A SURVEY OF HIGH SCHOOL STUDENTS' MATHEMATICS GRADES AND SUCCESS

A Thesis

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by

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Harold E. Nachtigall

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CHAPTER I

INTRODUCTION

1.1. Statement of the Problem. There has always been a need for competent mathematics teachers who are familiar with the best interests and needs of the high school student in light of the demands and requirements imposed upon them by their surrounding societies and by the colleges or universities of their choice.

If the teachers are responsible for advising and directing the student to achieve his highest mathematical ability and to stimulate his natural curiosity and desire to succeed, then they must be able to answer intelligently his questions about what mathematics courses to take and also to give a prediction, to a certain degree of accuracy, of his ability to succeed.

This study is an attempt to answer some of the questions which confront the high school teacher as he assists the student in selecting his course of study. A few of the questions which might arise are as follows: Is there a significant degree of correlation between the grades in different mathematics courses? Is there a certain trend in high school mathematics? Is there a relationship between mathematics students and class leaders? Is there a significant relationship between I.Q. scores and

mathematical ability? Is there a significant relationship between high school and college mathematics? Is mathematics only for boys? In summary the problem may be stated as a study of success and the need for mathematics in high school.

1.2. Purpose of the Study. A student may find himself in a high school situation faced with the responsibility of making important choices. Perhaps some of the following questions may arise. (1) Is it better to omit the so-called basic and more advanced courses and strive for that highest scholastic average? (2) What does the study of mathematics have to do with the desire to excel in student leadership? (3) Is mathematics perhaps too difficult for the student's own accepted ability?

It is of considerable importance that the student receive satisfactory guidance and concrete facts of research to help him make the choices that will be for his best interest.

It is the purpose of this thesis to gather information relating to the stated problem and to present statistics that may be of benefit in helping the student answer some of the questions posed in the preceding paragraphs.

1.3. Definition of Terms. The term "success" as used in this thesis refers to a student's achievement in terms of: (1) Having made high grades, (2) having been elected class officers and leaders, (3) having been appointed Girls State or Boys State representative.

Seaman is a Rural High School located just outside of the city limits of Topeka, Kansas. The average enrollment during the years included in this study was approximately 460.

The high school requirements for graduation at Seaman were thirty-two semester credits for the first two years of this study; this requirement was then raised to thirty-four semester credits. One of these requirements was to successfully complete one full year of mathematics, which was either general mathematics or algebra.

General mathematics is a one-year course offered to prepare freshmen for further high school mathematics. About ninety per cent of the high school freshmen are not prepared to take algebra; therefore, approximately ninety per cent of the freshmen take general mathematics.[1] A student can take general mathematics to meet the high school requirement of one year of high school mathematics.

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[1]Mr. Charles Logan, principal, Seaman Rural High School.

The mathematics curriculum at Seaman Rural High School at the time of this study consisted of:

Two semesters of general mathematics
Two semesters of algebra
Two semesters of geometry
One semester of algebra III
One semester of solid geometry (replaced by trigonometry in the fall of 1957).

1.4. Limitations. This study is limited to those students who graduated from and attended Seaman during the four years, 1955 to 1958. The students who transferred to Seaman are included in this study, however those students who transferred elsewhere from Seaman are not included in this study because records are not available concerning the school to which they transferred; thus it was not possible to follow their mathematics grades and include them in this study.

Since only a certain number of the Seaman graduates went on to college or university, the questionnaire used in Chapter IX of this study was sent to only those who continued their education in this way. A very limited amount of information was available concerning the location and address of the graduates used in this study; therefore it is not certain that all of the students who went to college received a questionnaire. Likewise some questionnaires were sent to students who had not gone to college.

1.5. Organization of the Thesis. Chapter II contains a summary of some of the related studies and a list of other materials also related to the study of this thesis.

The formulas and procedures used in this study are illustrated in Chapter III; a sample of the calculations used in finding the coefficient of correlation, standard error of estimate, and the line of regression is given.

For the next chapter, Chapter IV, a correlation was computed for the general mathematics and algebra grades. It also contains a correlation table and a figure showing the lines of regression and the standard errors of estimate for the general mathematics and algebra grades.

Chapter V contains a study of the relationship of algebra and geometry grades. Computed for this chapter is the numerical value for the coefficient of correlation, the standard errors of estimate, the lines of regression, the slopes of the lines, the mean for the geometry scores and the mean for the algebra scores.

As in the preceding two chapters, Chapter VI contains a study of correlations: I.Q. and mathematics grade averages.

Chapter VII consists of the relationship between mathematics and class leadership. It also includes a table

showing the students' activities and honors in relation to mathematics and the average mathematics grades received.

The main purpose of Chapter VIII is to present in tabulated form a comparison of scholastic high school averages with the number of credits of mathematics taken in high school.

Chapter IX is a review of the tabulated results of the questionnaire that was sent to the Seaman graduates who went on to a college or university.

The final chapter, Chapter X, contains a summary of this study and the conclusions based on the statistical results found in the preceding chapters.

The Bibliography contains references pertaining to this thesis on students' mathematics and success.

A sample of the questionnaire and the letter of explanation used in gathering data for Chapter IX is presented in the Appendix.

CHAPTER II

RELATED STUDIES

There have been other studies in related areas; some of these will be reviewed in part and others will be listed. This thesis does not endorse the validity nor the reliability of the following studies, but merely recognizes them as related material.

2.1. Related Articles. In a study at Washburn University, Seigle[1] compared the complete records of 1205 students in mathematics from 1945-49. In summarizing the results of this study he states:

> The Washburn Entrance Mathematics Test is the best single predictor of success in college algebra that was found in this study. It was not as effective in predicting success in trigonometry, analytic geometry, and calculus as it was in predicting success in college algebra, yet in all of these areas it contributed something to the coefficient of multiple correlation. The high school grade average was the second best predictor of success in college mathematics.[2]

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[1] William F. Seigle, "Prediction of Success in College Mathematics at Washburn University," Journal of Educational Research, April 1954, pp. 577-88.

[2] Ibid., p. 588.

Garrett[3] considered the high school grade point average quite reliable for predicting scholastic success in college. He regarded achievement tests and College Entrance Examination board tests as the second best prediction for this purpose.

Adams and Garrett,[4] in a study at Louisiana State University, reported that high school records appear to tell more about probable success in college physics than do entrance tests.

2.2. Related Theses. An unpublished thesis, made by Fulmer[5] in 1933, contained a study which compared the scholastic success in college of the high school graduate with the size of the high school. A summary of this report revealed that Class B schools placed first, Class C schools were second, Class D schools were third, and Class A schools were fourth.

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[3]Harley F. Garrett, "A Review and Interpretation of Investigations of Factors Related to Scholastic Success in Colleges of Arts and Science and Teachers Colleges," The Journal of Experimental Education, December 1949, pp. 91-138.

[4]Sam Adams and H. L. Garrett, "Scholastic Background as Related to Success in College Physics," Journal of Educational Research, March 1954, pp. 545-49.

