VARIABLES
(HARCOURT BRACE: SCHOOL NO. 1)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.553	.333	.409	.520	.448	.757	.674	.506
X_2		.034	.541	.428	.472	.774	.639	.603
X_3			.051	.137	.180	.101	.234	.211
X_4				.651	.720	.584	.436	.603
X_5					.737	.521	.680	.765
X_6						.512	.542	.715
X_7							.728	.599
X_8								.740

r = .422 at the 5% level

TABLE XLV

INTERCORRELATIONS AMONG ALL VARIABLES
(HARCOURT BRACE: SCHOOL NO. 2)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.434	.223	.294	.367	.170	.792	.580	.555
X_2		.071	.512	.662	.579	.465	.598	.751
X_3			.400	.463	.480	.461	.456	.165
X_4				.591	.519	.293	.198	.459
X_5					.834	.407	.642	.345
X_6						.190	.536	.322
X_7							.601	.644
X_8								.371

r = .495 at the 5% level

TABLE XLVI

INTERCORRELATIONS AMONG ALL VARIABLES
(HARCOURT BRACE: SCHOOL NO. 3)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.768	.538	.729	.608	.657	.853	.811	.711
X_2		.428	.732	.649	.724	.765	.754	.734
X_3			.627	.531	.593	.461	.515	.654
X_4				.683	.767	.712	.763	.812
X_5					.706	.543	.630	.767
X_6						.645	.667	.862
X_7							.842	.701
X_8								.735

r = .322 at the 1% level

TABLE XLVII

INTERCORRELATIONS AMONG ALL VARIABLES
(HOLT RINEHART WINSTON: ALL SUBJECTS)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.611	.360	.563	.667	.632	.799	.787	.501
X_2		.320	.436	.594	.484	.681	.679	.541
X_3			.408	.368	.365	.412	.363	.372
X_4				.731	.677	.579	.607	.677
X_5					.702	.663	.757	.721
X_6						.589	.727	.707
X_7							.862	.590
X_8								.692

r = .276 at the 5% level

TABLE XLVIII

INTERCORRELATIONS AMONG ALL VARIABLES
(SMSG: ALL SUBJECTS)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.349	-.333	.103	.483	.410	.536	.611	.385
X_2		-.123	.089	.356	.306	.284	.608	.207
X_3			.038	-.076	-.182	-.393	-.079	.070
X_4				.647	.436	-.338	.474	.511
X_5					.799	.189	.767	.685
X_6						.387	.618	.565
X_7							.306	-.055
X_8								.684

TABLE XLIX

INTERCORRELATIONS AMONG ALL VARIABLES
(ALL TEXTS: COMBINED STUDY GROUP)

	X_2	X_3	X_4	X_5	X_6	X_7	X_8	Y_c
X_1	.702	.497	.582	.611	.641	.811	.767	.582
X_2		.441	.578	.622	.622	.723	.702	.572
X_3			.473	.481	.521	.448	.470	.419
X_4				.704	.717	.577	.614	.629
X_5					.815	.621	.672	.664
X_6						.651	.694	.691
X_7							.840	.597
X_8								.624

r = .114 at the 1% level

APPENDIX B

SUMMARY OF TEST DATA FOR THE VARIOUS GROUPS

TABLE L

SUMMARY OF TEST DATA FOR THE SILVER BURDETT GROUP

	Test V (X_1)	LU (X_2)	AR (X_3)	N (X_4)	AC (X_5)	AP (X_6)	WK (X_7)	R (X_8)	Numer. Grade Y_c
Combined Group									
Mean	23.6	22.4	22.3	18.1	18.6	19.7	22.2	20.4	3.58
S.D.	7.86	7.82	9.93	5.86	6.91	7.36	9.98	8.29	2.63
School No.1									
Mean	22.7	22.8	24.7	20.3	20.6	21.4	22.4	21.0	3.33
S.D.	8.12	7.58	11.1	6.19	7.46	7.81	10.6	8.96	2.57
School No.2									
Mean	18.3	17.9	18.0	15.2	14.7	14.2	14.5	14.5	2.55
S.D.	4.28	4.23	4.24	3.90	3.83	3.77	3.80	3.80	1.60
School No.3									
Mean	25.8	24.7	23.3	17.0	17.8	19.0	24.1	21.4	4.18
S.D.	5.08	4.97	4.83	4.12	4.22	4.36	4.91	4.63	2.04
School No.4									
Mean	26.8	22.5	20.6	19.3	21.0	23.9	26.5	24.0	4.05
S.D.	5.18	4.74	4.54	4.93	4.58	4.89	5.15	4.90	2.01

TABLE LI

SUMMARY OF TEST DATA FOR THE LAIDLAW GROUP

	Test								Numer.
	V (X_1)	LU (X_2)	AR (X_3)	N (X_4)	AC (X_5)	AP (X_6)	WK (X_7)	R (X_8)	Grade Y_c
Combined Group									
Mean	22.6	20.7	23.7	20.8	19.6	21.0	23.1	21.3	4.18
S.D.	7.58	7.19	9.77	7.09	8.12	8.01	9.51	8.58	2.59
School No.1									
Mean	22.3	20.6	23.0	20.9	16.8	17.2	24.8	22.9	4.09
S.D.	8.41	6.76	10.6	5.97	9.50	8.92	9.73	9.78	2.13
School No.2									
Mean	23.6	20.8	27.6	20.4	21.6	22.6	23.7	20.2	4.24
S.D.	7.36	8.11	11.7	7.41	7.33	7.65	9.07	8.07	2.62
School No.3									
Mean	21.5	18.3	22.3	19.3	17.2	21.9	20.4	19.5	4.13
S.D.	5.77	5.90	6.56	5.48	4.75	5.47	9.40	6.56	3.22
School No.4									
Mean	23.1	23.9	19.8	23.4	24.7	24.0	22.1	22.3	4.33
S.D.	8.91	7.39	5.23	10.0	7.29	7.63	10.3	9.54	2.81

TABLE LII

SUMMARY OF TEST DATA FOR THE PRENTICE-HALL GROUP

	Test								Numer.
	V (X_1)	LU (X_2)	AR (X_3)	N (X_4)	AC (X_5)	AP (X_6)	WK (X_7)	R (X_8)	Grade Y_c
Combined Group									
Mean	26.2	24.2	24.9	21.1	20.0	21.7	26.1	24.4	3.91
S.D.	9.26	9.47	11.4	8.41	7.65	8.64	11.9	9.59	2.59
School No.1									
Mean	29.4	27.1	27.9	21.9	22.2	23.9	29.7	27.6	4.22
S.D.	9.42	10.0	12.0	8.36	6.66	8.26	11.5	9.09	2.32
School No.2									
Mean	22.9	21.1	21.7	20.4	17.6	19.4	22.3	21.2	3.59
S.D.	7.88	7.82	9.88	7.91	7.93	8.48	11.1	9.06	2.81

