1962

The Derivation of Two Regression Equations for Predicting Freshmen Cumulative Grade Point at Central Washington State College from Ninth Grade Subject Averages

Hugh Tims Albrecht
Central Washington University

THE DERIVATION OF TWO REGRESSION EQUATIONS FOR PREDICTING FRESHMEN CUMULATIVE GRADE POINT AT CENTRAL WASHINGTON STATE COLLEGE FROM NINTH GRADE SUBJECT AVERAGES

A Thesis
Presented to
the Graduate Faculty
Central Washington State College

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

---

by
Hugh Tims Albrecht
August 1962

THE DERIVATION OF TWO REGRESSION EQUATIONS FOR PREDICTING FRESHMEN CUMULATIVE GRADE POINT AT CENTRAL WASHINGTON STATE COLLEGE FROM NINTH GRADE SUBJECT AVERAGES

A Thesis

Presented to

the Graduate Faculty

Central Washington State College

In Partial Fulfillment

of the Requirements for the Degree

Master of Education

by

Hugh Ties Albrecht

August 1962

APPROVED FOR THE GRADUATE FACULTY

_____

Daryl Basler, CHAIRMAN

_____

M. L. Pettit

_____

E. E. Samuelson

ACKNOWLEDGMENTS

The writer is deeply indebted to the members of his committee, Dr. D. D. Basler, Dr. E. E. Samuelson, and Dr. M. L. Pettit, and to Dr. A. Dvorak of the University of Washington for their guidance and assistance in making this thesis possible.

TABLE OF CONTENTS

CHAPTER		PAGE
I.	INTRODUCTION	1
	The Problem	1
	Statement of the problem	1
	Importance of the study	1
	Definitions of Terms Used	2
	Freshmen cumulative grade point	2
	Ninth grade subject average	2
	Correlation	2
	Variable	3
	Limitations of the Study	3
II.	RELATED RESEARCH	4
III.	THE PROCEDURE AND ANALYSIS OF DATA	6
	Procedure	6
	Analysis of the Data	7
IV.	SUMMARY AND CONCLUSIONS	11
	Summary	11
	Implications	11
	Conclusions	12
BIBLIOGRAPHY		13
APPENDIXES		15

LIST OF TABLES

TABLE		PAGE
I.	SUMMARY OF DATA FROM BYRNS AND HENMON STUDY . . .	5
II.	SUMMARY OF THE PROCESSED DATA	8

CHAPTER I

INTRODUCTION

The role of high school counselors and advisors is not to make decisions for the student but to assist the student to a better understanding of his aims, motives, and potentialities. An awareness of these factors will help him make more satisfying decisions.

I. THE PROBLEM

Statement of the problem. The purpose of the study was to develop formulas to predict college freshmen cumulative grade point at Central Washington State College from grades received in ninth grade English, mathematics, or physical education, or from a combination of the three.

Importance of the study. In a democratic society all children should be given an equal opportunity to learn. With an increasing high school student body, new problems are arising in fitting students into a curriculum that will satisfy their needs. Handlin states in a recent article that:

> The high school must remain an undifferentiated institution through which the whole population will pass. It must focus its attention not on the preparation of one segment or another of its student body, but on the development in all of it of the core of habits, ideas, and assumptions that will make them, to the best of their abilities, creative citizens (5:32).

If ninth grade subject averages can be used to predict college freshmen cumulative grade point, there is a possibility that they can be used to predict high school success as well. If this is so ninth grade averages along

with other test data may be used in the future for grouping students, developing new curriculum areas, and advising high students.

Authorities have recognized that the last three years of high school are important in the preparation for college. Billhartz points out that:

> One of the serious limitations of the many researches which have been made for the purpose of predicting college success is that they have offered predictions on the basis of measures obtainable only at the end of high-school years or at the beginning of the college career. That is too late. Practically, pupils must plan to go to college or not to go to college three or four years before high-school graduation)1:547).

It was necessary for the purpose of this study to assume that students' freshmen scholastic standing could be used as an index of college potentiality. The scholastic standards of Central Washington State College are:

> Students are considered to be "in good standing" when their scholarship, that is, their grade point average is 2.00 (C) or better (8:72).

If a distinction could be made between students who have a college potentiality and those who do not, counselors would be in a better position for guiding students into college preparatory courses.

At the present time in most school systems, students are made aware of their college potentiality during their senior year of high school, either through grades received on special tests or combinations of high school subject grades. The students who possess this quality and were unaware of it may lack certain required entrance courses, depending on the selected college. Since there are numerous

combinations of subjects a student may take in his last three years of high school, an advisor or teacher must understand the student's potentiality in order to be effective in guidance.

