PREDICTING ACHIEVEMENT IN ALGEBRA 1 AT THE ELKHART JUNIOR HIGH SCHOOL

by 688

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CHAPTER I

INTRODUCTION

Background. Much attention has been focused on the ninth-grade year of the student. This attraction of attention is due, in part, to opportunities afforded the student through a selection of subjects. Mathematics is one of the first areas in the school curriculum in which a choice or selection is usually made. The selection is commonly made between algebra and general mathematics. It is recommended that assignment or selection be made on the basis of prognostic tests in algebra, scholastic ability, previous marks in mathematics, and pupil's choice; and that the assignment should be a composite judgement of the administrator, mathematics teachers, guidance counselor, parents, and the pupil.[1] Of course, the degree to which each participates in this decision depends upon the method that has been established by the school.

Recently, the method by which students at the Elkhart Junior High School are selected for algebra or general mathematics was changed. Formerly, the ninth-grade class was grouped into three sections on the basis of their eighth-grade performance in English, mathematics, and science. The students in the

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[1]Earl S. Elliott, "Mathematics and Guidance in Kansas Schools at the Ninth-Grade Level," The Mathematics Teacher, 48:433-34, October, 1955.

two higher sections were required to take algebra and those students in the lower section took general mathematics. For the past three years a more democratic approach has been used by letting the students exercise, to some extent, their own prerogative. However, the principal must approve the enrollment thus providing opportunity for counseling when it appears that the student has made an unsatisfactory choice. The principal's experience as a former mathematics teacher and guidance counselor has contributed to the success of this procedure.

Statement of the Problem. The purpose of this study was to determine the relationship between selected factors and achievement in Algebra 1. More specifically, it was intended to:

1. Determine the relationship between achievement in Algebra 1 as measured by the yearly grade and the factors of: (1) Verbal Reasoning score on the Differential Aptitude Test (DAT), (2) Numerical Ability score on the DAT, (3) Verbal Reasoning and Numerical Ability composite score on the DAT, (4) Abstract Reasoning score on the DAT, (5) Clerical Speed and Accuracy score on the DAT, (6) Mechanical Reasoning score on the DAT, (7) Space Relations score on the DAT, and (8) eighth-grade yearly mathematics grade.

2. Determine the relationship between the selected factors and achievement in Algebra 1 for two subgroups of the population formed on the basis of sex.

3. Investigate the comparative value of the more important factors in predicting achievement for each subgroup.

4. Develop multiple regression equations for predicting achievement in Algebra 1 for the population and each subgroup.

Importance of the Study. There is encouragement from professional guidance personnel to delete as much guesswork

as possible from the process of guidance. The need for prediction studies based on local data is advocated quite strongly.[1] A predictive study in mathematics had never been done at the Elkhart Junior High School. In the interest of the mathematics department and ninth-grade student, it was felt that such a study could provide a means for more profitable utilization of the data available.

Definition of Terms.

1. Achievement. A level of subject mastery as measured by the yearly grade.

2. Grade. A letter, or letter accented with a positive or negative sign, used to indicate a level of accomplishment in a subject.

3. Grade value. A numeral assigned to a grade as follows: F = 1, D- = 2, D = 3, D+ = 4, C- = 5, C = 6, C+ = 7, B- = 8, B = 9, B+ = 10, A- = 11, and A = 12.

4. Selected factors. All variables included as possible predictors of achievement in Algebra 1. The following were used as selected factors: (1) VR, Verbal Reasoning score on the DAT; (2) NA, Numerical Ability score on the DAT; (3) VR + NA, Verbal Reasoning and Numerical Ability composite score on the DAT; (4) AR, Abstract Reasoning score on the DAT; (5) CSA, Clerical Speed and Accuracy score on the DAT; (6) MR, Mechanical Reasoning score on the DAT; (7) SR, Space Relations score on the DAT; and (8) 8th Math, the eighth-grade yearly mathematics grade.

Limitations of the Study. The small number of students available, plus having to use only those students for which all scores were available were limiting factors of the study. The

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[1]Henry S. Dyer, "The Need for Do-It-Yourself Prediction Research in High School Guidance," Personnel and Guidance Journal, 36:163, November, 1957.

study was limited by the use of only that data which were available from the school records and usual testing program.

CHAPTER II

REVIEW OF LITERATURE

In the last half century educators have been actively engaged in predicting success in subjects by use of data other than just past performance. The literature is replete with research concerning the prediction of success in beginning algebra. The prognostic studies in algebra are characterized by (1) the type of instruments employed for measuring achievement, (2) the type of instruments used for predicting achievement, and (3) the predictive efficiency of the various forecasting instruments.

Achievement as used in many of the articles reviewed referred to performance on tests. Many of the tests were standardized achievement tests. In other studies, the criterion of achievement referred to the degree of attainment in the subject as shown by the teachers' marks.

Prognosis in algebra followed the development of tests, and often prompted the construction of tests designed for the specific purpose of measuring aptitude for algebra. As new tests or revised tests became available, they were employed as possible means for forecasting success in algebra. Those generally used were tests of intelligence, algebra prognostic tests, achievement tests, and general aptitude tests.

Use of the Intelligence Test. Prognostication of

probable success in algebra gained its foothold in the 1920's. Many looked upon the intelligence test as having real potential for such activity. In a paper presented at the meeting of the National Association of Directors of Educational Research at Atlantic City, New Jersey in 1921, Bright[1] concluded that the probable success of first-year pupils in the various subjects could be predicted with a reasonably high degree of accuracy. He based his conclusion upon the relationship of Latin, English, and algebra marks to scores on the Terman Group Test of Mental Ability. First quarter marks of 147 students were used. The coefficients of correlation were .65, .72, and .50 respectively.

Using a different approach, Elder[2] combined student ranks to get mean percentile ranks from two standard intelligence tests, the Mental Survey Scale Number One, prepared by the Department of Psychology of Indiana University and the Otis Self-Administering Test of Mental Ability. The correlation between the marks in algebra and the mean percentile ranks in intelligence was .60 ± .06. Based on the fifty students studied, his conclusion on accuracy of prediction was congruent with the study previously mentioned.

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[1]Ira J. Bright, "The Intelligence Examination for High-School Freshmen," Journal of Educational Research, 4:44-55, June, 1921.

[2]Harry E. Elder, "Percentile Rank in Intelligence as a Prognosis of Success in Algebra," The School Review, 34:143-46, September, 1926.