TABLE LIII

SUMMARY OF TEST DATA FOR THE HOLT RINEHART WINSTON GROUP

	Test								Numer.
	V (X_1)	LU (X_2)	AR (X_3)	N (X_4)	AC (X_5)	AP (X_6)	WK (X_7)	R (X_8)	Grade Y_c
Mean	27.2	26.6	21.9	20.8	21.4	24.6	28.1	26.3	4.76
S.D.	7.93	9.67	8.99	8.17	8.26	7.77	11.8	8.61	2.18

TABLE LIV

SUMMARY OF THE TEST DATA FOR THE HARCOURT BRACE GROUP

	Test								Numer.
	V (X_1)	LU (X_2)	AR (X_3)	N (X_4)	AC (X_5)	AP (X_6)	WK (X_7)	R (X_8)	Grade Y_c
Combined Group									
Mean	29.3	29.5	29.9	25.2	27.0	27.1	29.8	26.9	4.36
S.D.	8.81	10.5	11.7	8.71	7.31	7.56	11.3	8.62	2.36
School No.1									
Mean	27.5	24.6	20.8	19.7	20.7	21.5	24.6	21.5	3.82
S.D.	6.47	10.7	8.73	7.42	7.49	6.80	9.80	6.62	2.72
School No.2									
Mean	26.1	23.9	25.9	23.8	27.5	25.8	24.3	21.6	5.31
S.D.	6.20	8.44	11.5	5.95	6.63	6.53	9.69	6.14	2.02
School No.3									
Mean	30.7	32.6	34.0	27.4	29.1	29.4	33.0	30.1	4.30
S.D.	9.79	9.83	10.6	8.89	6.12	6.99	11.1	8.22	2.28

TABLE LV

SUMMARY OF TEST DATA FOR THE SMSG GROUP

	Test								Numer.
	V (X_1)	LU (X_2)	AR (X_3)	N (X_4)	AC (X_5)	AP (X_6)	WK (X_7)	R (X_8)	Grade Y_c
Mean	26.5	23.0	21.4	19.5	21.0	23.9	25.0	22.8	5.29
S.D.	6.32	7.79	7.81	5.51	6.96	7.09	8.21	6.87	2.59

TABLE LVI

SUMMARY OF TEST DATA FOR THE COMBINED STUDY GROUP (ALL TEXTS)

	Test								Numer.
	V (X_1)	LU (X_2)	AR (X_3)	N (X_4)	AC (X_5)	AP (X_6)	WK (X_7)	R (X_8)	Grade Y_c
Mean	25.8	24.5	24.7	21.1	21.2	22.6	25.7	23.7	4.11
S.D.	8.67	9.42	10.9	7.97	8.07	8.31	11.2	9.08	2.54

APPENDIX C

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS

TABLE LVII

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (SILVER BURDETT: ALL SCHOOLS)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equation
$r_{Y5}=.723$	1.82	124.000	$Y=.27524\ X_5-1.53074$
$R_{Y(57)}=.801$	1.59	36.983	$Y=.17218\ X_5+.11533\ X_7-2.17441$
$R_{Y(457)}=.813$	1.55	6.625	$Y=.08132\ X_4+.14087\ X_5+.10440\ X_7-2.81866$
$R_{Y(1457)}=.824$	1.51	6.180	$Y=.07724\ X_1+.08302\ X_4+.13246\ X_5+.05818\ X_7-3.48942$
$R_{Y(12457)}=.828$	1.51	2.102	$Y=.06736\ X_1+.03693\ X_2+.08169\ X_4+.12663\ X_5+.04788\ X_7$ -3.72510
$R_{Y(123457)}=.829$	1.51	.849	$Y=.05849\ X_1+.03365\ X_2+.01604\ X_3+.07586\ X_4+.12666\ X_5$ $+.04991\ X_7-3.73962$
$R_{Y(1234578)}=.830$	1.51	.195	$Y=.05581\ X_1+.03186\ X_2+.01570\ X_3+.07415\ X_4+.12438\ X_5$ $+.04494\ X_7+.01388\ X_8-3.72835$
$R_{Y(12345678)}=.830$	1.52	.099	$Y=.05603\ X_1+.03127\ X_2+.06174\ X_3+.07674\ X_4+.12871\ X_5$ $-.01126\ X_6+.04661\ X_7+.01580\ X_8-3.72554$

TABLE LVIII

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (SILVER BURDETT: SCHOOL NO. 1)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equation
$r_{Y7}=.889$	1.19	128.702	$Y=.21701\ X_7-1.53735$
$R_{Y(57)}=.919$	1.04	11.643	$Y=.10617\ X_5+.16809\ X_7-2.62796$
$R_{Y(357)}=.940$	.91	10.988	$Y=.0561\ X_3+.10263\ X_5+.13565\ X_7-3.21389$
$R_{Y(3457)}=.943$	.91	1.137	$Y=.05614\ X_3+.03754\ X_4+.09124\ X_5+.12654\ X_7-3.5381$
$R_{Y(13457)}=.946$	.89	2.258	$Y=.04944\ X_1+.04299\ X_3+.0553\ X_4+.07703\ X_5+.10643\ X_7-3.4982$
$R_{Y(123457)}=.948$	.90	.800	$Y=.04937\ X_1+.0253\ X_2+.03932\ X_3+.06092\ X_4+.07108\ X_5+.09728\ X_7-4.2198$
$R_{Y(1234578)}=.952$	.88	1.791	$Y=.06798\ X_1+.04215\ X_2+.04218\ X_3+.07613\ X_4+.07448\ X_5+.10582\ X_7=.05202\ X_8=4.57465$
$R_{Y(12345678)}=.958$	.90	.006	$Y=.06766\ X_1+.04239\ X_2+.04172\ X_3+.07553\ X_4+.0728\ X_5+.00365\ X_6+.10508\ X_7-.05211\ X_8-4.57447$

TABLE LIX

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (SILVER BURDETT: SCHOOL NO.2)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equation
$r_{Y7}=.662$	1.98	15.597	$Y=.29762\ X_7-1.75138$
$R_{Y(47)}=.752$	1.78	5.597	$Y=.17217\ X_4+.20768\ X_7-3.98904$
$R_{Y(457)}=.786$	1.72	2.432	$Y=.12578\ X_4+.14323\ X_5+.21235\ X_7-4.54232$
$R_{Y(3457)}=.798$	1.73	.884	$Y=-.07413\ X_3+.17408\ X_4+.16584\ X_5+.26038\ X_7-4.96968$
$R_{Y(34567)}=.808$	1.74	.739	$Y=-.07933\ X_3+.15778\ X_4+.13465\ X_5+.06032\ X_6+.26157\ X_7-5.04528$
$R_{Y(134567)}=.815$	1.77	.505	$Y=.06312\ X_1-.08667\ X_3+.13726\ X_4+.13469\ X_5+.07213\ X_6+.22639\ X_7-5.41725$
$R_{Y(1234567)}=.826$	1.78	.798	$Y=.08398\ X_1-.09285\ X_2-.08488\ X_3+.12775\ X_4+.13203\ X_5+.09418\ X_6+.26437\ X_7-4.85187$
$R_{Y(12345678)}=.826$	1.85	.003	$Y=.08396\ X_1-.09411\ X_2-.084\ X_3+.12591\ X_4+.12961\ X_5+.09384\ X_6+.26181\ X_7+.00604\ X_8-4.82662$