[5]Virgil G. Fulmer, "College Success of Kansas High School Graduates," (unpublished Master's Thesis, Kansas State Teachers College, Emporia, 1933), p. 46.

In a thesis at Kansas State Teachers College, Emporia, Martin[6] made a study of the effect of background in mathematics upon achievement in a college-level calculating machines course. The following conclusion was stated:

> The hypothesis [sic] in this correlation was that the students taking the college-level calculating machines course with a limited background in mathematics tended to make lower letter grades in the college-level calculating machines course, and that the more background in mathematics a student had the better letter grade he tended to make in the college-level calculating machines course.[7]

In a thesis at Kansas State Teachers College, Emporia, Henry[8] made the following conclusion in his study of the correlation between college mathematics grades and high school mathematics grades:

> In conclusion, it has been established, at the 99 per cent level of confidence, that the correlation between the college grade point averages and the high school grade point averages is significantly different from zero. Therefore, in so far as the individuals under study may be regarded as constituting a representation of a random sample, the probabilities given by the

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[6]Kenneth E. Martin, "A Study of the Effect of the Background in Mathematics upon Achievement in a College-level Calculating Machines Course," (unpublished Master's thesis, Kansas State Teachers College, Emporia, 1958).

[7]Ibid., p. 34.

[8]Everett Lanklin Henry, "The Correlation between College Mathematics Grades and High School Mathematics Grades," (unpublished Master's thesis, Kansas State Teachers College, Emporia, 1957).

tables II, III, IV, and V and Figure 1 may be used in the guidance of high school students.[9]

2.3. Other Related Studies. As a further guide the following materials are listed as related studies.

Ora M. Shields, "A Study of the Effect of the Completion of High School Mathematics Courses upon Success in Such Courses at the College Level," (unpublished Master's thesis, Kansas State Teachers College, Emporia, 1956.)

Vera Davis, "High School Marks in Relation to College Success as Measured by College Marks and Entrance Examinations," (unpublished Master's thesis, Kansas State Teachers College, Emporia, 1935), 56 pp.

G. K. Schoepfle and D. L. Arnold, "Correlation of High School and College Grades," Am. J. Physics 26: 537-39, November, 1958.

D. L. Frick, "Pattern Research in Guidance: Prediction of Student Success," Occupations, 30: 663-4, May, 1952.

J. V. Hanna, "Comparison of Cooperative Test Scores and High School Grades as Measures for Predicting Success in College," Journal of Applied Psychology, 23: 289-97, April, 1939.

C. M. Scott, "Background and Personal Data as Factors in the Prediction of Scholastic Success in College," Journal of Applied Psychology, 22:42-9, February, 1938.

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[9] Ibid., p. 45.

CHAPTER III

STATISTICAL FORMULAS AND PROCEDURES

It is recognized that the validity and the reliability of this study is dependent upon the completeness of the Seaman Rural High School records, the exactness and limitations of the formulas used, and the application of such formulas. Predictions are made with a certain degree of reservation and should be accepted only as predictions. An attempt is made in this chapter to list and define terms and formulas used in this study.

3.1. Coefficient of Correlation. The coefficient of correlation in this study is a device to show the relationship or the association between student grades in the different mathematics courses. It is a number between plus one and minus one which indicates the degree of linear relationship between the two sets of numbers. The coefficient of correlation, "r", measures how near the points are to lying on a straight line. If "r" is plus one, the points lie on a line and the two sets of data are said to be in perfect correlation.

The coefficient of correlation, "r", may also be defined as the quotient of the sum of the products of the algebraic deviations from the mean of the corresponding

numbers of the two sets and the square root of the product of the sum of the squares of the deviations from the mean of each set.[1]

The following formulas are used to find the coefficient of correlation, "r", between two sets of N numbers arranged in a frequency table, the pair (x_i, y_j) occurring with frequency f_{ij}:

$$r = \frac{p}{\sigma_x \sigma_y},$$

where

$$p = \frac{\sum_{i,j=1}^{n} f_{ij}\ x_i\ y_i}{N} - \frac{\sum_{i=1}^{n} f_i\ x_i}{N} \cdot \frac{\sum_{j=1}^{n} f_j\ y_j}{N}$$

$$f_i = \sum_{j=1}^{n} f_{ij}, \quad f_j = \sum_{i=1}^{n} f_{ij},$$

$$N = \sum_{i,j=1}^{n} f_{ij} = \sum_{j=1}^{n} f_j = \sum_{i=1}^{n} f_i$$

and σ_x, σ_y are the standard deviations

$$\sigma_x = \sqrt{\frac{\sum_{i=1}^{n} f_i\ x_i^2}{N} - \left(\frac{\sum_{i=1}^{n} f_i\ x_i}{N}\right)^2}.$$

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[1] Glenn James and Robert C. James, Mathematics Dictionary, D. Van Nostrand Co., Inc., 1959, Princeton, New Jersey.

$$\sigma_y = \sqrt{\frac{\sum_{j=1}^{n} f_j y_j^2}{N} - \left(\frac{\sum_{j=1}^{n} f_j y_j}{N}\right)^2}$$

3.2. Standard Error of Estimate. The standard error of estimate of x on y, S_{xy} is computed from the formula:

$$S_{xy} = \sigma_x \sqrt{1 - r^2}$$

where "r" is the coefficient of correlation and σ_x is the standard deviation.

The standard error of estimate of y on x, S_{yx} is computed from the formula

$$S_{yx} = \sigma_y \sqrt{1 - r^2}$$

The prediction is made that 68 per cent of the time the related item under study will fall within one standard error of estimate measured off plus and minus about the line of regression. This is illustrated by the Figures in this study.

3.3. The Line of Regression. The line of regression is found by the formula:

$$y - y_o = r \frac{\sigma_y}{\sigma_x} (x - x_o) \text{ for y on x}$$

$$x - x_o = r \frac{\sigma_x}{\sigma_y} (y - y_o) \text{ for x on y}$$

Again "r", "σ_x", and "σ_y" are used as stated in the previous paragraphs, x_o and y_o are mean x and mean y respectively.

3.4. An Example of Calculations. The following calculations are submitted as an example of the procedure used in the following chapters. This example shows the relationship between algebra and geometry grades as used in chapter five of this study. Logarithms were used for calculations of division and multiplication.