With an expressed interest in selecting students for different ability groups, McCuen[1] found the Group Intelligence Quotient, as determined by the Terman Group Test of Mental Ability ($r = .57 \pm .06$), was a better basis for grouping students in algebra according to probable success than any of the other criteria used in his study. He was concerned with determining the relative value of the Group Intelligence Quotient, score on the Revision of the Stanford Achievement Test, score on the Arithmetic Computation section of the Stanford Test, score on the Arithmetic Reasoning section of the Stanford Achievement Test, score on the Terman Group Test, score on the Number Series section of the Terman Test, and score on the Arithmetic section of the Terman Group Test in predicting a student's success in algebra. Success in algebra was measured by a Douglass Stanford Diagnostic Algebra Test. He further concluded that there are too many unmeasurable factors to permit the accurate prediction of success in algebra.

Research by Rosilda[2] challenges some of the conclusions made on the value of the I.Q. as a predictive measure. Only a moderate relationship ($r = .42$) between I.Q. scores and algebraic achievement was found. In her study ($N = 635$), success in

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[1]Theron L. McCuen, "Predicting Success in Algebra," Journal of Educational Research, 21:72-74, January, 1930.

[2]Sister Mary Rosilda, "Is an I.Q. an Index to Algebra Ability?" Journal of Educational Research, 44:391-93, January, 1951.

algebra was measured by the Cooperative Elementary Algebra Test, and the California Test of Mental Maturity, Advanced S Form, was used as the predictive instrument.

More specific conclusions were reached in a ten year study (N = 1146) by Mitchell.[1] Of the eleven classes included in the study, four were given the Terman Group Test of Mental Ability, while the remaining seven classes were given the Otis Self-Administering Intelligence Test. That pupils with an I.Q. of one hundred or above are almost certain to pass algebra and that pupils with I.Q.'s of ninety or below should not be encouraged to pursue algebra were two of the conclusions made. Greenspan[2] supports this latter conclusion. However, he also utilized the New York Arithmetic Computation Test scores to reveal that students selected for the study of algebra should be required to have at least an I.Q. of ninety and a minimum Computation Test score of seven and two-tenths.

Use of the Algebra Prognostic Test. The Rogers Test of Mathematical Ability was the forerunner of the tests developed for the specific purpose of measuring ability in mathematics.[3]

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[1]Claude Mitchell, "Prognostic Value of Intelligence Tests," Journal of Educational Research, 28:577-81, April, 1935.

[2]Philip Greenspan, "Predicting Success in Algebra," High Points, 35:19-22, May, 1953.

[3]Joseph B. Orleans, "A Study of Prognosis of Probable Success in Algebra and in Geometry," The Mathematics Teacher, 27:173, April, 1934.

Apparently it was one of the least used, judging from the lack of published studies concerning its value. However, Dickter[1] found it to be the best criterion of prediction, with teachers' marks and I.Q.'s ranking second and third respectively. By correlating results of the Breslich Algebra Survey Test, First Semester, Form A with results of the Rogers Test, results of the Otis Group Intelligence Scale, and with teachers' marks for the year's work in eighth-grade general mathematics, coefficients of .65 ± .05, .54 ± .06, and .61 ± .06 were obtained. A composite of the Rogers Test and teachers' marks produced a multiple correlation coefficient of .73 ± .04 as the best combination of two predictive variables, but an inappreciable increase of .01 in the multiple R was obtained by a combination of all three measures.

After constructing his algebra prognostic test, Orleans[2] conducted studies in several New York City Schools. He reported seventeen coefficients of correlation (the sum of the N's equal to 1088) ranging from .50 to .80 between scores on his test, the Orleans Algebra Prognosis Test, and the Columbia Research Bureau Algebra Test. Seventeen r's were also reported using marks as the criterion of success. They ranged from .06 to .92. Of the three instruments studied, he indicated a preference for the

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[1]M. Richard Dickter, "Predicting Algebraic Ability," The School Review, 41:604-6, October, 1933.

[2]Joseph B. Orleans, "A Study of Prognosis of Probable Success in Algebra and in Geometry," The Mathematics Teacher, 27:225-46, May, 1934.

test of specific ability, with the intelligence test (the Otis Self-Administering Test) second, and the arithmetic marks third. Grover[1] also found that the Orleans Test predicted achievement very well; although, the validity of the prognosis was increased if the Orleans Test was combined with that of an intelligence test. A multiple regression equation was developed for predicting scores on the Columbia Research Bureau Algebra Test in terms of the Terman Group Test of Mental Ability and the Orleans Test. He recommended that those students whose predicted score obtained from the equation was seven or less (twenty-five possible) could strongly be urged to take other courses and omit algebra.

The Lee Test of Algebraic Ability was found to be the best single predictor of achievement in an investigation by Lee and Hughes.[2] When correlated with results on the Columbia Algebra Test, the Lee Test gave a coefficient of correlation of .62. The best prediction of marks in algebra was obtained by the use of either the Hughes Trait Rating Scale (r = .60) or the teachers' rating on mathematical ability (r = .59). Other factors considered in the study were the Kuhlmann-Anderson Intelligence Test results, the Terman Group Test of Mental Ability results, and

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[1]C. C. Grover, "Results of an Experiment in Predicting Success in First Year Algebra in Two Oakland Junior High Schools," The Journal of Educational Psychology, 23:309-14, April, 1932.

[2]J. Murray Lee and W. Hardin Hughes, "Predicting Success in Algebra and Geometry," The School Review, 42:188-96, March, 1934.

chronological age. The multiple correlations of achievement in algebra and certain combinations of these factors were as follows: test of algebraic ability and the Kuhlmann-Anderson Intelligence Test, .65; trait rating and the Kuhlmann-Anderson Intelligence Test, .59. Critical scores were determined. Pupils receiving a score on the aptitude test of less than sixty-four and a trait rating of less than forty were given rather small chances for success. Some ramification of their study indicated that poor teaching, resulting in low achievement, tended to lower the predictive value of the factors considered. Another study conducted for the specific purpose of determining the influence of the teacher factor in predicting success disclosed this same adverse affect.[1]

Torgerson and Aamodt[2] found the Lee Test of Algebraic Ability, the Orleans Algebra Prognosis Test, and the Otis Self-Administering Test of Mental Ability all about equally effective in predicting grades in algebra. The intelligence quotients correlated with marks in algebra at the end of the first semester to the extent of .61. The Orleans Test and grades in algebra yielded a coefficient of .60, while the Lee Test and algebra

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[1]William H. Dunn, "The Influence of the Teacher Factor in Predicting Success in Ninth Grade Algebra," Journal of Educational Research, 30:577-82, April, 1937.