TABLE LX

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (SILVER BURDETT: SCHOOL NO.3)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
$r_{Y5}=.822$	1.50	75.058	$Y=.31743-1.45439$
$R_{Y(45)}=.881$	1.26	15.799	$Y=.17902\ X_4+.24429\ X_5-3.20341$
$R_{Y(458)}=.886$	1.26	1.239	$Y=.16566\ X_4+.22912\ X_5+.03558\ X_8-3.46875$
$R_{Y(3458)}=.888$	1.27	.555	$Y=.01725\ X_3+.15689\ X_4+.22781\ X_5+.03213\ X_8-3.62360$
$R_{Y(34568)}=.888$	1.28	.153	$Y=.02031\ X_3+.16099\ X_4+.23451\ X_5-.02206\ X_6+.03749\ X_8-3.57902$
$R_{Y(345678)}=.886$	1.30	.219	$Y=.01998\ X_3+.15968\ X_4+.23063\ X_5-.02812\ X_6+.01522\ X_7+.02892\ X_8-3.54917$
$R_{Y(2345678)}=.889$	1.32	.073	$Y=.00991\ X_2+.01938\ X_3+.157\ X_4+.22836\ X_5-.02854\ X_6\ .01216\ X_7+.02773\ X_8-3.58646$
$R_{Y(12345678)}=.889$	1.34	.0004	$Y=.00151\ X_1+.00961\ X_2+.01923\ X_3+.15703\ X_4+.22834\ X_5-.02885\ X_6+.0115\ X_7+.02782\ X_8-3.59490$

TABLE LXI

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (SILVER BURDETT: SCHOOL NO.4)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equation
$r_{Y6}=.796$	1.63	29.370	$Y=.35219\ X_6-4.36301$
$R_{Y(56)}=.818$	1.59	1.761	$Y=.13092\ X_5+.25042\ X_6-4.68062$
$R_{Y(568)}=.838$	1.56	1.622	$Y=.1264\ X_5+.16486\ X_6+.0956\ X_8-4.83076$
$R_{Y(4568)}=.851$	1.56	1.143	$Y=.1032\ X_4+.11653\ X_5+.0995\ X_6+.11003\ X_8-5.39511$
$R_{Y(14568)}=.858$	1.58	.536	$Y=-.08646\ X_1+.1237\ X_4+.1103\ X_5+.10631\ X_6+.17675\ X_8-5.10338$
$R_{Y(134568)}=.890$	1.63	.173	$Y=-.12304\ X_1+.02507\ X_3+.13612\ X_4+.10832\ X_5+.09306\ X_6+.21096\ X_8=5.33996$
$R_{Y(1234568)}=.860$	1.70	.058	$Y=-.11124\ X_1+.01876\ X_2+.01891\ X_3+.12849\ X_4+.10526\ X_5+.09779\ X_6+.19132\ X_8-5.38233$
$R_{Y(12345678)}=.862$	1.78	.078	$Y=-.08513\ X_1+.02623\ X_2+.01247\ X_3+.12147\ X_4+.09946\ X_5+.11698\ X_6-.05115\ X_7+.21088\ X_8-5.43025$

TABLE LXII

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (LAID LAW: ALL SCHOOLS)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equation
$r_{Y6}=.754$	1.72	90.962	$Y=.24427\ X_6-.93638$
$R_{Y(67)}=.811$	1.54	17.782	$Y=.17694\ X_6+.09926\ X_7-1.81525$
$R_{Y(467)}=.832$	1.47	7.514	$Y=.09077\ X_4+.13393\ X_6+.08724\ X_7-2.51414$
$R_{Y(2467)}=.837$	1.46	1.880	$Y=.04668\ X_2+.08084\ X_4+.12517\ X_6+.07234\ X_7-2.76259$
$R_{Y(12467)}=.843$	1.45	2.173	$Y=-.06848\ X_1+.05743\ X_2.08813\ X_4+.13268\ X_6+.10678\ X_7-2.53913$
$R_{Y(124567)}=.843$	1.46	.138	$Y=-.06739\ X_1+.05508\ X_2+.08508\ X_4+.01561\ X_5+.12333\ X_6+.10467\ X_7-2.51311$
$R_{Y(1245678)}=.844$	1.47	.018	$Y=-.06847\ X_1+.05445\ X_2+.08393\ X_4+.01506\ X_5+.12448\ X_6+.10103\ X_7+.00613\ X_8-2.51163$
$R_{Y(12345678)}=.798$	1.48	.009	$Y=-.06802\ X_1+.05456\ X_2-.00223\ X_3+.08429\ X_4+.01468\ X_5+.12555\ X_6+.10201\ X_7+.00531\ X_8-2.49897$

TABLE LXIII

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (LAID LAW: SCHOOL NO. 1)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equation
$R_{Y7}=.887$	1.01	77.605	$Y=.19426\ X_7-.72733$
$R_{Y(67)}=.935$	.79	14.059	$Y=.11749\ X_6+.10830\ X_7-.62005$
$R_{Y(367)}=.947$	.74	4.086	$Y=.03931\ X_3+.08714\ X_6+.10794\ X_7-.99279$
$R_{Y(1367)}=.950$	.73	1.168	$Y=.04540\ X_1+.04099\ X_3+.08235\ X_6+.07533\ X_7-1.15169$
$R_{Y(13678)}=.951$	.75	.194	$Y=.06131\ X_1+.03789\ X_3+.0809\ X_6+.08681\ X_7-.02314\ X_8-1.16598$
$R_{Y(134678)}=.951$	.77	.052	$Y=.06209\ X_1+.03561\ X_3+.00965\ X_4+.07947\ X_6+.089\ X_7-.02763\ X_8-1.25844$
$R_{Y(1234678)}=.951$	.80	.010	$Y=.05940\ X_1+.00362\ X_2+.03512\ X_3+.01028\ X_4+.07921\ X_6+.09038\ X_7-.02816\ X_8-1.29293$
$R_{Y(12345678)}=.951$	.82	.004	$Y=.05791\ X_1+.00353\ X_2+.03458\ X_3+.0122\ X_4-.00388\ X_5+.08247\ X_6+.09025\ X_7-.02654\ X_8-1.31069$