Coefficient of correlation

$$p = \frac{\sum_{i,j=1}^{n} f_{ij}\, x_i\, y_i}{N} - \frac{\sum_{i=1}^{n} f_i\, x_i}{N} \cdot \frac{\sum_{j=1}^{n} f_j\, y_j}{N}$$

$$p = \frac{1176}{138} - \frac{336}{138} \cdot \frac{313}{138}$$

$$p = 3.00$$

$$\sigma_x = \sqrt{\frac{\sum_{i=1}^{n} f_i\, x_i^2}{N} - \left(\frac{\sum_{i=1}^{n} f_i\, x_i}{N}\right)^2}$$

$$\sigma_x = \sqrt{\frac{1468}{138} - \left(\frac{336}{138}\right)^2}$$

$$\sigma_x = 2.17$$

$$\sigma_y = \sqrt{\frac{\sum_{j=1}^{n} f_j\, y_j^2}{N} - \left(\frac{\sum_{j=1}^{n} f_j\, y_j}{N}\right)^2}$$

$$\sigma_y = \sqrt{\left(\frac{1193}{138}\right) - \left(\frac{313}{138}\right)^2}$$

$$\sigma_y = 1.87$$

$$r = \frac{p}{\sigma_x \sigma_y}$$

$$r = \frac{3.00}{(2.17)(1.87)}$$

$$r = .739$$

Standard Error of Estimate of x on y

$$S_{xy} = \sigma_x \sqrt{1 - r^2}$$

$$S_{xy} = 2.17 \sqrt{1 - (.739)^2}$$

$$S_{xy} = 1.46$$

Standard Error of Estimate of y on x

$$S_{yx} = \sigma_y \sqrt{1 - r^2}$$

$$S_{yx} = 1.87 \sqrt{1 - (.739)^2}$$

$$S_{yx} = 1.26$$

Line of Regression for x on y

$$(x - x_o) = r \frac{\sigma_x}{\sigma_y} (y - y_o)$$

$$x - 2.43 = .852(y - 2.27)$$

$$x = .852y + 2.43 - 1.93$$

$$x = .85y + .51$$

$$x \text{ mean} = \frac{336}{138} = 2.43$$

$$y \text{ mean} = \frac{313}{138} = 2.27$$

Line of Regression for y on x

$$(y - y_o) = r \frac{\sigma_y}{\sigma_x} (x - x_o)$$

$$y - 2.27 = .636(x - 2.43)$$

$$y = .636x + 2.27 - 1.55$$

$$y = .636x + .72$$

CHAPTER IV

CORRELATION OF GENERAL MATHEMATICS AND ALGEBRA GRADES

This chapter contains a study of the general mathematics grades and the algebra grades of 187 students who attended Seaman during the years 1954-55 through 1957-58. The students who transferred to Seaman are included in the study, however those students who transferred elsewhere from Seaman are not included because no records are available concerning the place of their transfer; thus it was impossible to follow their mathematics grades and include them in this study. Those who dropped out of school for different reasons and did not complete their term of work are included in the group that failed.

Table I shows the distribution of the general mathematics and algebra grades of the 187 students. Values are given to the grades as follows: A - 0, AB - 1, B - 2, BC - 3, C - 4, CD - 5, D - 6, DF - 7, F - 8. According to the following data the coefficient of correlation is .671. The standard error of estimate of y on x is 1.26 and the line of regression is $y = 1.11 + .579x$. For x on y the standard error of estimate is 1.46 and the line of regression is $x = .852y + .51$.

When the coefficient of correlation is between 0 and plus 1 it is considered a positive correlation, when it lies

between 0 and minus 1 it is considered a negative correlation. The nearer the coefficient of correlation is to plus 1 the more the direct relationship or association. The nearer it becomes to minus 1 the more perfect the inverse relationship. In this case the coefficient of correlation (.671) is positive and shows a relatively good degree of association. If a student makes a high grade in general mathematics, then there is a central tendency that he will make a high grade in algebra also.

The standard error of estimate shows a scatter in which we can predict that 68 per cent of the grades will fall within one standard error measured off plus and minus about the line of regression. The standard error of estimate and the line of regression is shown for x on y and also for y on x. The standard error of estimate for x on y is 1.46 and for y on x it is 1.26. This is illustrated as shown in Figure 1.

Example: Considering a student who has made a grade of B in general mathematics, a prediction can be made that about 68 per cent of the time the student will make between .75 (A) and 3.67 (C) as illustrated by the following calculation:

$$x = .852y + .51$$
$$x = .852(2) + .51$$
$$x = 2.21$$

$$\begin{array}{r} 2.21 \\ -1.46 \\ \hline .75 \end{array} \qquad \begin{array}{r} 2.21 \\ +1.46 \\ \hline 3.67. \end{array}$$

TABLE I

CORRELATION OF GENERAL MATHEMATICS AND ALGEBRA GRADES

General Math Grades					Algebra I and II Grades										
Grade Interval					A	AB	B	BC	C	CD	D	DF	F	Total	$f(d_x d_y)$
	x / y	f	f_y	f_y^2 f_x f_x^2	0	1	2	3	4	5	6	7	8		
					31	18	31	24	32	17	20	1	13	187	
					0	18	62	72	128	85	120	7	104	596	
					0	18	124	216	512	425	720	49	832	2896	
F	8	1	8	64							1				48
DF	7	1	7	49					1						28
D	6	20	120	720				2	6	2	6	1	3		642
CD	5	24	120	600			3	3	7	4	6		1		535
C	4	36	144	576	1		5	5	8	6	4		7		668
BC	3	27	81	243	1	1	7	7	7	2	2				258
B	2	25	50	100	3	5	5	5	2	3	1		1		134
AB	1	23	23	23	8	6	7	2							26
A	0	30	0	0	18	6	4		1				1		0
		187	553	2375											2339