[2]T. L. Torgerson and Geneva P. Aamodt, "The Validity of Certain Prognostic Tests in Predicting Algebraic Ability," Journal of Experimental Education, 1:277-79, March, 1933.

grades yielded a coefficient of .62. However, when critical scores were set up, they found that the sharpest discrimination was made by the intelligence test as twenty-two of twenty-three pupils with intelligence quotients below ninety failed in algebra at the end of the year. The fortieth percentile was selected as the critical point on both prognostic tests. The Orleans Test and the intelligence test agreed on nine cases; the Lee Test and the intelligence test agreed on fourteen cases; and all three agreed on eight cases.

Several studies showed the Iowa Algebra Aptitude Test to be superior to many of the predictive instruments mentioned heretofore. Morris[1] found that the Iowa Test (N = 141) correlated better with first semester grades than either the Orleans or the Lee Test of algebraic aptitude, an r = .69 compared to r = .67 and r = .63 respectively. An unusual increment was found in the multiple correlation coefficient over the zero-order coefficient of correlation when results on a General Scholarship Test were combined with the Iowa Test results, from r = .69 to R = .77. Slight increases of .02 and .03 were obtained over the simple coefficients of correlation when Arithmetic Computation scores, intelligence quotients, or Arithmetic Reasoning scores were combined with the Iowa Test results.

Using the Iowa Algebra Aptitude Test against the first

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[1]Leon M. Morris, "Prognosis in First Year Algebra," Ohio Schools, 18:20-21, January, 1940.

semester achievement test scores of 2,615 elementary algebra pupils in the Cleveland Public Schools, Grime[1] reported a coefficient equal to .68. The scores made on the Iowa Test by the Cleveland pupils ranged all the way from one to ninety-seven, with a median of approximately forty-five. Critical scores were set a fifty-five and above for those who were to be urged to take algebra; those making scores of thirty-seven and under were not to be enrolled in algebra in the ninth grade unless parental opposition was met. For those with scores from thirty-eight to fifty-four, additional evidence of ability was to be sought in records such as previous success in mathematics. Although critical scores were not determined, Guiler[2] reported a predictive value of the Iowa Test considerably higher than any of the related studies in which standardized algebra survey tests were used to measure achievement. Algebra aptitude test scores of the seventy-five pupils studied correlated with semester scores on the Breslich Algebra Survey Test, Form B, to the extent of an r of .775.

Considering the possibility that a reading test might be an aid in the prediction precedure, the Iowa Silent Reading Test

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[1]Herschel E. Grime, "Aptitude and Ability in Elementary Algebra," School Science and Mathematics, 47:781-84, December, 1947.

[2]W. S. Guiler, "Forecasting Achievement in Elementary Algebra," Journal of Educational Research, 38:25-33, September, 1944.

was included along with the Iowa Algebra Test and Otis Quick-Scoring Mental Ability Test as a predictive instrument in a study conducted by Shaw.[1] Of the 387 freshmen studied, sixty-four pupils failed the first term and forty-eight failed the second term for a twenty-nine per cent failure rate. Two plans for multiple screening were devised where the cutoff scores on both were I.Q.'s under ninety-three and Iowa Algebra scores of thirty or less. Plan I had a cutoff level on the Iowa Reading Test under the seventh-year level. This plan would have made it possible to eliminate thirty-eight of the students who were doomed to fail algebra, but twenty-four students who did pass the course would have been unjustly eliminated along with the others on the basis of the scores selected. Seventy-four students who did fail would not have been picked up in the screening. Similarly, Plan II, while it missed only forty-six who eventually failed, would have unjustly eliminated fifty-six students along with the sixty-six who did fail. Plan II had a cutoff reading level under that of a grade-eight level. Thus, as the reading level was raised those unjustly eliminated increased and those doomed for failure decreased, as would be expected. As measured by the Lankton First Year Algebra Test in this study, the Iowa Algebra Test correlated with achievement to the extent of $r = .54$, negligibly better than the intelligence test. Intelligence was

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[1]Geraldine S. Shaw, "Prediction of Success in Elementary Algebra," The Mathematics Teacher, 49:173-78, March, 1956.

correlated with achievement in algebra, r = .53; and reading ability was correlated with algebraic achievement, r = .45. The latter coefficient of correlation was identical to that obtained in an earlier study between mathematics marks and the Thorndike-McCall Silent Reading Scale.[1]

Use of Achievement Tests and Grades. In an effort to see whether educational quotients were of value in indicating probable success, Haddock[2] compared them with teachers' marks in the Louisville Public Schools. The educational ages were measured in the eighth grade by the Stanford Achievement Test. An educational age of fourteen years nine months or an E.Q. of 104.2 was reported as the median. She distributed the failures according to the various subjects and found that in algebra sixty-six per cent of the failures were made by students with E.Q.'s below 105, the approximate median value.

Seagoe[3] and Clifton[4] also reported work with the Stanford Achievement Test. The former reported it superior to both the

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[1]Charles E. Dickinson, "A Study of the Relation of Reading Ability to Scholastic Achievement," The School Review, 33:616-26, October, 1925.

[2]Nellie P. Haddock, "The Use of the Stanford Achievement Test to Indicate High School Success," School and Society, 25:114-16, January, 1927.

[3]May V. Seagoe, "Prediction of Achievement in Elementary Algebra," Journal of Applied Psychology, 22:493-503, October, 1938.

[4]L. L. Clifton, "Prediction of High School Marks in Elementary Algebra," Journal of Experimental Education, 8:410-13, June, 1940.

Orleans Algebra Prognosis Test and general intelligence tests in predicting grades. However, the latter utilized the Stanford scores and the Otis I.Q.'s in a prediction formula to find that if the prediction was as high as 3.50 (with C = 3 and B = 4) the student had a fifty-fifty chance of making above a C. This information was to serve as a forewarning against students neglecting opportunities to learn in the algebra class.

A locally constructed arithmetic test, as claimed by Frost and Brandes,[1] provided a predictive factor for beginning algebra that was just as significant as any of the similar commercially distributed standardized tests. They found the correlation of the arithmetic test with success in beginning algebra to be .54. Three predictive factors were used. The arithmetic test was followed by the Otis "A" Intelligence Test scores with a correlation of .51. Eighth-grade arithmetic marks were the least valid with a correlation of .15. They reported eighth-grade pupils unable to score more than fifteen on the arithmetic test, who had an Otis "A" Intelligence Test score of less than ninety-five, and had not earned a mark of "A" or "B" in eighth-grade arithmetic, had virtually no chance of earning a C in algebra.

To distinguish the useful predictive variables from a maze of thirteen variables, the Wherry-Doolittle Test Selection

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[1]Norman F. Frost and Louis G. Brandes, "Factors for Predicting Success in Beginning Algebra," California Journal of Educational Research, 7:79-83, March, 1956.