TABLE LXIV

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (LAID LAW: SCHOOL NO. 2)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equation
$R_{Y6}=.819$	1.55	38.642	$Y=.28088\ X_6-2.11528$
$R_{Y(56)}=.870$	1.36	6.476	$Y=.1656\ X_5+.15875\ X_6-2.92508$
$R_{Y(568)}=.874$	1.38	.470	$Y=.15796\ X_5+.14386\ X_6+.03296\ X_8-3.09072$
$R_{Y(5678)}=.886$	1.36	1.613	$Y=.18033\ X_5+.1625\ X_6-.10923\ X_7+.12088-3.18903$
$R_{Y(35678)}=.888$	1.40	.148	$Y=.01601\ X_3+.17977\ X_5+.15402\ X_6-.11689\ X_7+.11836\ X_8$ -3.19506
$R_{Y(135678)}=.888$	1.44	.051	$Y=.0191\ X_1+.02184\ X_3+.17785\ X_5+.15801\ X_6-.11013\ X_7$ $+.11613\ X_8-3.06938$
$R_{Y(1345678)}=.888$	1.49	.050	$Y=-.02631\ X_1+.02246\ X_3+.01752\ X_4+.17497\ X_5+.14704\ X_6$ $-.10088\ X_7+.11078\ X_8-3.07435$
$R_{Y(12345678)}=.888$	1.56	.0001	$Y=-.02655\ X_1+.00077\ X_2+.02247\ X_3+.01777\ X_4+.17459\ X_5$ $+.14674\ X_6-.10049\ X_7+.11028\ X_8-3.07416$

TABLE LXV

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (LAID LAW: SCHOOL NO. 3)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
$r_{Y5}=.776$	2.11	19.659	$Y=.52654\ X_5-4.92331$
$R_{Y(56)}=.850$	1.84	5.182	$Y=.31856\ X_5+.27282\ X_6-7.32996$
$R_{Y(456)}=.859$	1.86	.661	$Y=.09281\ X_4+.26917\ X_5+.25488\ X_6-7.88132$
$R_{Y(4567)}=.869$	1.89	.742	$Y=.11109\ X_4+.19304\ X_5+.23324\ X_6+.06253\ X_7-7.72642$
$R_{Y(14567)}=.896$	1.78	2.181	$Y=-.22075\ X_1+.14007\ X_4+.1746\ X_5+.2346\ X_6+.17531\ X_7-5.54423$
$R_{Y(145678)}=.902$	1.84	.477	$Y=-.25627\ X_1+.14173\ X_4+.15908\ X_5+.24642\ X_6+.14113\ X_7+.09411\ X_8-5.94717$
$R_{Y(135678)}=.903$	1.96	.020	$Y=-.24978-.01331\ X_3+.14225\ X_4+.16049\ X_5+.25126\ X_6+.13643\ X_7+.09783\ X_8-5.90672$
$R_{Y(12345678)}=.903$	2.12	.001	$Y=-.25119\ X_1+.00751\ X_2-.01305\ X_3+.14013\ X_4+.15873\ X_5+.24985\ X_6+.13559\ X_7+.09631\ X_8-5.87024$

TABLE LXVI

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (LAID LAW: SCHOOL NO. 4)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
$r_{Y5}=.917$	1.18	52.773	$Y=.35483\ X_5-4.41935$
$R_{Y(35)}=.950$	.97	5.562	$Y=-.14302\ X_3+.39422\ X_5-2.55410$
$R_{Y(358)}=.976$	.72	8.499	$Y=-.1322\ X_3+.31875\ X_5+.08631\ X_8-2.82757$
$R_{Y(2358)}=.980$	.70	1.342	$Y=-.06146\ X_2-.12401\ X_3+.35167\ X_5+.10344\ X_8-2.7133$
$R_{Y(23568)}=.981$	.73	.530	$Y=-.0551\ X_2-.1278\ X_3+.30719\ X_5+.04345\ X_6+.10424\ X_8-2.75377$
$R_{Y(234568)}=.982$	.79	.122	$Y=-.05649\ X_2-.12721\ X_3-.01828\ X_4+.31305\ X_5+.05314\ X_6+.11241\ X_8-2.86296$
$R_{Y(1234568)}=.988$	.86	.250	$Y=-.03425\ X_1-.03695\ X_2-.13913\ X_3-.03244\ X_4+.31426\ X_5+.06344\ X_6+.13515\ X_8-2.75472$
$R_{Y(12345678)}=.983$	.98	.029	$Y=-.06603\ X_1-.04295\ X_2-.1541\ X_3-.02604\ X_4+.3272\ X_5+.06103\ X_6+.04035\ X_7+.11497\ X_8-2.43398$

TABLE LXVII

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (PRENTICE-HALL: ALL SCHOOLS)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
$r_{Y6}=.715$	1.81	154.12	$Y=.21407\ X_6-.72504$
$R_{Y(46)}=.746$	1.74	14.465	$Y=.09722\ X_4+.14321\ X_6-1.24597$
$R_{Y(246)}=.764$	1.69	9.601	$Y=.06002\ X_2+.07915\ X_4+.1149\ X_6-1.70051$
$R_{Y(2346)}=.766$	1.68	1.241	$Y=.0553\ X_2+.01613\ X_3+.07942\ X_4+.10622\ X_6-1.82442$
$R_{Y(23468)}=.768$	1.69	.952	$Y=.0466\ X_2+.01507\ X_3+.07942\ X_4+.09621\ X_6+.02224\ X_8-1.89537$
$R_{Y(123468)}=.770$	1.69	.789	$Y=-.02334\ X_1+.05458\ X_2+.01733\ X_3+.0825\ X_4+.0965\ X_6+.03054\ X_8-1.80897$
$R_{Y(1234568)}=.770$	1.69	.624	$Y=.02313\ X_1+.05289\ X_2+.01688\ X_3+.07910\ X_4+.02958\ X_5+.07931\ X_6+.02856\ X_8-1.85775$
$R_{Y(12345678)}=.770$	1.69	.000	$Y=.02319\ X_1+.05283\ X_2+.0169\ X_3+.0791\ X_4+.02957\ X_5+.07932\ X_6+.00018\ X_7+.02843\ X_8-1.85705$