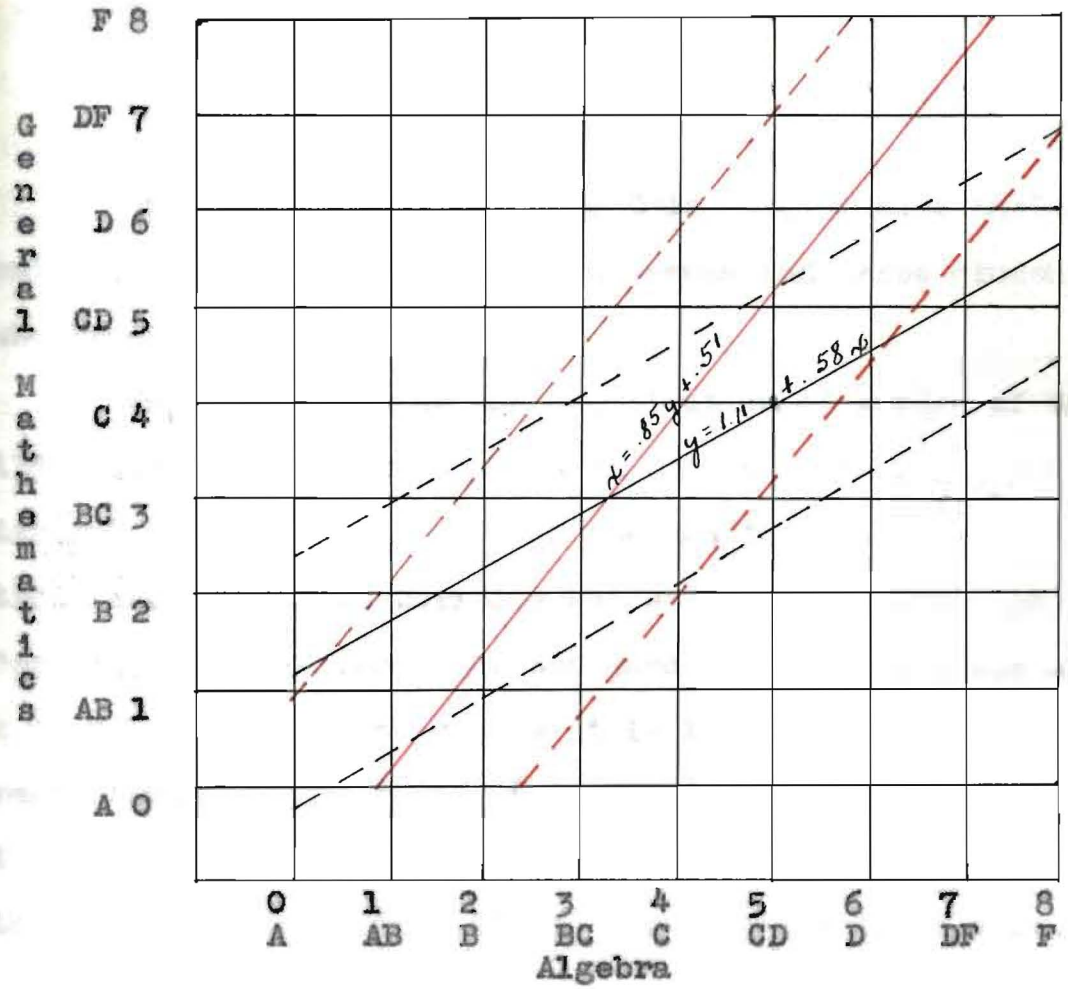

FIGURE 1

LINES OF REGRESSION AND STANDARD ERRORS OF ESTIMATE

FOR GENERAL MATHEMATICS AND ALGEBRA GRADES

NOTE: The solid black line in the figure represents the line of regression for general mathematics grades on algebra grades, the two black dotted lines measured vertically from the line of regression show the standard error of estimate for general mathematics grades on algebra grades.

The solid red line represents the line of regression for algebra grades on general mathematics grades and the two red dotted lines measured horizontally from the line of regression show the standard error of estimate for algebra grades on general mathematics grades.

CHAPTER V

CORRELATION OF ALGEBRA AND GEOMETRY GRADES

As was previously stated, this chapter also includes only those students who attended Seaman and those students who transferred to Seaman.

Table II contains the distribution of grades of the 138 students who were enrolled in both algebra and geometry. According to the outlined data the coefficient of correlation is .739. It is positive and shows a relatively high degree of association. The standard error of estimate of x on y is 1.46 and for y on x it is 1.26. The line of regression for y on x is: $y = .718 + .637x$. For x on y the line of regression is $x = .750 + .740y$. The mean for the geometry scores is 2.43 and the mean for the algebra scores is 2.27.

Table II also shows a slight tendency for the geometry grades to be lower than the algebra grades when the algebra grades are high, and the geometry grades are slightly higher than the algebra grades farther down the scale.

The 138 algebra and geometry students used for the study in this chapter represent 56 per cent of the total number of students in the complete study. As stated

previously this chapter includes those students who dropped out of school but not those who transferred elsewhere from Seaman during the years under study in this thesis; however, it was found that only nine per cent, or 16 of the 179 students who dropped out or transferred, had ever been enrolled in geometry.

TABLE II

CORRELATION OF ALGEBRA AND GEOMETRY GRADES

Algebra I Grades	Class Interval					Geometry Grades: A	AB	B	BC	C	CD	D	DF	F	Total	$f(d_x d_y)$
		x				0	1	2	3	4	5	6	7	8		
		y	f			37	17	26	13	21	10	9	0	5	138	
				f_y	f_x	0	17	52	39	84	50	54	0	40	336	
					f_y^2 f_x^2	0	17	104	117	336	250	324	0	320	1468	
	F	8	0	0	0											
	DF	7	0	0	0											
	D	6	8	48	288					1	2	4		1		276
	CD	5	8	40	200			1		4	1	1		1		185
	C	4	30	120	480	1	3	3	3	10	7	1		2		460
	BC	3	10	30	90	1	2	3	2	1		1				72
	B	2	30	60	120	2	2	12	6	5		2		1		168
	AB	1	15	15	15	5	5	5								15
	A	0	37	0	0	28	5	2	2							0
			138	313	1193											1176