Method was employed by Dinkel[1] to find that the first variable selected was a Cooperative Mathematics Test, a measure of arithmetic competency. The I.Q. as measured on the California Test of Mental Maturity was added next, then came the previous year's arithmetic grades, and finally the scores from the Orleans Algebra Test. Disappointment in other variables such as "Numbers" and "Reasons" on Thurstone's Primary Mental Ability Test, chronological age, and sex was expressed. Success, as measured at the end of the year, was the average of scaled scores on two forms of the Cooperative Elementary Algebra Test.

Contradictory to the above study made in algebraic prognosis, Layton[2] found eighth-grade mathematics grades to be a better basis for prognosis than intelligence, eighth-grade achievement test results, or prognostic test results. The coefficient obtained from a correlation of eighth-grade mathematics grades with algebra grades was .82. Coefficients of .55, .67, and .64 were obtained when results of the Otis Self-Administering Test of Mental Ability, the New Stanford Arithmetic Test, and the Lee Test of Algebraic Ability were correlated with algebra grades. The highest multiple R reported was .86, which indicated further, that eighth-grade mathematics grades alone were

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[1]Robert E. Dinkel, "Prognosis for Studying Algebra," The Arithmetic Teacher, 6:317-19, December, 1959.

[2]R. B. Layton, "A Study of Prognosis in High School Algebra," Journal of Educational Research, 340:601-5, April, 1941.

practically as good as any combination of two or more of the independent variables.

Challenging the use of a cutoff percentile score of sixty or better on the Mathematics Concepts section of the SRA Achievement Test as a requisite to enrollment in algebra, Rothenberger[1] also found performance in eighth-grade mathematics the best indicator of success in algebra. Mathematics grades of two hundred randomly selected students correlated with algebra grades to yield a coefficient of .687. The other predictive variables, solid subject grades, Otis I.Q., SRA Mathematics Reasoning score, SRA Mathematics Concept score, SRA Mathematics Computations score, and the SRA Composite score correlated with achievement to produce coefficients of .624, .240, .393, .362, .630, and .444 respectively. Thus, if an achievement test score were to be used as a predictor, the Mathematics Computation section would be of more significance than any of the other scores. Further analysis of the data showed that students with less than a C average in eighth-grade mathematics could not expect to make C's or better in both semesters of algebra. Most all of the students who had only a D average in eighth-grade mathematics failed at least one semester of algebra. A majority of the students, as reported in this study, who had grade level equivalents of eight and one-half or lower on one or more sections of the SRA Test maintained less

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[1]Max L. Rothenberger, "Who Should Take Algebra?" The Clearing House, 42:226-28, December, 1967.

than a C average in algebra.

Although reporting less relationship between eighth-grade mathematics grades and ninth-grade algebra grades (r = .58 in both studies), Callicutt[1] and others[2] support the previous two studies in singling out previous grades as the best predictor of success. They also found standardized achievement test results in second place, being better than I.Q. results, and the Orleans Algebra Prognostic Test results in the case of the latter study. However, with the decreased coefficient of correlation between mathematics grades and algebra grades, the achievement test results added significantly to the predictive value of previous mathematics grades.

A narrowing margin was found between the predicting efficiency of grades and achievement test scores in the preceding sequential arrangement of studies. As would be expected then, prevalence for the achievement test results over grades was found. Ivanoff[3] and others conducted an interesting study designed only to dichotomize students, designating them as either

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[1]Wade Callicutt, "The Problem of Predicting Success in Algebra," National Association of Secondary-School Principals, 45:107-11, November, 1961.

[2]Ward E. Barnes and John W. Asher, "Predicting Student's Success in First-Year Algebra," The Mathematics Teacher, 55:651-54, December, 1962.

[3]John M. Ivanoff, Evermode T. DeWane, and O. Praem, "Use of Discriminant Analysis for Selecting Students for Ninth-Grade Algebra or General Mathematics," The Mathematics Teacher, 58:412-16, May, 1965.

algebra students or general mathematics students. With the aid of an IBM 1620 digital computer and using a two-group multiple variable stepwise discriminant analysis program, they found the composite score from the High School Placement Test was selected as the best single predictor of the dichotomy. The remaining significant variables selected in heirarchal order were the Arithmetic score on the HSPT, eighth-grade mathematics marks and the Reading score on the HSPT. Four-hundred forty-eight freshmen were selected for the study. Impellitteri,[1] studying a sample composed of 3,194 boys, presented a different order on the sub-tests of the HSPT. Although only a moderate relationship was found r = .46 and r = .41, his study showed the HSPT Arithmetic scores correlated better with algebra grades than did the HSPT Composite score.

Use of the Differential Aptitude Test. The Differential Aptitude Test Battery has been one of many instruments more recently developed and has been subjected to investigation regarding its value in predicting success in mathematics. Rezac,[2] through the use of expectancy tables (N = 350), concluded from his study that in order for students to achieve any degree

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[1]Joseph T. Impellitteri, "Predicting Academic Achievement with the High School Placement Test," Personnel and Guidance Journal, 46:140-43, October, 1967.

[2]James L. Rezac, "Predicting Success of Ninth Grade Mathematics Students in Manhattan Junior High School" (unpublished Master's report, Kansas State University, Manhattan, Kansas, 1962), pp. 33-34.

of success in algebra the students should achieve a percentile rank of forty or over on the Numerical Ability Test of the DAT Battery. With regard to the Arithmetic Reasoning Test and Arithmetic Computation Test of the Stanford Achievement Test taken as sixth graders, the student should have achieved a rank of at least grade six to enroll in ninth-grade algebra. Eighth-grade mathematics grades were found to be the most accurate predictor with a recommendation whereby only those who have received a C, and preferable a B in the eighth grade be allowed to take algebra in the ninth grade. The Henmon-Nelson I.Q. score was labeled as the least reliable. An I.Q. rating of less than ninety was recommended as cut off scores for those who should definitely not attempt algebra. A study by Lazarus[1] also revealed eighth-grade mathematics grades as the best index to achievement in algebra. Coefficients of correlation equal to .747, .567, .108, and .389 were found between marks in algebra and eighth-grade mathematics grades, DAT Numerical Ability results, DAT Verbal Reasoning results, and the DAT Numerical plus Verbal Reasoning results, respectively.

Guilford[2] and others found that a combination of four DAT

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[1]Gary J. Lazarus, "The Use of Selected Factors for Prediction of Success in Algebra" (unpublished Master's report, Kansas State University, Manhattan, Kansas, 1968), p. 13.