TABLE LXVIII

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATION (PRENTICE-HALL: SCHOOL NO. 1)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
$r_{Y6}=.697$	1.68	70.035	$Y=.19619\ X_6-.45907$
$R_{Y(26)}=.759$	1.51	17.908	$Y=.09721\ X_2+.12824\ X_6-1.35046$
$R_{Y(236)}=.770$	1.49	2.956	$Y=.08393\ X_2+.02906\ X_3+.11368\ X_6-1.57717$
$R_{Y(1236)}=.777$	1.49	1.553	$Y=.03633\ X_1+.06562\ X_2+.02778\ X_3+.10124\ X_6-1.81562$
$R_{Y(12367)}=.781$	1.48	1.455	$Y=.06098\ X_1+.08183\ X_2+.02684\ X_3+.10051\ X_6-.03594\ X_7-1.86721$
$R_{Y(123678)}=.783$	1.49	.424	$Y=.05655\ X_1+.08164\ X_2+.0261\ X_3+.09613\ X_6-.4636\ X_7+.02394\ X_8-1.95717$
$R_{Y1234678)}=.783$	1.50	.268	$Y=.05269\ X_1+.08137\ X_2+.22586\ X_3+.01732\ X_4+.08657\ X_6-.04813\ X_7+.02398\ X_8-1.92935$
$R_{Y(12345678)}=.784$	1.51	.051	$Y=.05213\ X_1+.07958\ X_2+.02562\ X_3+.01503\ X_4+.01232\ X_5+.08076\ X_6-.04727\ X_7+.02467\ X_8-1.98689$

TABLE LXIX

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATION (PRENTICE-HALL: SCHOOL NO. 2)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
$r_{Y6}=.728$	1.93	81.480	$Y=.24234\ X_6-1.10521$
$R_{Y\,(46)}=.779$	1.79	12.978	$Y=.14491\ X_4+.14118\ X_6-2.09770$
$R_{Y\,(467)}=.792$	1.75	3.825	$Y=.14983\ X_4+.09443\ X_6+.04927\ X_7+2.39316$
$R_{Y\,(3467)}=.794$	1.76	.564	$Y=.01792\ X_3+.15197\ X_4+.08286\ X_6+.04952\ X_7-2.60660$
$R_{Y\,(13467)}=.797$	1.76	.816	$Y=-.03615\ X_1+.02683\ X_3+.15853\ X_4+.08092\ X_6+.06314\ X_7$ -2.37104
$R_{Y\,(123467)}=.800$	1.76	.812	$Y=-.04781\ X_1+.03620\ X_2+.02683\ X_3+.14972\ X_4+.07977\ X_6$ $+.05572\ X_7-2.49971$
$R_{Y\,(1234567)}=.800$	1.77	.207	$Y=-.04716\ X_1+.03727\ X_2+.02616\ X_3+.14582\ X_4+.02453\ X_5$ $+.06487\ X_6+.05263\ X_7-2.51733$
$R_{Y\,(12345678)}=.800$	1.79	.061	$Y=-.04713\ X_1+.03788\ X_2+.02538\ X_3+.14492\ X_4+.02328\ X_5$ $+.06309\ X_6+04529\ X_7+.01279\ X_8-2.5460)$

TABLE LXX

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (HARCOURT BRACE: ALL SCHOOLS)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
$r_{Y6}=.689$	1.72	89.615	$Y=.21569\ X_6-1.49286$
$R_{Y(16)}=.732$	1.63	12.774	$Y=.0805\ X_1+.11197\ X_6-2.39463$
$R_{Y(156)}=.747$	1.59	5.086	$Y=.07172\ X_1+.07953\ X_5+.108\ X_6-2.82442$
$R_{Y(1456)}=.756$	1.58	2.823	$Y=.05647\ X_1+.05321\ X_4+.0669\ X_5+.08058\ X_6-2.6324$
$R_{Y(13456)}=.760$	1.58	1.350	$Y=.06036\ X_1-.02037\ X_3+.05828\ X_4+.07056\ X_5+.08971\ X_6-2.61227$
$R_{Y(134568)}=.762$	1.58	.652	$Y=.07271\ X_1-.01815\ X_3+.0608\ X_4+.07669\ X_5+.09376\ X_6-.02707\ X_8-2.65125$
$R_{Y(1345678)}=.764$	1.58	.885	$Y=.05649\ X_1-.01726\ X_3+.05622\ X_4+.08005\ X_5+.0923\ X_6+.02827\ X_7-.04348\ X_8-2.53973$
$R_{Y(12345678)}=.765$	1.59	.379	$Y=.05464\ X_1+.01704\ X_2-.01457\ X_3+.05312\ X_4+.07907\ X_5+.08659\ X_6+.02335\ X_7-.04849\ X_8-2.52826$

TABLE LXXI

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (HARCOURT BRACE: SCHOOL NO.1)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
$r_{Y5}=.765$	1.79	28.288	$Y=.27755\ X_5-1.92212$
$R_{Y(25)}=.824$	1.62	5.493	$Y=.08597\ X_2+.22519\ X_5-2.95337$
$R_{Y(258)}=.840$	1.59	1.634	$Y=.05752\ X_2+.17792\ X_5+.10754\ X_8-3.58356$
$R_{Y(2568)}=.856$	1.57	1.653	$Y=.04362\ X_2+.11611\ X_5+.09904\ X_6+.11433\ X_8-4.23407$
$R_{Y(12568)}=.859$	1.60	.352	$Y=-.04463\ X_1+.04909\ X_2+.11981\ X_5+.10041\ X_6+.13447\ X_8-3.68108$
$R_{Y(123568)}=.862$	1.63	.377	$Y=-.05909\ X_1+.05636\ X_2+.02751\ X_3+.12724\ X_5+.09304\ X_6+.12642\ X_8-3.85830$
$R_{Y(1234568)}=.862$	1.69	.006	$Y=-.05938+.05484\ X_2+.02771\ X_3+.00644\ X_4+.12496\ X_5+.08998\ X_6+.12842\ X_8-3.87428$
$R_{Y(12345678)}=.862$	1.75	.001	$Y=-.05779\ X_1+.05555\ X_2+.02742\ X_3+.00721\ X_4+.12449\ X_5+.08992\ X_6-.00249\ X_7+.12942\ X_8-3.89403$

TABLE LXXII

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (HARCOURT BRACE: SCHOOL NO.2)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
$r_{Y2}=.751$	1.38	18.151	$Y=.18006\ X_2+1.01343$
$R_{Y(27)}=.822$	1.24	4.442	$Y=.13814\ X_2+.07858\ X_7+.10360$
$R_{Y(278)}=.868$	1.12	3.803	$Y=.17625\ X_2+.11227\ X_7-.12897\ +1.15582$
$R_{Y(2578)}=.883$	1.11	1.267	$Y=.20081\ X_2-.07126\ X_5+.11035\ X_7-.09792\ X_8+1.90616$
$R_{Y(25678)}=.900$	1.08	1.653	$Y=.19251\ X_2-.15506\ X_5+.10687\ X_6+.12842\ X_7-.11104\ X_8$ $+1.49367$
$R_{Y(245678)}=.903$	1.12	.309	$Y=.18486\ X_2+.0381\ X_4-.17191\ X_5+.10057\ X_6+.12268\ X_7$ $-.09135\ X_8+1.11$
$R_{Y(1245678)}=.905$	1.18	.154	$Y=.03308\ X_1+.18444\ X_2+03307\ X_4-.17106\ X_5+.10538\ X_6$ $+.10952\ X_7-.10025\ X_8+.73959$
$R_{Y(12345678)}=.909$	1.23	.294	$Y=.05938\ X_1+.21699\ X_2+.03027\ X_3+.00632\ X_4-.16381\ X_5$ $+.07917\ X_6+.08322\ X_7-.12830\ X_8+.85062$