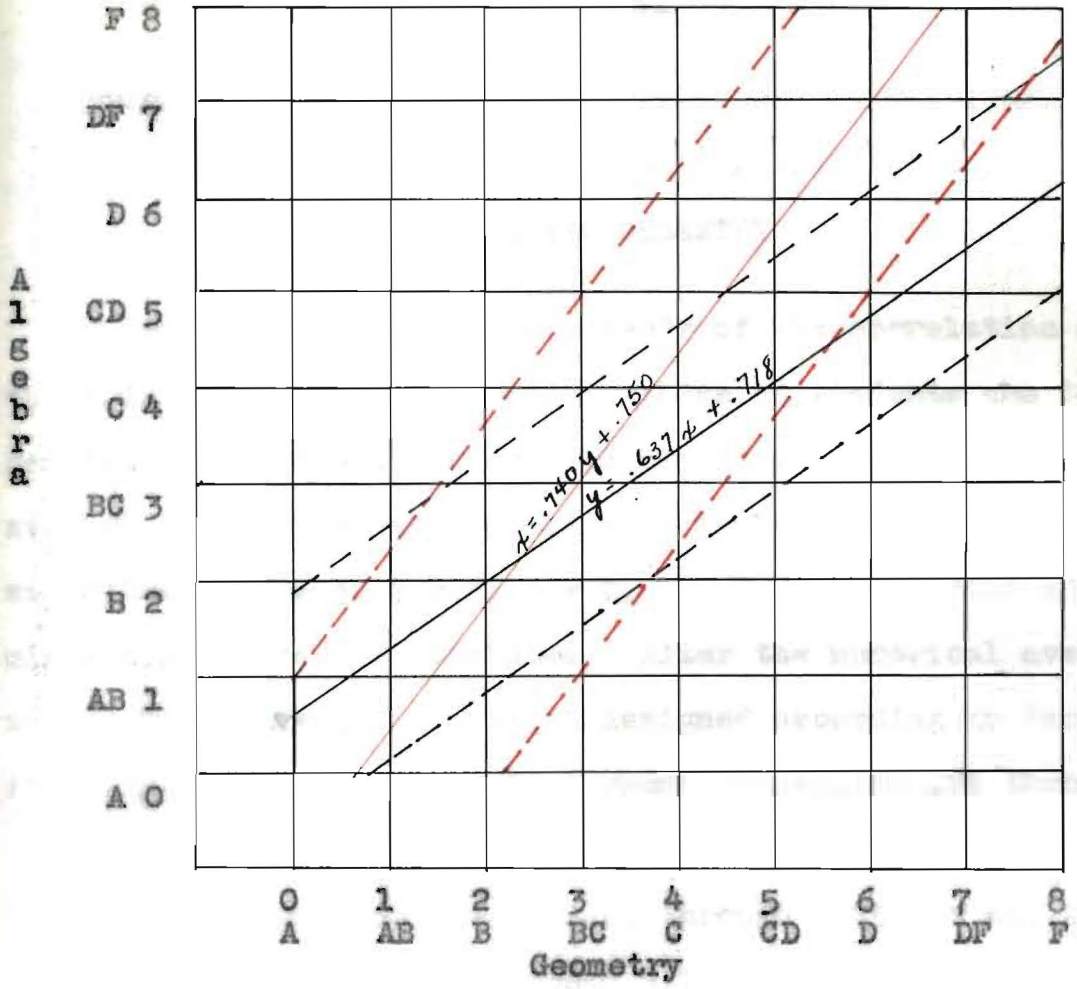

FIGURE 2

LINES OF REGRESSION AND STANDARD ERRORS OF ESTIMATES

FOR ALGEBRA AND GEOMETRY GRADES

NOTE: The solid black line in the figure represents the line of regression for algebra grades on geometry grades, the two black dotted lines measured vertically from the line of regression show the standard error of estimate for algebra grades on geometry grades.

The solid red line represents the line of regression for geometry grades on algebra grades and the two red dotted lines measured horizontally from the line of regression show the standard error of estimate for geometry grades on algebra grades.

CHAPTER VI

CORRELATION OF I.Q. AND GRADE AVERAGE FOR THE THREE YEARS OF MATHEMATICS: GENERAL MATHEMATICS, ALGEBRA AND GEOMETRY

This chapter contains a study of the correlation of the I.Q. scores and the average grades of students who took general mathematics, algebra and geometry. To find the average grade numerical values were assigned to each grade as follows: A = 4, B = 3, C = 2, D = 1, F = 0. Plus and minus signs were not tabulated. After the numerical average was found an average grade was assigned according to the following distribution: .00 through .25 was F, .26 through .75 was DF, .76 through 1.25 was D, 1.26 through 1.75 was CD, 1.76 through 2.25 was C, 2.26 through 2.75 was BC, 2.76 through 3.25 was B, 3.26 through 3.75 was AB, 3.76 through 4.0 was A.

Table III shows the distribution of 42 I.Q. and grade average scores. According to the outlined data the coefficient of correlation (.700) is positive and shows a relatively high degree of association. The standard error of estimate is 1.17. The line of regression for y on x is: $y = 125.39 - 5.95x$ and for x on y it is $x = -.14y + 17.9$. The mean score for the mathematics averages is 2.14. The mean I.Q. score is 113.0.

The 42 students under study in this chapter represent 17 per cent of the total number of students used in the complete study of this thesis. This percentage is somewhat low because a number of the student record cards did not list an I.Q. score. When two I.Q. scores were listed for two different years, the average score was used. The records of one student showed a variation of 22 points on his two I.Q. test scores.

The I.Q. tests that were used were the Army Alpha-Schrammel revision Form A, from the Bureau of Educational Measurements, Kansas State Teachers College, Emporia, Kansas.

This I.Q. test has shown a positive correlation (.86) with the student's four-year academic grade average. The I.Q. scores also had a high positive correlation with the student's reading ability. This correlation was computed for the graduating class of 1958.[1]

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[1]Mrs. Margaret Epps, Teacher and Counselor at Seaman Rural High School.

TABLE III

CORRELATION OF I.Q. AND GRADE AVERAGES FOR THE THREE YEARS

MATHEMATICS: GENERAL MATHEMATICS, ALGEBRA AND GEOMETRY

Mathematics Grades

Class Interval	Mid-point	x	f	f_x	f_x^2	A	AB	B	BC	C	CD	D	DF	F	Total	$f(d_x d_y)$
		y	f	f_y	f_y^2	0	1	2	3	4	5	6	7	8		
						8	9	10	4	6	5	0	0	0	42	
						0	9	20	12	24	25	0	0	0	90	
						0	9	40	36	96	125	0	0	0	306	
85 90	88	12	2	24	288				1	1						84
91 95	93	11	2	22	242					1	1					99
96 100	98	10	5	50	500			1	2		2					180
101 105	103	9	5	45	405			2		3						144
106 110	108	8	7	56	448		2	3		1	1					136
111 115	113	7	3	21	147		2	1								28
116 120	118	6	5	30	180	1	1	2	1							48
121 125	123	5	7	35	175	3	2	1			1					45
126 130	128	4	1	4	16		1									4
131 135	133	3	2	6	18	1	1									3
136 140	138	2	2	4	8	2										0
141 145	143	1	0	0	0											0
146 150	148	0	1	0	0	1										0
			42	297	2427											771