[2]J. P. Guilford, Ralph Hoepfner, and Hugh Petersen, "Predicting Achievement in Ninth-Grade Mathematics from Measures of Intellectual-Aptitude Factors," Educational and Psychological Measurement, 25:659-82, Autumn, 1965.

subtests (the Verbal Reasoning, Numerical Ability, Abstract Reasoning, and the Clerical Speed and Accuracy) did about as well in predicting achievement in algebra as did batteries measuring a great variety of intellectual-aptitude factors. Multiple correlation coefficients of .53, .24, and .70 were obtained between the DAT subtests and achievement scores in three different levels of algebra, non-college algebra, regular algebra, and accelerated algebra. The best multiple coefficients of correlation reported for the factor tests were .56, .39, and .74 for the three levels of algebra. Two other standard test instruments other than the DAT were used in the study, the California Test of Mental Maturity and the Iowa Test of Basic Skills. Noticeable increases in the multiple R's resulted with the addition of the factor variables to the standard test instruments. The higher the level of the algebra course, the larger and more significant were the gains. The gains were least for addition to the DAT Battery and most for addition to the California Test of Mental Maturity. When the scores from the DAT, California Test of Mental Maturity, and the Iowa Basic Test were placed in competition with one another for inclusion in a stepwise multiple-regression scheme, the DAT Numerical Test was found to lead the list. The DAT Abstract variable and the Iowa Reading Comprehension results (in the case of the accelerated group) also appeared in the list of significant predictors in developing multiple regression equations.

Osburn and Melton[1] analyzed test data on eighty-two students in an experimental modern ninth-grade course in algebra and seventy-three students in a traditional ninth-grade algebra course. They found the sum of the Verbal Reasoning and Numerical Ability results from the DAT predicted proficiency in both courses with validity equal to that of the Iowa Algebra Aptitude Test and the Orleans Algebra Prognosis Test. The DAT Clerical Test was reported as having no predictive value for algebra, a contradiction to the latter study. With the exception of the Spatial and Mechanical Tests the other subtests of the DAT were found equally valid in predicting proficiency for each of the two groups. However, this was not found to be the case when Cain[2] collected grades in first-year algebra and utilized data available from a Biological Science Curriculum Study. Scores of the Differential Aptitude Tests of Numerical Ability and Verbal Reasoning indicated greater validity for prediction of the BSCS group than they did for the traditional biology group. Scores on the Verbal Reasoning and Numerical Ability Tests of the BSCS group correlated with algebra grades to the extent of .52 and .68, respectively. Likewise, scores of the traditional group

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[1]H. G. Osburn and R. S. Melton, "Prediction of Proficiency in a Modern and Traditional Course in Beginning Algebra," Educational and Psychological Measurement, 23:277-87, Summer, 1963.

[2]Ralph W. Cain, "Relationship of Verbal Reasoning and Numerical Ability to Achievement in First-Year Algebra," School Science and Mathematics, 66:131-34, February, 1966.

yielded coefficients of correlation equal to .37 and .46.

Different predictive values of the DAT subtests and other measures were found when students were grouped according to the sexes. Jacobs[1] reported all coefficients of correlation greater for girls where the grade point average in three or more high school mathematics subjects was correlated with scores on the DAT Verbal Reasoning Test, DAT Numerical Ability Test, DAT Mechanical Reasoning Test, Terman I.Q., and an Arithmetic Proficiency Test. The coefficients for the girls (N = 71) were .566, .654, .506, .622, and .671 respectively. Comparatively, coefficients of .379, .495, .271, .433, and .610 were obtained for the boys (N = 107). It was concluded that the inclusion of the DAT subtests for purposes of predicting high school academic success in various subject areas did not seem justified. The achievement and intelligence tests that were currently used were considered more effective than the DAT Battery as predictive tests.

Summary. Varied reports were given as to the predictive efficiency of each forecasting instrument or factor used. In general, those studies that investigated the I.Q. as a predictive factor agreed that it had value in predicting achievement in algebra. It was also the consensus of most studies that a student should have at least an I.Q. of ninety or above to enroll

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[1]James N. Jacobs, "Aptitude and Achievement Measures in Predicting High School Academic Success," Personnel and Guidance Journal, 37:334-41, January, 1959.

in algebra.

Algebra aptitude tests were favored in many of the studies. Several showed the Iowa Algebra Aptitude Test to be superior to the other algebra aptitude tests. Various studies established critical scores with algebra aptitude tests. In general, students that were not to take algebra ranked below the fortieth percentile. For students ranking between the fortieth and sixtieth percentile, additional indices to future success were to be used.

One of the biggest discrepancies among the studies seemed to lie in the utility of the eighth-grade mathematics grades for prognosis. In some studies, the previous year's performance was found as the best factor for predicting success in beginning algebra. Other studies revealed the contingent nature of grades. Prevalence for predicting success in algebra with achievement test results was found.

Studies utilizing the Differential Aptitude Test Battery varied as to its value in predicting success in algebra. It was the consensus of most studies using the DAT Battery that the Numerical Ability Test and composite score of the Verbal Reasoning Test and Numerical Ability Test displayed an effective role in forecasting future success in algebra.

CHAPTER III

DESIGN AND PROCEDURE

Population of the Study. The subjects of this study were taken from the ninth-grade students who completed Algebra 1 at the Elkhart Junior High School during the school years 1966-67 and 1967-68. A total of thirty-three ninth-graders completed Algebra 1 in 1966-67 and a total of thirty-eight ninth-graders completed the course in 1967-68. Complete data for each of the selected factors were not available for ten students; therefore the number included in the study was sixty-one--thirty girls and thirty-one boys. The subjects were believed to be typical of those who usually enroll in Algebra 1 as ninth-graders.

Description of Data. The data for the study were of two categories--grades and test scores. The grades used were the Algebra 1 and the eighth-grade mathematics yearly grades. As eighth graders, all students in the study were taught by the same teacher. The eighth-grade text used was Modern Mathematics Through Discovery Book Two published by the Silver Burdett Company. The textbook is designed to help pupils to move--step by step--from one idea to another. It emphasizes inquiry, exploration, and discovery. Attention is focused on the nature of numerical systems, fundamental ideas in geometry, ideas of structure, and elementary experiences in algebra.

Also as ninth graders, all student were taught by the same teacher, the writer in this case. The algebra text used was

Modern Algebra One published by the Houghton Mifflin Company. The textbook emphasizes the basic structure of algebra, properties of the real numbers, and the axioms applied in solving equations and inequalities.

The test scores used were those from the Differential Aptitude Test Battery. The battery yields scores for eight abilities and provides also a ninth score, Verbal Reasoning plus Numerical Ability, which is a measure of general scholastic aptitude or intelligence. Included in the battery of Differential Aptitude Tests are the following: Verbal Reasoning (VR), Numerical Ability (NA), Abstract Reasoning (AR), Clerical Speed and Accuracy (CSA), Mechanical Reasoning (MR), Space Relations (SR), Spelling (Sp), and Grammar (Gr). The Verbal Reasoning plus Numerical Ability score is designated by VR + NA.