II. DEFINITIONS OF TERMS USED

Freshmen cumulative grade point. The freshmen cumulative grade point was based on the completion of not less than 42 and not more than 55 quarter hours. The cumulative grade point was figured at the Office of the Registrar.

Ninth grade subject average. Grades in ninth grade English, mathematics, and physical education were averaged according to the four point grading system, as follows: A = 4.00, B = 3.00, C = 2.00, D = 1.00, and F or E = 0.00.

Correlation. This refers to a relationship between two or more variables. Correlation is evidence of relationship, but not necessarily of cause-effect relationship (9:14).

Variable. This is a quantity or force which throughour an investigation is assumed to vary or be capable of varying (9:38).

III. LIMITATIONS OF THE STUDY

The study was limited to those students who completed their freshmen year of college at Central Washington State College. Students receiving a grade of "S" or those with incomplete ninth grade records were not used.

CHAPTER II

RELATED RESEARCH

One of the functions of guidance is informing students of their educational and vocational opportunities. If this function is to be fulfilled at the secondary level, the students' potentialities must be known with some degree of accuracy.

A study made in 1941 by Billhartz for the purpose of predicting college success from junior high cumulative grades found a positive correlation of .561 between the two (1:549). Billhartz recognized the need for research in this area and concluded:

> That college success can be predicted at the end of junior high school as well as at the end of senior high school is a finding of substantial import for guidance programs. The break between the junior and senior high school is as crucial a period for guidance as any in the school career of youth. Counselors must aid pupils in their choice of the diverse educational highways which confront them after junior high school years. To perform this task they need instruments that will enable them to peer into the future and to help pupils estimate their own powers and interests with greater accuracy (1:551).

An earlier study made in 1928 by Byrns and Henmon found a positive correlation of .64 between tenth grade average and I.Q. and first semester college grades. In this study I.Q. tests were administered at grades 4 to 8 inclusive. A formula to predict freshmen achievement by combining the I.Q. and tenth grade average was derived from a regression equation based on the collected data (Table I) (2:879). The developed regression equation was:

$X_1 = .029X_2 + .018X_3 - 8.699$, in which X_1 represents the predicted grade point average, X_2 stands for I.Q., and X_3 represents the tenth grade average (2:879).

From the two studies it could be concluded that inability to do successful college work could be determined relatively early in an individual's educational career. The present study confirms the above conclusion, and the writer submits two new equations for predicting freshmen cumulative grade point at Central Washington State College from ninth grade subject averages.

TABLE I

SUMMARY OF DATA FROM BYRNS AND HENMON STUDY

1. First semester grade point average.
2. I.Q.
3. Tenth-grade average

$Mean_1 = 1.26$	$Mean_2 = 109.27$	$Mean_3 = 83.5$
$1 = .794$	$2 = 6.46$	$3 = 5.35$
$r_{12} = .454$	$r_{13} = .642$	$r_{23} = .397$

CHAPTER III

THE PROCEDURE AND ANALYSIS OF DATA

I. PROCEDURE

The study was started during the spring of 1958. At that time 826 students at Central Washington State College had not attended another institution of higher learning and had some ninth grade records. Records were incomplete or a grade of "S" indicated in one or more of the ninth grade subjects for 274 students. Of the remaining 522 students, only 349 college freshmen cumulative grade points were available through use of the active files during the spring and the summer of 1958 and the summer of 1962.

The above sample is considered a random sample based on what McNemar asserted:

> In the absence of an obviously valid scheme for drawing the sample, the only thing one can do is to describe the sample as completely as possible with regard to known characteristics of the universe from which it was drawn. If the sample is typical of the universe in several variables which are related to the variate being studied, it is safe to assume that it is representative (7:348).

Grades in ninth grade English, mathematics, and physical education were obtained from high school and junior high school transcripts on file in the Office of the Registrar, Central Washington State College. The freshmen cumulative grade point was available from transcripts on file in the Office of the Registrar.

The completed data (Appendix A) was transferred from the worksheet (Appendix B) onto a special form (Appendix C) prepared by Dr. Dvorak of the University of Washington to

facilitate the transfer of data onto I.B.M. cards. Dr. Dvorak arranged for the transfer and processing of the data through the use of an I.B.M. 650 machine. The multiple correlation was obtained by using the Horst Iteration method for computing multiple correlation problems (6). Appendix E is a copy of the worksheet used by Dr. Dvorak to develop the regression equation and multiple correlation.

The standard errors of the coefficients of correlations (Table II) were developed using the usual formula (Appendix D). Using the highest zero order correlation, the regression equation on page 9 was developed to predict college freshmen cumulative grade point at Central Washington State College. The standard error of estimate was developed. The regression equation for predicting the college freshmen cumulative grade point from the combination of mathematics, English, and physical education (page 10) was developed by Dr. Dvorak using the Horst Iteration method.