I Q Scores

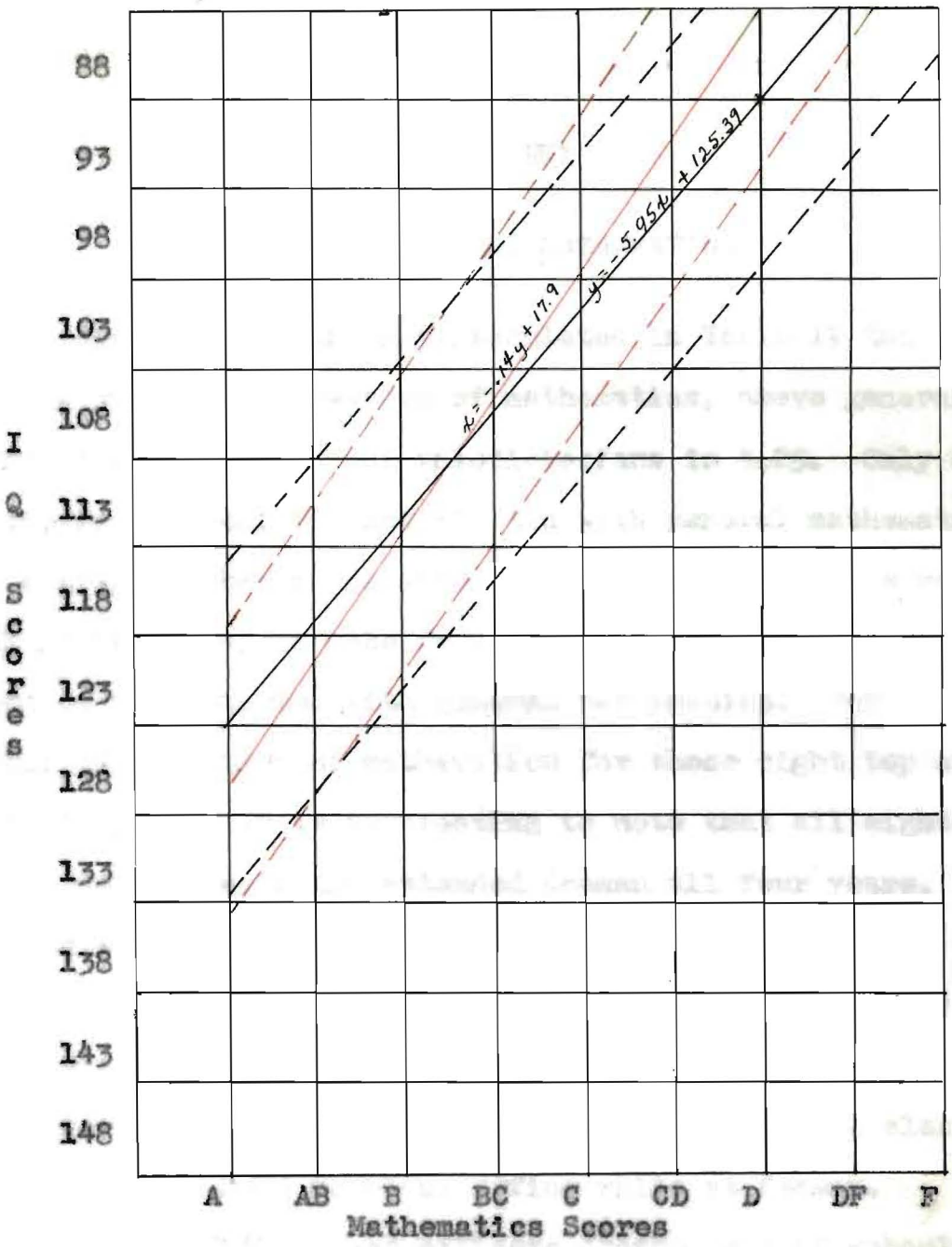

FIGURE 3

LINES OF REGRESSION AND STANDARD ERRORS OF ESTIMATE FOR I.Q. AND MATHEMATICS GRADES

NOTE: The solid black line in the figure represents the line of regression for I.Q. scores on mathematics grades, the two black dotted lines measured vertically from the line of regression show the standard error of estimate for I.Q. scores on mathematics grades. The solid red line represents the line of regression for mathematics grades on I.Q. scores and the two red dotted lines measured horizontally from the line of regression show the standard error of estimate for mathematics grades on I.Q. scores.

CHAPTER VII

CLASS LEADERS AND MATHEMATICS

According to the data tabulated in Table IV the average number of semesters of mathematics, above general mathematics, for the four valedictorians is 4.25. Only one of the four valedictorians started with general mathematics. The average number of semesters of mathematics, above general mathematics, for the four salutatorians is 4.0; however, three of them started with general mathematics. The average number of semesters of mathematics for these eight top students is 5.13. It is interesting to note that all eight were local students and attended Seaman all four years. Also of interest is the fact that all eight are girls. Three valedictorians held one class office during their four years at Seaman, the other one held no class office. One salutatorian held three class offices, one held one class office and two held no class office while at Seaman.

Three of the class officers dropped out of school, three transferred to Seaman, and one transferred from Seaman during his first year. The other 49 were local four-year Seaman students.

The average number of semesters of mathematics for all the class leaders during their four years is 5.20. This does not include the one who transferred from Seaman and the

one whose record card could not be found. The average number of semesters above general mathematics is 3.54.

Forty-three girls and 39 boys held class offices, however, the boys are out in front 5.64 to 4.48 in the number of semesters of mathematics and 3.92 to 3.0 in the number of semesters of mathematics above general mathematics.

The seniors during the years 1954-55 through 1957-58 had been enrolled in mathematics classes as follows: 159 girls and 183 boys were enrolled in general mathematics, 117 girls and 158 boys were enrolled in algebra I and II, 50 girls and 89 boys were enrolled in geometry, 9 girls and 36 boys were enrolled in algebra III, 2 girls and 10 boys were enrolled in solid geometry which was offered in 1954-55 and 1955-56, 2 girls and 18 boys were enrolled in trigonometry which was offered in 1956-57 and 1957-58. This makes a total of 339 girls and 494 boys enrolled in mathematics courses during the specified four years.

It was also found that 36 per cent of the students who took the full three years of mathematics, above general mathematics, held at least one class office or school honor; 13 per cent held at least two such positions, and 6 per cent held three or more positions. Twenty-five per cent of the students who had at least two years of mathematics, above

general mathematics, held at least one class office or honor.

Table IV shows the relationship of class leaders on honors with the number of semesters, and grade, of mathematics taken in high school.

TABLE IV

CLASS LEADERS AND MATHEMATICS

Student No.	Activities and Honors	Semesters of Mathematics		Average Grade	Years at Seaman
		Gen. Math.	Above G.Math.		
1	Valedictorian; Sr. Pres.	0	6	A	4
2	Salutatorian	2	4	A	4
3	Girls State	0	5	B	4
4	Boys State; Soph. Pres.	2	0	C	4
5	Sr. V. Pres.	2	4	AB	4
6	Sr. Sec.; Jr. Treas.	2	2	BC	4
7	Sr. Treas.; Soph. Treas.	2	4	AB	4
8	Jr. V. Pres.; Fresh. Sec.	2	2	BC	4
9	Jr. Sec.	2	4	B	4
10	Soph. V. Pres.	2	4	C	3
11	Soph. Sec.	2	2	B	4
12	Fresh. Pres.	2	2	AB	4
13	Fresh. V. Pres.	2	4	C	4
14	Fresh. Treas.	2	0	A	4
15	Jr. Pres.	No record card			4
16	Valedictorian; Soph. Treas.	0	5	A	4
17	Salutatorian	0	4	A	4

TABLE IV (continued)

Student No.	Activities and Honors	Semesters of Mathematics		Average Grade	Years at Seaman
		Gen. Math.	Above G.Math.		
18	Sr. Pres.; Jr. Treas.; Soph. V. Pres.	2	4	C	4
19	Sr. V. Pres.	0	6	C	2
20	Sr. Sec.; Jr. Pres.; Fresh. V. Pres.; Boys State	2	6	AB	4
21	Sr. Treas.	0	6	A	4
22	Jr. V. Pres.; Fresh. Sec.	2	4	A	4
23	Jr. Sec.; Fresh. Pres.	2	4	B	4
24	Soph. Pres.	2	4	B	4
25	Soph. Sec.	2	4	D	3*
26	Fresh. Treas.	2	0	D	2*
27	Girls State	2	4	A	4
28	Valedictorian; Jr. V. Pres.	0	4	A	4
29	Salutatorian; Sr. Sec.; Jr. Treas.; Fresh. V. Pres.	2	4	A	4
30	Sr. Pres.; Soph. Pres.	2	6	A	4
31	Sr. V. Pres.; Jr. Pres.	2	6	A	4

*Dropped out of school after specified number of years.