The Verbal Reasoning Test is a measure of ability to understand concepts framed in words. It is aimed at the evaluation of the student's ability to abstract or generalize and to think constructively. It may be expected to predict with reasonable accuracy success in fields where complex verbal relationships and concepts are important. It should be considered in judgments to whether or not a student is likely "college material."

The Numerical Ability Test is designed to test understanding of numerical relationships and facility in handling numerical concepts. It is a measure of the student's ability to reason with numbers, to manipulate numerical relationships,

and to deal intelligently with quantitative materials. Educationally it is important for prediction in mathematics.

The Abstract Reasoning Test is intended as a nonverbal measure of the student's reasoning ability. It involves the ability to perceive relationships in abstract figure patterns.

The Clerical Speed and Accuracy Test is intended to measure speed of response in a simple perceptual task. It is designed to measure the student's speed and accuracy with simple number and letter combinations.

The Mechanical Reasoning Test is designed to measure understanding of mechanical and physical principles. The test items consist of a pictorially presented mechanical situation together with a simple worded question.

The Space Relations Test is a measure of ability to deal with concrete materials through visualization. The test involves visualizing an object rotated in various ways.[1]

Procedure. The data were obtained from the student's permanent record at the Elkhart Junior High School. All grades were converted to their corresponding grade value. Raw scores were used from the Differential Aptitude Test Battery. The data were then transferred to IBM cards according to the format of a multiple regression program obtained from the Statistics Department at Kansas State University. The program and data cards were

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[1]George K. Bennett, Harold G. Seashore, and Alexander G. Wesman, Fourth Edition Manual for the Differential Aptitude Tests (New York: Psychological Corporation, 1966), pp. 5-9.

then submitted to the Computer Center at Kansas State University. The complete data were run first and then divided into the sub-groups (according to sex) and run separately for each. Some difficulty was encountered on the first run of the data. This was due to the fact that the VR + NA variable was a linear combination of the VR variable and NA variable. This was overcome by elimination of the VR variable from the multiple regression part of the program.

The program printout included the following: a dictionary of variables, the simple correlation matrix, the regression coefficients and constants for writing the prediction equations using one to seven of the independent variables, the t values used to determine if the regression coefficients are significantly different from zero, the contribution made to R-square by the use of each additional independent variable in the prediction scheme, and the F value used to determine if the addition of that variable contributed significantly to the R-square value.

In addition to the tests of significance made on the regression coefficients and contributions to R-square, the t value which is used to determine if a simple coefficient of correlation indicates a significant relationship was calculated and tested for all coefficients obtained between each of the predictor variables and grades in Algebra 1.

CHAPTER IV

FINDINGS

Simple Correlations for the Population. Examination of Table I reveals that five of the independent variables used were found to be significantly related to achievement in Algebra 1. The largest coefficient of correlation, r = .69, was found between eighth-grade mathematics grades and achievement in Algebra 1. This identifies it as the best single predictor of achievement in Algebra 1 for the population. Approximately fifty per cent of the variance in the dependent variable can be accounted for by the variance in the mathematics grades. The VR, NA, and VR + NA factors from the Differential Aptitude Test Battery exhibited a fair degree of relationship to Algebra 1 achievement. With the VR and NA factors being significantly related to the dependent variable, the relationship of the VR + NA to the criterion is somewhat conspicuous. However, as a composite of the two, it shows a slight indication of being a better predictor of achievement for the population than the NA factor does by itself.

Simple Correlations for the Subgroups. The population was divided into two subgroups according to the sexes. This was done mainly as a measure to detect any unbalanced influence that either sex had on the population results.

When the data on the female and male groups were examined separately, the eighth-year mathematics grades still displayed

TABLE I

SIMPLE CORRELATION MATRIX FOR THE POPULATION

N = 61

Variable	VR	NA	VR + NA	AR	CSA	MR	SR	8th Math	Alg 1
VR	1.000								
NA	.457	1.000							
VR + NA	.914	.779	1.000						
AR	.128	.257	.208	1.000					
CSA	-.127	.205	.005	.061	1.000				
MR	.399	.095	.324	.194	-.114	1.000			
SR	.097	.261	.187	.481	.404	.424	1.000		
8th Math	.360	.576	.517	.206	.278	.096	.195	1.000	
Alg 1	0.455*	0.575*	0.584*	0.229	0.212	0.165	0.248*	0.693*	1.000

* Significant at the .01 level of confidence

the greatest value for predicting Algebra 1 grades. Tables II and III show that past performance of the girls in mathematics correlated somewhat better with achievement in Algebra 1 than it did for the boys, an r = .71 compared with an r = .68.

Varied results of the relationship of the DAT factors to achievement were obtained by separate treatment of the data. Inspection of Table II shows the Numerical Ability Test as the second best indicator of success for the girls. Table III reveals the VR + NA variable as the second best factor for predicting Algebra 1 achievement for the boys. When correlated with Algebra 1 grades, the VR, NA, and VR + NA factors for the female group gave coefficients of .40, .67, and .57 respectively. Only the NA and VR + NA factors proved to be significantly related to achievement in algebra. The same factors for the male group produced coefficients of .56, .50, and .61 respectively. All three coefficients were significant. The comparative value that the NA factor has in predicting for each subgroup presented an interesting finding (r = .67 vs r = .50). Both subgroups show very similar coefficients of correlation between eighth-grade mathematics grades and the NA scores (r = .56 for the girls and r = .55 for the boys), and both show similar correlations between eighth-year mathematics grades and algebra grades (r = .71 for the girls and r = .68 for the boys).

As stated previously, the VR + NA factor was found to rank second as an index to future achievement of the boys in algebra. Algebra grades correlated to the extent of .61 with the boys'

TABLE II

SIMPLE CORRELATION MATRIX FOR THE FEMALE SUBGROUP

N = 30

Variable	VR	NA	VR + NA	AR	CSA	MR	SR	8th Math	Alg 1
VR	1.000								
NA	.508	1.000							
VR + NA	.929	.790	1.000						
AR	.301	.250	.322	1.000					
CSA	-.021	.190	.067	-.079	1.000				
MR	.389	.209	.367	.279	.126	1.000			
SR	.285	.446	.394	.479	.307	.541	1.000		
8th Math	.291	.557	.446	.102	.212	.000	.097	1.000	
Alg 1	0.402	0.668*	0.572*	0.148	0.373	0.147	0.387	0.714*	1.000

* Significant at the .01 level of confidence

TABLE III

SIMPLE CORRELATION MATRIX FOR THE MALE SUBGROUP

N = 31

Variable	VR	NA	VR + NA	AR	CSA	MR	SR	8th Math	Alg 1
VR	1.000								
NA	.532	1.000							
VR + NA	.925	.814	1.000						
AR	-.002	.204	.090	1.000					
CSA	-.097	-.095	-.109	.008	1.000				
MR	.368	.248	.364	.274	.202	1.000			
SR	-.020	-.012	-.019	.447	.373	.610	1.000		
8th Math	.536	.552	.616	.276	.157	.452	.219	1.000	
Alg 1	0.560*	0.505*	0.611*	0.328	0.011	0.282	0.053	0.678*	1.000

* Significant at the .01 level of confidence

VR + NA scores; for the girls the same independent factor yielded a coefficient of correlation equal to .57. The comparative value that the VR factor has in predicting for each subgroup rests in the fact that it showed a significant correlation for the male group and proved to be insignificant for the female group.