TABLE LXXIII

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (HARCOURT BRACE: SCHOOL NO.3)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
$r_{Y6}=.862$	1.16	177.137	$Y=.28086\ X_6-3.96383$
$R_{Y(46)}=.893$	1.04	16.359	$Y=.09346\ X_4+.18976\ X_6-3.84680$
$R_{Y(456)}=.907$	.98	8.347	$Y=.07278\ X_4+.08721\ X_5+.15594\ X_6-4.82576$
$R_{Y(4567)}=.912$	.96	2.909	$Y=.055\ X_4+.0858\ X_5+.146\ X_6+.02751\ X_7-4.91144$
$R_{Y(34567)}=.916$	.95	2.958	$Y=.02582\ X_3+.04291\ X_4+.08047\ X_5+.13703\ X_6+.02825\ X_7-5.06387$
$R_{Y(345678)}=.917$	.96	.238	$Y=.02552\ X_3+.03957\ X_4+.07762\ X_5+.13726\ X_6+.02159\ X_7+.01514\ X_8-5.12252$
$R_{Y(2345678)}=.917$	.96	.060	$Y=.0057\ X_2+.02626\ X_3+.03853\ X_4+.07622\ X_5+.13521\ X_6+.01986\ X_7+.01415\ X_8-5.11731$
$R_{Y(12345678)}=.928$	.97	.035	$Y=-.00514\ X_1+.00666\ X_2+.02683\ X_3+.03879\ X_4+.07673\ X_5+.13487\ X_6+.02209\ X_7+.01508\ X_8-5.12342$

TABLE LXXIV

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (HOLT RINEHART WINSTON: ALL SUBJECTS)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
r_{Y5}=.721	1.53	52.966	$Y=.19\ X_5+.68894$
$R_{Y(56)}$=.774	1.41	9.490	$Y=.11679\ X_5+.11088\ X_6-.47364$
$R_{Y(456)}$=.785	1.39	2.182	$Y=.05529\ X_4+.08923\ X_5+.09209\ X_6-.56907$
$R_{Y(4568)}$=.794	1.38	1.812	$Y=.05647\ X_4+.06256\ X_5+.06972\ X_6+.05146\ X_8-.86203$
$R_{Y(14568)}$=.809	1.35	3.144	$Y=-.07063\ X_1+.06117\ X_4+.06944\ X_5+.07402\ X_6+.09214\ X_8-.32644$
$R_{Y(124568)}$=.815	1.35	1.139	$Y=-.07728\ X_1+.0295\ X_2+.06279\ X_4+.06191\ X_5+.07736\ X_6+.07680\ X_8-.47966$
$R_{Y(1234568)}$=.816	1.36	.232	$Y=-.07866\ X_1+.02829\ X_2+.01151\ X_3+.05959\ X_4+.07629\ X_6+.07681\ X_8-.57163$
$R_{Y(12345678)}$=.816	1.37	.022	$Y=-.08106\ X_1+.02742\ X_2+.01092\ X_3+.05866\ X_4+.06268\ X_5+.07768\ X_6+.00559\ X_7+.07199\ X_8-.52919$

TABLE LXXV
SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD
ERROR OF Y AND REGRESSION EQUATIONS
(SMSG: ALL SUBJECTS)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
r_{Y5}=.685	1.94	16.805	$Y=.25516\ X_5-.07276$
$R_{Y(58)}$=.728	1.87	2,334	$Y=.14532\ X_5+.14505\ X_8-1.06785$
$R_{Y(578)}$=.773	1.78	2,838	$Y=.13405\ X_5-.08615\ X_7+.18532\ X_8+.41024$
$R_{Y(2578)}$=.795	1.76	1.479	$Y=-.07896\ X_2+.11105\ X_5-.07894\ X_7+.25554\ X_8+.9512$
$R_{Y(25678)}$=.807	1.76	.887	$Y=-.07896\ X_2+.03143\ X_5+.0956\ X_6-.10046\ X_7+.26372\ X_8+.67788$
$R_{Y(245678)}$=.817	1.79	.660	$Y=-.08737\ X_2-.10066\ X_4+.0718\ X_5+.10481\ X_6-.13556\ X_7+.28339\ X_8+2.20135$
$R_{Y(1245678)}$=.822	1.83	.303	$Y=.05215\ X_1-.08328\ X_2-.09736\ X_4+.05865\ X_5+.11551\ X_6-.15285\ X_7+.25972\ X_8+1.65468$
$R_{Y(12345678)}$=.822	1.90	.027	$Y=.05639\ X_1-.08181\ X_2+.01033\ X_3-.09274\ X_4+.05624\ X_5+.11692\ X_6-.14898\ X_7+.25506\ X_8+1.2232$

TABLE LXXVI

SUMMARY OF CORRELATION COEFFICIENTS WITH STANDARD ERROR OF Y AND REGRESSION EQUATIONS (ALL TEXTS: COMBINED STUDY GROUP)

Multiple R (or r)	Standard Error of Y	F Value	Regression Equations
$r_{Y6}=.691$	1.84	461.42	$Y=.211\ X_6-.6595$
$R_{Y(68)}=.719$	1.77	42.358	$Y=.15175\ X_6+.07815\ X_8-1.17192$
$R_{Y(468)}=.735$	1.73	24.652	$Y=.07046\ X_4+.11379\ X_6+.0643\ X_8-1.47397$
$R_{Y(4568)}=.740$	1.71	9.636	$Y=.05915\ X_4+.05401\ X_5+.08458\ X_6+.05666\ X_8-1.54011$
$R_{Y(24568)}=.743$	1.71	4.689	$Y=.02582\ X_2+.05536\ X_4+.04938\ X_5+.08206\ X_6+.04424\ X_8-1.64466$
$R_{Y(245678)}=.744$	1.71	2.084	$Y=.02021\ X_2+.05489\ X_4+.04989\ X_5+.08024\ X_6+.01927\ X_7+.0295\ X_8-1.61215$
$R_{Y(1245678)}=.745$	1.71	.800	$Y=.01444\ X_1+.01806\ X_2+.05396\ X_4+.04979\ X_5+.07191\ X_6+.01408\ X_7+.0271\ X_8-1.69703$
$R_{Y(12345678)}=.745$	1.71	.0001	$Y=.0144\ X_1+.01805\ X_2+.00011\ X_3+.05394\ X_4+.04978\ X_5+.07915\ X_6+.01409\ X_7+.0271\ X_8-1.69752$