TABLE IV (continued)

Student No.	Activities and Honors	Semesters of Mathematics		Average Grade	Years at Seaman
		Gen. Math.	Above G.Math.		
32	Sr. Treas.; Soph. V. Pres.	2	2	AB	4
33	Jr. Sec.	2	6	C	4
34	Soph. Sec.	2	2	B	4
35	Soph. Treas.	2	0	A	4
36	Fresh. Pres.	2	4	AB	4
37	Fresh. Sec.	Transferred			
38	Fresh. Treas.	2	6	B	4
39	Boys State	2	6	BC	4
40	Girls State	2	4	A	4
41	Valedictorian	2	2	A	4
42	Salutatorian; Sr. Sec.	2	4	A	4
43	Sr. Pres.; Jr. Pres.; Boys State	2	4	BC	4
44	Sr. V. Pres.	0	4	C	4
45	Sr. Treas.	2	2	C	4
46	Jr. V. Pres.; Boys State	2	4	B	4
47	Jr. Sec.	0	4	C	4
48	Jr. Treas.	2	2	CD	4
49	Soph. Pres.	2	2	BC	4

TABLE IV (continued)

Student No.	Activities and Honors	Semesters of Mathematics		Average Grade	Years at Seaman
		Gen. Math.	Above G.Math.		
50	Soph. V. Pres.	2	2	BC	4
51	Soph. Sec.; Girls State	2	5	A	4
52	Soph. Treas.	2	2	C	4
53	Fresh. Pres.	2	0	D	1 1/2*
54	Fresh. V. Pres.	2	4	A	4
55	Fresh. Sec.	2	2	C	4
56	Fresh. Treas.	2	4	B	4

*Dropped out of school after specified number of years.

CHAPTER VIII

SCHOLASTIC AVERAGE AND SEMESTERS OF MATHEMATICS

The earlier chapters dealt mainly with the problem of correlations. The main purpose of this chapter is to present in tabulated form a comparison of the scholastic high school average with the number of credits of mathematics taken in high school.

The high school grade point average was computed from the grades as they appear on the student's individual four-year grade cards in the permanent files at Seaman Rural High School. As indicated in Table V the four-year grade average was computed by using the following assigned numerical values: A+ = $-\frac{2}{3}$, A = 0, A- = $\frac{2}{3}$, B+ = $\frac{4}{3}$, B = 2, B- = $2\frac{2}{3}$, C+ = $3\frac{1}{3}$, C = 4, C- = $4\frac{2}{3}$, D+ = $5\frac{1}{3}$, D = 6, D- = 7, F = 8. The numerical values were chosen in this way to be consistant with the assigned values used in the preceeding chapters. The sum of the numerical values was then divided by the total number of credits. The resulting value correct to the nearest whole number was then listed as the tabulated four-year scholastic average.

Table VI contains the tabulation of the four-year average compared with the total number of mathematics credits. A credit is equivalent to one unit of mathematics

each semester. The high school mathematics curriculum consists of eight units of mathematics including two units of general mathematics. About 79 per cent or 196 of the 248 graduates during the four years under study started their freshman year with general mathematics.

Only nine per cent of the 248 graduates with less than a c- four-year average took more than one year, or two units, of high school mathematics. Thirty-three per cent of the 248 graduates with an average above C+ took more than two units of high school mathematics.

Thirteen per cent, or 32 of the 248 graduates had been enrolled in all advanced mathematics courses offered. During the years 1954-56 the highest level courses offered were algebra III and solid geometry. Then solid geometry was replaced by trigonometry for the next two years, 1956-58.

Thirty-five per cent of the 248 graduates were enrolled in three years or more of high school mathematics. General mathematics was considered as a full year course.

TABLE V

SAMPLE COMPUTATION OF GRADE POINT AVERAGE

Grade	Point Value	No. Credit Points	Total Grade Points
A+	$-\frac{2}{3}$	1	$-\frac{2}{3}$
A	0	2	0
A-	$\frac{2}{3}$	0	0
B+	$\frac{4}{3}$	4	$5\frac{1}{3}$
B	2	6	12
B-	$2\frac{2}{3}$	3	8
C+	$3\frac{1}{3}$	8	$26\frac{2}{3}$
C	4	4	16
C-	$4\frac{2}{3}$	2	$9\frac{1}{3}$
D+	$5\frac{1}{3}$	1	$5\frac{1}{3}$
D	6	2	12
D-	7	0	0
F	8	1	0
Total		34	$95\frac{1}{3}$

$$\text{Grade Point Average} = \frac{\text{Total Grade Points}}{\text{Total Credit Points}} = \frac{95\frac{1}{3}}{34} = 2.8$$

A grade point average of 2.8 is nearest to the grade value $2\frac{2}{3}$ and would therefore be interpreted as an average grade of B-.

TABLE VI

RELATIONSHIP BETWEEN HIGH SCHOOL GRADE AVERAGE AND SEMESTERS OF MATHEMATICS

Grade Average	Semesters of Mathematics							Total
	2	3	4	5	6	7	8	
A+								
A			1	1	3	1		6
A-			4		5		3	12
B+	3		7	4	8		5	27
B	4		13		11			28
B-	5		8	1	5		1	20
C+	5	1	8	1	6		2	23
C	12		15		11	4	5	47
C-	17	1	19	1	6	1	1	46
D+	7	1	8	2	5		2	25
D	7	2	2		1			12
D-	2							2
Total	62	5	85	10	61	6	19	248

CHAPTER IX

COLLEGE STUDENTS QUESTIONNAIRE RESULTS

According to the Seaman Rural High School records there were 248 graduates during the four years 1954-55 through 1957-58. Of these 248, it is believed that 62 or 25 per cent went on to college.[1] It is recognized that this list is subject to error. There may be a few more who attended college after having moved to another location and consequently it would not be recorded on the Seaman files. Three students who were recorded as having gone to college indicated on the questionnaires that they had not enrolled in college but had found employment instead; two questionnaires were returned because of no known person at that address and no forwarding address available. This study does not include the three returned questionnaires of the students who stated that they had not gone to college. Fifty-seven per cent of the questionnaires sent out were completed and returned. Table VII contains the compiled data of the questionnaires.

The data from the 32 completed questionnaires that were returned revealed that two had been in nurses training

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[1]This list and number was obtained from the file in the Seaman High School Guidance Office along with the help of Mr. Logan, teacher and principal at Seaman for the past forty years.

and had taken no mathematics. One was enrolled in a business college which required no mathematics. The other 29 were or had been enrolled in a liberal arts college. Two of these 29 had graduated from college without any college mathematics. Another five students were in college and had not as yet taken a college mathematics course. The remaining 22 students were or had been enrolled in college mathematics courses, ranging from one year to a major in mathematics.

Of the 32 Seaman students here reported who attended college, 31 had two or more years of high school mathematics. Sixty-eight per cent of these students had been enrolled in college mathematics courses.

This study includes the years of high school graduation 1955-58, therefore the 1958 graduates had had only one year of college work to record on the questionnaires, the 1957 graduates had two years, the 1956 graduates had three years, and the 1955 graduates who had attended college each year since high school graduation had four years of college work to record on the questionnaire.

Table VIII contains a list of each different mathematics course as indicated on the questionnaire and the number of semester hours of credit in that course. Tabulated in the table is the number of students that have taken the specified courses for the specified number of semester hours.

Table IX shows the relationship of the number of semesters of college work and the number of semesters of college mathematics taken. This table also indicates that 34 per cent of the students who have been in college prior to September, 1959, had enrolled in no college mathematics whatsoever.