Multiple Regression Analysis for the Population. With the yearly grades in Algebra 1 as the criterion variable (Y), combinations of the following factors were investigated for their predictive value:

X_1: Numerical Ability Test score

X_2: Verbal Reasoning plus Numerical Ability score

X_3: Abstract Reasoning Test score

X_4: Clerical Speed and Accuracy Test score

X_5: Mechanical Reasoning Test score

X_6: Space Relations Test score

X_7: Eighth-grade yearly mathematics grade.

When the data for the population were subjected to the multiple regression scheme the equation formulated for the maximum prediction of the criterion was

$$Y = -2.0415 + .0205X_1 + .0636X_2 + .0147X_3 + .0112X_4 - .0017X_5 + .0170X_6 + .5646X_7.$$

The multiple coefficient of correlation obtained between the combination of seven independent variables and the criterion was .748. By squaring this value, it can be seen that this combination accounts for approximately fifty-six per cent of the variance showed by the dependent variable. The mathematics

grades and VR + NA scores were the only factors that made a significant contribution to the R and R-square values. A combination of these two variables proved to do equally well in predicting as did all seven variables. They produced a multiple coefficient of .742. Inspection of Table IV reveals the ineffectiveness of the other five variables in the prognosis. The prediction equation formulated on the basis of the mathematics grades and VR + NA scores was

$$Y = -.7289 + .0703X_2 + .6052X_7.$$

Multiple Regression Analysis for the Subgroups. As would be expected from observing the results of the simple correlations, the multiple regression analysis proved to be equally varied in findings between the two subgroups. Since the eighth-grade mathematics grade showed the greatest relationship or largest simple coefficient of correlation with algebra grades for both subgroups, it was selected first when the independent variables were placed in competition with each other for inclusion in the predictive scheme. But, inspection of Table IV reveals that the variables from the DAT did not contribute in the same orderly fashion for both subgroups.

For the female group the NA factor added significantly (.01 level of confidence) to the multiple R and R-square values. The fact that the CSA scores added significantly (.05 level of confidence) above the contributions already made by the mathematics grades and NA scores is noteworthy. A combination of all seven variables yielded a multiple coefficient of correlation

TABLE IV

STEPWISE CONTRIBUTION TO THE R-SQUARE VALUES

Population		Female Subgroup		Male Subgroup	
Independent Variable	Contribution to R-Square	Independent Variable	Contribution to R-Square	Independent Variable	Contribution to R-Square
8th Math	0.480694*	8th Math	0.509338*	8th Math	0.459384*
VR + NA	.069379*	NA	.105929*	VR + NA	.060305#
SR	.007816	CSA	.039382#	AR	.030212
CSA	.001125	SR	.018409	SR	.016949
NA	.000728	VR + NA	.006625	NA	.006864
AR	.000542	AR	.003604	CSA	.000936
MR	0.000010	MR	0.003395	MR	0.000696

* Significant at the .01 level of confidence

Significant at the .05 level of confidence

equal to .829. The multiple regression equation formulated for the prediction of the Algebra 1 grades based on the seven independent variables was

$$Y = -4.4260 + .0868X_1 + .0490X_2 - .0445X_3 + .0644X_4 - .0351X_5 + .0704X_6 + .6008X_7.$$

A combination of the mathematics grades and NA scores produced a multiple R of .784, a noticeable decrease from that obtained with all independent variables. Approximately sixty-two per cent of the variance in the female Algebra 1 grades is predictable from the mathematics grades and NA scores. The multiple regression equation formulated for the female group based on these two variables was

$$Y = -2.8740 + .2396X_1 + .5920X_7.$$

The fact that the CSA scores showed a significant contribution to the R and R-square values at the .05 level of confidence merits some consideration. The multiple R obtained from a combination of the three most contributing predictive variables was .809. Sixty-five per cent of the variance showed by the dependent variable is accounted for by the variance in a combination of the mathematics grades, NA scores, and CSA scores. The prediction equation formulated from these factors was

$$Y = -6.6833 + .2266X_1 + .0819X_4 + .5545X_7.$$

For the male group, none of the DAT scores made a significant contribution to the multiple R using the .01 level of confidence. However, like the CSA scores for the female group, the VR + NA scores contributed significantly (at the .05 level) for

the male group to indicate some degree of usefulness in conjunction with the mathematics grades. A combination of all seven predictor variables produced a multiple correlation coefficient of .756, an R which indicates that approximately fifty-seven per cent of the variance in the male Algebra 1 grades is predictable from that combination. The multiple regression equation formulated by using all the independent variables was

$$Y = -2.6322 - .0666X_1 + .0858X_2 + .1313X_3 + .0120X_4 - .0153X_5 - .0377X_6 + .5090X_7.$$

A combination of the mathematics grades and VR + NA scores correlated with the criterion variable yielded a multiple correlation coefficient of .721. A multiple R of .721 reveals that the combination of the two accounts for approximately fifty-two per cent of the variance of the Algebra 1 grades. The prediction equation formulated from these two independent variables was

$$Y = .3562 + .0629X_2 + .5368X_7.$$

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Conclusions of the Study. Any conclusions drawn from the findings of this study are, of course, most applicable to the particular school system involved. If other variables, such as a standardized algebra aptitude test had been included, the best criteria found for prognosis in algebra might have differed. But in view of the variables used and the findings of the study, the following conclusions seem warranted: (1) the eighth-grade mathematics grade is the best single factor for predicting future achievement in ninth-grade algebra, (2) predictions made on the basis of more than one variable are decisively better than those based on a single variable, (3) it was indicated by the contribution of the Clerical Speed and Accuracy scores in predicting for the female subgroup that the girls exercised their ability to do routine work in algebra to a greater extent than the boys did, (4) a comparison of the coefficients of correlation obtained for each of the subgroups between eighth-grade mathematics grades and NA scores, between eighth-grade mathematics grades and algebra grades, and between algebra grades and NA scores indicates that the boys did not actualize their potential achievement in algebra in relation to their mathematical ability, and (5) marked differences can exist in the predicting efficiency that the same factors have for the two sexes.