APPENDIX D

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH GRAPHIC CUTTING SCORES

TABLE LXXVII

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR SILVER BURDETT GROUP (V + N + AC + WK)

Sum of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
136-40											2	65
131-35									2			63
126-30									1		1	61
121-25								2			1	59
116-20							1	1	1		3	56
111-15			1	1		1	1		2		1	50
106-10				1		1	1			1		45
101-05				1		3	3		2	1		42
96-100			1	2		3	1					33
91-95				2	2	3	2			1		29
86-90			1	3		2	1	1				21
81-85		1	1	5	1	1						17
76-80		1	3	9	1	1						15
71-75		1	2	12		2	1			1		13
66-70	1	1	5	19	1	2		1				9
61-65	2	3	3	27	1							5
56-60	3	2	2	34		1						4
51-55	1	1	3	39	1	1						3
46-50	2	3	1	45	1							1
41-45	2			47								
36-40	3			50								

Cutting score: 85 — Minimun error: 20

TABLE LXXVIII

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR SILVER BURDETT: SCHOOL NO. 1 (AR + AC + WK)

Sum of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
110-14											2	18
105-09								1				16
100-04									1			15
95 -99							3	1				14
90 -94												10
85 -89												10
80 -84									2			10
75 -79					1		1					8
70 -74			1	1		4	1					6
65 -69				1								1
60 -64			2	3		1						1
55 -59		1		4								
50 -54		1	2	7								
45 -49	2	1	2	12								
40 -44	1	1	1	15								
35 -39		1		16								
30 -34	1			17								
Un -30	1			18								

Cutting score: 69 Minimum error: 2

TABLE LXXIX

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR SILVER BURDETT: SCHOOL NO.2
(N + WK)

Sum of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
51 -54									1			8
47 -50												7
43 -46										1		7
39 -42						4						6
35 -38			1	1						1		5
31 -34		1	2	4	1							4
27 -30	1	1	2	8				1				3
23 -26	2		1	11	2							2
19 -22	1			12								
15 -18	2			14								

Cutting score : 35 Minimum error : 5

TABLE LXXX

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR SILVER BURDETT: SCHOOL NO.3 (N + AC)

Sum of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
55 -58									1		1	26
51 -54									2		2	24
47 -50									1			20
43 -46										1		19
39 -42						1	1			1		18
35 -38							3					15
31 -34		2	1	3		5	1	1				12
---	---	---	---	---	---	---	---	---	---	---	---	---
27 -30		2	1	6	2	2						5
23 -26			3	9		1						1
19 -22	2	1		12								

Cutting score : 30 Minimum error : 8

TABLE LXXXI

DISTRIBUTION OF RAW SCORES WITH CUTTING SCORES FOR ARITHMETIC COMPUTATION
Silver Burdett: School No. 4

Sum of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F
33-34								1				13
31-32											2	12
29-30											1	10
27-28						1						9
25-26					1	3						8
23-24			2	2		1						4
21-22			1	3	1							3
19-20				3		1	1					2
17-18			1	4								
15-16				4								
13-14	1	1		6								

Cutting Score: 24 Minimum error: 4

TABLE LXXXII

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR LAIDLAW: ALL SCHOOLS
(N + AP + WK)

Sum of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
104-07									1	1		47
100-03									1	2		45
96-99								1		1		42
92-95						1		3				40
88-91											1	36
84-87								2				35
80-83							1	2	1			33
76-79								1	2	1		29
72-75						1	2	1	3		1	25
68-71						1						17
64-67					3	1			2			16
60-63	1		1	2				1				10
56-59				2	1	2						9
52-55		1	2	5	1	1						6
48-51				5		1						4
44-47	2	2	2	11	3							3
40-43	2	1	4	18								
36-39		2	2	22								
32-35		1		23								
28-31		1		24								

Cutting Score: 55 Minimum error: 8

TABLE LXXXIII

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR LAIDLAW: SCHOOL NO.1
(AR + AP + WK)

Sum of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
105-08								2				15
101-04									1			13
97-100									1			12
93-96												11
89-92									1			11
85-88								1				10
81-84								1				9
77-80								1				8
73-76							2					7
69-72												5
65-68							1					5
61-64						1						4
57-60												3
53-56			1	1	1		1					3
49-52			1	2	1							1
45-48				2								
41-44			1	3								
Un-40		3	2	8								

Cutting Score: 56 Minimum error: 3

TABLE LXXXIV

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR LAIDLAW: SCHOOL NO.2 (AC + AP)

Sum of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
62-65									2			15
58-61								1				13
54-57									1	1	1	12
50-53						1						9
46-49						2		1				8
42-45					2	1			1			5
38-41												1
34-37												1
30-33	1	1	1	3	1							1
26-29				3								
22-25		1	1	5								
18-21		1		6								

Cutting Score: 33 Minimum error: 1

TABLE LXXXV

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT
VARIABLES WITH CUTTING SCORE FOR
LAIDLAW: SCHOOL NO. 3
(AC + AP)

Sums of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
53-54										1	1	9
51-52												7
49-50										1		7
47-48									1			6
45-46												5
43-44								1				5
41-42					1							4
39-40									1			3
37-38						1						2
35-36	1		1	2								1
33-34	1			3			1					1
31-32		1		4								
29-30				4								
27-28			1	5								
25-26				5								
23-24				5								
21-22	1			6								

Cutting Score: 36 Minimum error: 1

TABLE LXXXVI

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR LAIDLAW: SCHOOL NO. 4
(AR + AC + R)

Test	Unsuccessful				Successful							
Score	0	1	2	C.F.	3	4	5	6	7	8	9	C.F
85-Up								1		2		8
81-84												5
77-80												5
73-76								1				5
69-72					1				1			4
65-68												2
61-64								1				2
57-60		1		1								1
53-56			1	2	1							1
49-52				2								
45-48				2								
41-44	1		1	4								

Cutting Score: 60 Minimum error: 1

TABLE LXXXVII

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE
PRENTICE-HALL GROUP
(LU + N + AP)

Sum of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
100-up								3	3	2	4	92
97-100						1			1	1	2	80
93 -96			1	1		1		2	2			75
89 -92			1	2					5			70
85 -88				2				1	2	1		65
81 -84				2		2	3	3	1	1		61
77 -80			1	3		1				1		51
73 -76			1	4	1	2	2					49
69 -72			1	5	2	1		4		1		44
65 -68	1	2	2	10	1		3		3	1		36
61 -64			1	11	2	3	3					28
57-60		2	8	21		2		2				20
53 -56	2		4	27		1						16
49 -52	1		2	30	3	1	2	1				15
45 -48		2	2	34	3							8
41 -44	2	1	3	40	1							5
Un -40	10	4	3	57	2	2						4