A copy of the questionnaire and the letter of explanation that was sent to the Seaman graduates is included in the Appendix of this study. The questionnaire and letter was complete with a stamped, self-addressed envelope. They were sent out about the middle of May, and the results were tabulated six weeks later. During this time several students were called to remind them of returning the questionnaires. No questionnaires were returned after the tabulation was completed.

TABLE VII

QUESTIONNAIRE RESULTS

Year of high school graduation	Number of high school graduates	Number of graduates who attended college	Per cent of graduates attending college	Number of questionnaires sent out	COMPLETED QUESTIONNAIRES RETURNED			
					Number	PER CENT Returned	Taking college math.	With two or more years of high sch. math.
1955	57	15	26	11	6	55	66	100
1956	58	17	29	15	11	73	64	100
1957	67	11	16	12	5	42	80	100
1958	66	19	29	18	10	56	70	90
	Total 248	Total 62	Average 25	Total 56	Total 32	Average 57	Average 68	Average 98

TABLE VIII

COLLEGE MATHEMATICS COURSES AND THE NUMBER OF SEMESTER HOURS AS WAS INDICATED ON THE RETURNED QUESTIONNAIRES

College Courses	Number of Semester Hours					
	1	2	3	4	5	6
College algebra			11		1	1
Trigonometry		1	3		2	
College algebra and trigonometry combined					8	
Analytical geometry			1		4	
Calculus I					5	
Calculus II			5			
Analytical geometry and Calculus I				1	1	
Analytical geometry and Calculus II				1	1	
Analytical geometry and Calculus III				1		
Differential Equations		1	1			
Theory of Equations			1			
Commercial algebra			1			
Applied Engineering Mathematics			1			

TABLE IX

NUMBER OF STUDENTS HAVING THE FOLLOWING NUMBER OF SEMESTERS OF COLLEGE AND THE NUMBER OF HOURS OF COLLEGE CREDIT IN MATHEMATICS

Semester Hours of Mathematics	Number of Semesters in College							
	1	2	3	4	5	6	7	8
0	1	3		2		3		2
1								
2								
3		1		1	1			1
4								
5		2	1					1
6		2				1		
7								
8		1		1				
9				1				
10				1				
11								
12								
13								
14				1				
15								
16								
17								
18				1		1		
19								
20								
21						3		

CHAPTER X

SUMMARY AND CONCLUSIONS

10.1. Summary. It was the purpose of this study to gather information showing the relationship between the grades of different mathematics courses and the association of mathematics and success as defined in terms of having made high grades and having been elected class officers.

The importance of this study is revealed by the present increased emphasis on mathematics and the questions which students have about different mathematics courses and their importance in terms of success.

The data and results of this study were divided into six chapters, IV through IX.

A positive correlation (.671) was found to exist between general mathematics grades and algebra grades. It was also shown that in a majority of the cases the algebra grades averaged slightly higher than the general mathematics grades when the average grades were above BC and slightly lower when the average grades were below BC.

A positive correlation (.739) was found to exist between algebra and geometry grades. There was a slight tendency for the geometry grades to be lower when the algebra grades were high, and the geometry grades were

slightly higher than the algebra grades farther down the scale. It was also found that only nine per cent of the students who dropped out of school or transferred had ever been enrolled in geometry.

A positive and relatively high correlation (.700) was found to exist between the I.Q. scores and the average grades for three years of high school mathematics. A previous study has shown a higher positive correlation (.86) of I.Q. scores with the student's four-year academic grade average and the I.Q. scores had a high positive correlation with the student's reading ability.

The average number of semesters of mathematics for all the class leaders included in this study was found to be 5.20. It was found that girls held all the honors of valedictorians and salutatorians. The average number of semesters of mathematics for these eight top students was 5.13. Three valedictorians held one class office during their four years at Seaman, the other one held one class office. One salutatorian held three class offices, one held one class office and two held no class office. Forty-three girls and 39 boys held class offices, however, the boys had enrolled in more mathematics, 5.64 semesters (average) compared to 4.48 for the girls. A total of 339 girls and 494 boys were enrolled in mathematics courses

during the specified years. It was also found that 36 per cent of the students who took the full three years of mathematics above general mathematics held at least one class office or school honor; 13 per cent held at least two such positions, and 6 per cent held three or more positions. Twenty-five per cent of the students who had at least two years of mathematics above general mathematics held at least one class office or honor.

It was found that 79 per cent of the students included in this study took general mathematics; thirteen per cent had been enrolled in all advanced high school mathematics courses offered at Seaman. Only 9 per cent of the students with less than a C minus four-year scholastic average took more than the required one full year of mathematics, while 33 per cent of the students with a four-year scholastic average above C plus took more than one full year of high school mathematics. Thirty-five per cent of the students were enrolled in three or more years of high school mathematics. No students with an A or A minus scholastic average had less than two full years of high school mathematics.

The data from the 32 completed questionnaires that were returned revealed that 31 had two or more years of high school mathematics and 68 per cent of these students

had been enrolled in college mathematics courses. Thirty-four per cent of the students who were or had been in college had enrolled in no college mathematics courses. It was also found that two students had graduated from a liberal arts college without taking a college mathematics course; two had been in nurses training and had no college mathematics and one was in business college which required no college mathematics.

10.2. Conclusions. A positive and relatively high degree of correlation was found to exist between the grades of different high school mathematics courses. Also positively related were high school mathematics grades and leadership in the school. High school mathematics was found to be very important for the students who went on to college. This was often stated by the individual students in their personal remarks that were made on the questionnaire.

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APPENDIX

Enclosed in this appendix is a copy of the questionnaire and the letter of explanation that was sent to the Seaman Rural High School graduates who went to college during the time specified in this study.

Date

Student's Name

At the present time I am teaching mathematics at Seaman High School. Last summer I began work on my thesis for a Masters Degree at Kansas State Teachers College at Emporia. With the school's permission and assistance I have been using their records as the basis for my research. No names are used in this study. Each Seaman graduate is referred to only by number. The major items of research are correlations of grades between:

1. General math and algebra
2. Algebra and geometry
3. Math students and class leaders
4. I.Q. and math averages
5. Math averages and high school average
6. High school math and college math

Would you please complete the enclosed questionnaire and return it to me in the self-addressed envelope. Your prompt return will be greatly appreciated. Thank you. If these results are of interest to you, they will be available.

Sincerely,

Harold Nachtigall

HN:en

Enclosures

QUESTIONNAIRE

No. ____

College or University attended: _____

No. of years attended: _____ From _____ to _____

Courses Taken

(Please list only those courses taken before September, 1959.)

Courses	No. of Semester Hours (2, 3, 4, 5)	Grade	Year taken
College Algebra			
Trigonometry			
Analytical Geometry			
Calculus I			
Calculus II			
Advanced Calculus			
Differential Equations			
Theory of Equations			
College Algebra and Trig. combined			
Analytical Geometry and Calculus I			
Analytical Geometry and Calculus II			
Analytical Geometry and Calculus III			
Others: _____			
_____			
_____			

Average grade of all college courses taken before September, 1959: ____