Recommendations. The review of literature reveals the

suitability of an algebra prognostic test for predicting success in algebra. One of the limitations of this study is that an algebra aptitude test was not included as a predictor variable. Thus, in light of that limitation and the findings of the study, the following two recommendations are made: (1) that a more comprehensive selection of predictor variables be used when seeking data for predicting success in algebra, and (2) that separation of the sexes be considered when formulating prediction equations.

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APPENDIX

TABLE V

DIFFERENTIAL APTITUDE TEST SCORES AND GRADES

Student	Sex	VR	NA	VR + NA	AR	CSA	MR	SR	8th Math	Alg 1
1	F	19	24	43	37	50	41	25	4	6
2	M	30	14	44	30	33	40	18	6	6
3	F	37	27	64	44	54	45	47	8	8
4	F	31	29	60	32	60	41	26	10	9
5	M	26	19	45	38	43	50	39	4	7
6	M	21	23	44	32	38	40	14	6	7
7	F	21	20	41	39	47	42	20	5	1
8	F	43	31	74	39	64	47	47	10	11
9	M	20	24	44	34	49	39	24	6	9
10	F	32	27	59	42	53	48	44	11	12
11	M	17	13	30	32	40	39	16	4	7
12	F	23	20	43	33	49	27	19	8	7
13	M	20	14	34	40	40	50	35	5	5
14	F	29	24	53	41	49	44	45	8	8
15	M	30	25	55	33	45	50	23	7	6
16	F	15	17	32	24	68	35	22	10	10
17	F	25	22	47	41	57	48	31	10	11
18	F	18	18	36	33	43	40	35	2	5
19	F	29	18	47	31	50	47	25	5	6
20	F	11	17	28	31	42	28	18	8	1
21	M	39	18	57	33	42	57	42	6	5
22	M	40	24	64	31	55	51	34	10	9
23	M	33	22	55	37	31	43	37	8	9
24	M	21	18	39	41	49	50	46	5	7
25	M	20	15	35	31	43	41	18	4	6
26	M	28	20	48	28	42	48	23	8	7
27	M	10	14	24	41	44	45	34	5	3
28	F	21	20	41	34	52	45	43	4	6
29	M	20	21	41	36	38	48	29	7	6
30	F	19	25	44	33	62	48	37	8	7
31	M	26	13	39	36	52	53	35	6	6
32	F	33	16	49	41	49	50	27	4	3
33	M	38	20	58	33	53	49	21	8	11
34	F	13	18	31	40	66	40	40	7	7
35	F	39	22	61	39	59	42	33	7	6
36	F	20	26	46	36	47	44	29	8	6
37	M	28	12	40	32	37	44	15	7	6
38	F	26	24	50	28	59	49	37	7	5
39	M	23	18	41	36	35	46	21	5	7
40	M	25	25	50	29	41	40	21	5	4
41	M	14	13	27	38	58	45	37	9	6
42	M	17	12	29	19	48	46	29	3	1

TABLE V (continued)

Student	Sex	VR	NA	VR + NA	AR	CSA	MR	SR	8th Math	Alg 1
43	M	39	32	71	39	36	45	18	8	8
44	F	19	17	36	30	56	33	23	5	5
45	M	31	22	53	34	42	47	17	5	4
46	F	27	26	53	40	51	28	24	8	9
47	F	16	12	28	40	51	42	20	8	3
48	M	37	17	54	36	40	46	19	6	9
49	M	32	21	53	34	50	40	27	6	6
50	F	14	17	31	35	62	45	40	3	3
51	F	24	25	49	39	49	46	42	11	11
52	F	26	25	51	36	48	42	29	9	9
53	F	20	31	51	38	62	43	36	10	10
54	M	34	24	58	34	41	54	32	10	10
55	F	31	24	55	27	53	41	16	9	9
56	M	35	30	65	43	46	61	42	12	11
57	F	33	22	55	33	38	46	28	9	6
58	F	24	28	52	39	55	39	40	9	8
59	M	27	25	52	33	41	56	26	8	8
60	M	19	18	37	37	47	45	28	5	4
61	M	29	20	49	36	44	40	23	8	6

PREDICTING ACHIEVEMENT IN ALGEBRA 1 AT THE ELKHART JUNIOR HIGH SCHOOL

by

FORREST EUGENE ADAMS

B. S., Panhandle State College, 1963

AN ABSTRACT OF A MASTER'S REPORT

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requirements for the degree

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The primary purpose of this study was to determine the relationship between achievement in Algebra 1 as measured by the yearly grade and the selected factors of: (1) Verbal Reasoning score on the Differential Aptitude Test (DAT), (2) Numerical Ability score on the DAT, (3) Verbal Reasoning and Numerical Ability composite score on the DAT, (4) Abstract Reasoning score on the DAT, (5) Clerical Speed and Accuracy score on the DAT, (6) Mechanical Reasoning score on the DAT, (7) Space Relations score on the DAT, and (8) eighth-grade yearly mathematics grade.

The subjects of this study were taken from the ninth-grade students who completed Algebra 1 at the Elkhart Junior High School during the school years 1966-67 and 1967-68. The study was conducted by correlating the selected factors with algebra grades. Tests for the significance of the relationships shown by the simple coefficients of correlation were made by the use of the t value. The predictive power of combining the independent variables was determined by a multiple regression analysis.

Five of the factors were found to be significantly related to achievement in algebra for the population. The highest simple coefficient of correlation, $r = .693$, was found between the eighth-grade mathematics grades and algebra grades. In order of decreasing relationship, the other significant factors were the Verbal Reasoning and Numerical Ability composite scores, Numerical Ability scores, Verbal Reasoning scores, and the Space Relations scores. The corresponding coefficients of correlation

were .583, .575, .455, and .248.

In view of the variables used and the findings of the study, the following conclusions were made:

1. The eighth-grade mathematics grade is the best single factor for predicting future achievement in ninth-grade algebra.

2. Predictions made on the basis of more than one variable are decisively better than those based on a single variable.

3. It was indicated by the contribution of the Clerical Speed and Accuracy scores in predicting for the female subgroup that the girls exercised their ability to do routine work in algebra to a greater extent than the boys did.

4. A comparison of the coefficients of correlation obtained for each of the subgroups between eighth-grade mathematics grades and Numerical Ability scores, between eighth-grade mathematics grades and algebra grades, and between algebra grades and Numerical Ability scores indicates that the boys did not actualize their potential achievement in algebra in relation to their mathematical ability.

5. Marked differences can exist in the predicting efficiency that the same factors have for the two sexes.