II. ANALYSIS OF THE DATA

The purpose of the study was to develop formulas to predict college freshmen cumulative grade point at Central Washington State College from grades received in ninth grade English, mathematics, or physical education or from a combination of the three. From the collected data it appeared that the best predictors were ninth grade English and a combination of English, mathematics, and physical education.

Table II shows a summary of the collected data. The standard errors of the coefficients of correlations were .05

TABLE II

SUMMARY OF THE PROCESSED DATA

	Mean	Sigma	SE of r	r
College freshmen cumulative	$\bar{a}$ 2.430	a = .540	a_{cb} = .04	r_{ab} = .489
Ninth grade mathematics	$\bar{b}$ 2.389	b = .871	r_{ac} = .04	r_{ac} = .572
Ninth grade English	$\bar{c}$ 2.520	c = .881	r_{ad} = .05	r_{ad} = .206
Ninth grade physical education	$\bar{d}$ 2.935	d = .758		$R_{a.bcd}$ = .597

and less. From this it could be concluded that the correlations were significant. The findings of this study are summarized below.

The best single predictor of college freshmen cumulative grade point from the three ninth grade subjects was English. Using the following formula, freshmen cumulative grade point can be predicted from ninth grade English with a standard error estimate of $\pm$ .442:

$$F = 1.545 + .351E \pm .442.$$

F represents freshmen cumulative grade point; E represents the ninth grade English average grade.

To use the above formula, let us assume a ninth grade student received an "A" in English one semester and a "C" the second semester. This student's grade average for the two semesters would be 3.00. Substitute 3.00 in the formula for E and take the product of it and .351 to receive 1.053. Add the 1.545 to the 1.053 to receive a total of 2.598. This would be the predicted college freshmen cumulative grade point. Using the standard error of estimate it could be concluded that 68 times out of 100 the freshmen cumulative grade point for this example would not be more than 3.040 nor less than 2.156.

The highest correlation in the study was received from combining the three ninth grade subject averages with the freshmen cumulative. The multiple correlation was .02 higher than the highest zero order correlation, or .597. The regression equation for predictive purposes was developed by Dr. Dvorak of the University of Washington. Using the regression equation which follows, freshmen cumulative

grade point could be predicted from a combination of the three ninth grade subjects, English, mathematics and physical education, with a standard error of estimate of ± .433:

$$F = .136M + .267E - .030P + 1.419 \pm .433.$$

The letter F represents freshmen cumulative grade point, M represents the ninth grade mathematics average, E represents the ninth grade English average, and P represents the ninth grade physical education average.

To use the formula in an example, let us assume a certain student received the following ninth grade averages: ninth grade mathematics, first semester "A," second semester "B," average 3.50; ninth grade English, first semester "B," second semester "C," average 2.50; ninth grade physical education, first semester "C," second semester "C," average 2.00.

Using the averages, first multiply the mathematics average by .136. The product is .476. The second product of the English average and .176 is .690. The last product of physical education and -.030 is a negative value of -.06. Adding the first two products and subtracting the last product, a difference of 1.106 is obtained. When this quantity is added to 1.419, the predicted freshmen cumulative grade point at Central Washington State College is 2.525. Using the standard error of estimate, it could be concluded that 68 times out of 100 the freshmen cumulative grade point for this example would be no more than 2.958 nor less than 2.092.

CHAPTER IV

SUMMARY AND CONCLUSIONS

I. SUMMARY

Two formulas were developed to predict freshmen cumulative grade point at Central Washington State College from ninth grade subject averages. The best predictor of freshmen cumulative grade point at Central Washington State College came from combining the three ninth grade subjects, English, mathematics, and physical education. The best single predictor was ninth grade English. The highest zero order correlation, only .02 lower than the multiple, was between ninth grade English and freshmen cumulative grade point at Central Washington State College.

II. IMPLICATIONS

1. From the correlations received in this study it appears that high school success could be predicted from ninth grade subject averages.

2. If high school success could be predicted from ninth grade subject averages, students could be made aware of their educational potentialities when they first enter the tenth grade.

3. This is another tool that could be used by educational guidance workers and student counselors for the practical and scientific guidance of youth in senior high school.

4. There has been little research in this area. More is needed to encourage senior high students to continue their education.

III. CONCLUSIONS

1. Freshmen cumulative grade point at Central Washington State College can be predicted almost as well from ninth grade English as from combining the three ninth grade subjects, English, mathematics, and physical education.

2. The study indicates that the ability to do successful college work could be predicted relatively early in the individual's educational career. This is significant to educational guidance workers and student counselors, for it is another step toward the practical and scientific guidance of youth.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Billhartz, W. H., and P. W. Hutson. "Determining College Ability During Junior-High School Years," School and Society, 53:547-52, April, 1941.