Cutting score: 60 Minimum error: 31

TABLE LXXXVIII

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR PRENTICE-HALL: SCHOOL NO.1 (LU + AP)

Sums of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
90-93											1	52
86-89												51
82-85									2	1		51
78-81								1				48
74-77						1		1		1		47
70-73								1	2			44
66-69								1	4			41
62-65							1	1	2			36
58-61			1	1			1	1	1			32
54-57				1		3	1	3	1			29
50-53			2	3		2	2	1	1			21
46-49			2	5		1						15
42-45	1		3	9	1		1		1			14
38-41	2	1	1	13		4		1				11
34-37			3	16	1							6
30-33			3	19	2							5
26-29	2	2	1	24	1	2						3

Cutting Score: 49 Minimum error: 18

TABLE LXXXIX

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR PRENTICE-HALL: SCHOOL NO.2 (N + AP)

Sums of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
78-81											1	40
74-77											1	39
70-73										1	1	38
66-69										1	1	36
62-65										1		34
58-61						1			1		1	33
54-57			1	1				1				30
50-53		1		2		1		1				29
46-49			1	3	2		3	1	1	2		27
42-45		1	1	5	1	1	2			1		18
38-41		1	1	7	1	1		2				13
34-37		1	4	12	2							9
30-33	1		3	16	2		2		1			7
26-29	3	1	2	22								2
22-25	3			25	1							2
18-21	1	4	1	31	1							1
14-17	1			32								
10-13	1			33								

Cutting Score: 40 Minimum error: 16

TABLE XC

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR HARCOURT BRACE: ALL SCHOOLS (V + AC + AP)

Sums of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
122-27										2	1	75
116-21							1		1	1		72
110-15								1	1	1		69
104-09							3	4		1		66
98-103							1	2	2	2		58
92-97					1	2	2	2	1	2		51
86-91					1	5	5	2	1	1		41
80-85			1	1	4		1	1	1	1		26
74-79	2		3	6	2	2	1			1		18
68-73			3	9	2	2			1			12
62-67		2	1	12	1	3						7
56-61		4		16			1					3
50-55	2	1	3	22								2
44-49		1	2	25	1			1				2
36-41	1			26								

Cutting Score: 79 Minimum error: 19

TABLE XCI

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR HARCOURT BRACE: SCHOOL NO.1 (LU + AC)

Sums of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
81-84										1		11
77-80												10
73-76												10
69-72												10
65-68										1		10
61-64			1	1				1		1		9
57-60				1					1	1		7
53-56				1								5
49-52				1		1						5
45-48				1		1			1			4
41-44			1	2								2
37-40		3		5		1						2
33-36		1		6								1
29-32			3	9	1							1
25-28		1	1	11								

Cutting Score: 44 Minimum error: 3

TABLE XCII

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR HARCOURT BRACE: SCHOOL NO.2 (LU + WK)

Sums of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
74-77										1		14
70-73												13
66-69										1		13
62-65									1			12
58-61								1	1	1		11
54-57							1					8
50-53												7
46-49					1			1				7
42-45						1		1				5
38-41												3
34-37			1	1			1					3
30-33				1		1						2
26-29				1								1
22-25			1	2		1						1

Cutting Score: 37 Minimum error: 3

TABLE XCIII

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR HARCOURT BRACE: SCHOOL NO. 3
(N + AC + AP)

Sums of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
123-27											1	50
118-22										1		49
113-17									1	2		48
108-12							2		2	1		45
103-07							1			1		40
98-102							3	2				38
93-97							2	5	1			33
88-92						2	3	2				25
83-87					2	3	1					18
78-82					2		1					12
73-77	1		1	2	2	2						9
68-72	1		3	6	2	1						5
63-67				6	1							2
58-62		1	1	8	1							1
53-57		2		10								
48-52	1			11								
43-47				11								
38-42	1			12								
33-37	1			13								

Cutting Score: 72 Minumum error: 7

TABLE XCIV

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR Holt Rinehart Winston Group (N + AC + AP + R)

Sums of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
149-54										1		43
143-48										1		42
137-42									1	1		41
131-36									1			39
125-30								2	1			38
119-24							1		1	1		35
113-18									2			32
107-12					1	1	1	1				30
101-06						1			2	1		26
95-100			1	1		2		1				22
89-94				1		2	1	1	2			19
83-88				1	1	2			1			13
77-82				1	1	2						9
71-76				1	1	1						6
65-70			1	2	1							4
59-64		1		3	1	1						3
53-58		1	1	5								1
47-52				5								1
41-46				5								1
35-40		1	1	7		1						1
29-34	1			8								

Cutting Score: 58 Minimum error: 4

TABLE XCV

DISTRIBUTION OF RAW SCORES WITH CUTTING SCORE
FOR ARITHMETIC COMPUTATION
FOR THE SMSG GROUP

Test	Unsuccessful				Successful							
Score	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
29-30								2		1	1	16
27-28									1			12
25-26								2		1		11
23-24								1	1			8
21-22									1			6
19-20			1	1		1			1			5
17-18			1	2								3
15-16				2				2				3
13-14			1	3								1
11-12	1			4								1
9-10				4								1
7-8	1			5				1				1

Cutting Score: 14 Minimum error: 3

TABLE XCVI

DISTRIBUTION OF SUMS OF RAW SCORES FOR SIGNIFICANT VARIABLES WITH CUTTING SCORE FOR THE COMBINED STUDY GROUP (LU + N + AC + AP + R)

Sums of Scores	Unsuccessful				Successful							
	0	1	2	C.F.	3	4	5	6	7	8	9	C.F.
205-Up										3	2	338
195-204										2		333
185-194							3	1	6	3		331
175-184							1	6	2	4	1	318
165-174						2	1	4	5	2	3	304
155-164			1	1			2	2	4	3	4	287
145-154				1	3	3	6	9	13	3	4	272
135-144			1	2	2	6	8	10	5	4	3	231
125-134	3		3	8	4	6	4	5	5	7		193
115-124		1	9	18	6	12	6	8	6	1	1	162
105-114		3	9	30	11	16	6	4	8	2		122
95-104		2	12	44	2	8	5	5	4	2		75
85-94	5	8	12	69	8	13	2	3				49
75-84	5	11	14	99	5	2	1	2				23
65-74	8	11	13	131	4	3	1					13
55-64	11	6	8	156	3							5
45-54	6	3	2	167	1	1						
Un-44	3			170								

Cutting Score: 94 Minimum error: 93

VITA

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Candidate for the Degree of

Doctor of Education

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