2. Byrns, R., and V. A. C. Henmon. "Long-Range Prediction of College Achievement," School and Society, 41:877-80, June, 1935.

3. Garrett, Henry E., Ph.D. Statistics in Psychology and Education. New York: Longmans, Green and Company, 1947.

4. Goedicke, Victor. Theory of Statistics. New York: Harper and Brothers, 1953.

5. Handlin, Oscar. "Live Students and Dead Education," The Atlantic, 208:29-34, September, 1961.

6. Horst, Paul, and S. Smith. "The Discrimination of Two Racial Samples," Psychometrika, 15:271-89, September, 1950.

7. McNemar, Quinn. "Sampling in Psychological Research," The Psychological Bulletin, 37:348, June, 1940.

8. The Quarterly for the Central Washington State College. Ellensburg, Washington: Volume 53, Number 4, (July 1961), p. 72.

9. Wilkening, Howard. A Student's Psychology Handbook. California: Chandler Publishing Company, Inc., 1958, p. 14, 38.

APPENDIXES

APPENDIX A

DATA

A: freshmen accumulative grade point at Central Washington State College.

B: ninth grade mathematics average.

C: ninth grade English average.

D: ninth grade physical education average.

No.	A	B	C	D	No.	A	B	C	D
1.	1.72	1.00	1.00	2.00	31.	2.76	2.50	3.50	2.50
2.	2.06	3.00	1.00	2.00	32.	2.51	3.50	2.50	1.50
3.	2.61	3.50	3.00	4.00	33.	2.57	1.00	2.50	2.00
4.	2.40	3.00	3.00	4.00	34.	2.06	1.50	2.50	3.00
5.	2.74	3.00	3.00	4.00	35.	1.49	2.50	3.00	4.00
6.	2.02	4.00	4.00	3.50	36.	3.04	2.50	2.50	3.00
7.	2.92	2.50	3.00	2.00	37.	1.63	1.50	3.00	4.00
8.	1.83	2.50	2.00	2.50	38.	2.07	3.50	2.00	3.50
9.	2.30	2.50	2.00	2.50	39.	1.71	2.00	2.50	2.50
10.	1.87	2.00	2.50	3.00	40.	3.37	4.00	4.00	4.00
11.	2.01	0.50	1.50	3.00	41.	2.58	3.00	3.50	3.00
12.	2.54	3.50	2.00	3.00	42.	1.89	1.50	1.00	3.00
13.	2.37	3.00	2.50	4.00	43.	2.13	2.00	1.00	1.00
14.	2.12	2.00	2.00	3.00	44.	2.39	2.50	2.00	2.00
15.	2.18	1.00	2.00	3.00	45.	1.76	1.00	1.00	2.00
16.	2.13	2.00	1.50	3.50	46.	3.11	2.00	2.50	3.00
17.	1.87	2.00	2.50	4.00	47.	1.71	2.00	1.00	3.00
18.	2.06	2.00	2.00	2.00	48.	2.58	2.50	3.00	3.00
19.	2.77	3.00	4.00	4.00	49.	2.04	2.50	3.00	2.00
20.	3.10	2.00	2.00	2.50	50.	3.34	2.50	2.50	3.00
21.	2.77	2.50	3.00	2.00	51.	2.65	1.50	1.50	2.50
22.	1.89	2.00	2.50	4.00	52.	2.52	0.50	0.50	2.00
23.	1.88	1.00	1.50	2.50	53.	2.66	2.50	2.00	2.50
24.	2.62	2.00	2.50	2.00	54.	2.48	4.00	3.50	3.50
25.	1.95	2.00	4.00	3.00	55.	2.52	2.50	3.00	2.00
26.	2.02	2.50	1.50	3.00	56.	2.22	3.00	2.50	3.00
27.	2.08	1.00	2.00	3.00	57.	2.85	1.50	2.50	4.00
28.	2.13	2.00	2.00	2.50	58.	1.91	1.50	1.00	3.00
29.	1.97	2.00	3.00	4.00	59.	2.26	1.00	2.00	3.00
30.	2.14	2.00	2.50	1.50	60.	3.38	3.00	4.00	4.00

61.	1.22	1.00	2.00	1.50	105.	2.66	3.00	3.00	3.00
62.	2.86	2.00	4.00	3.50	106.	2.30	2.00	2.50	2.50
63.	2.22	3.50	3.00	2.00	107.	2.25	2.50	2.00	2.50
64.	2.46	2.00	2.50	3.00	108.	2.06	2.50	2.00	3.00
65.	3.04	3.00	2.50	4.00	109.	3.29	4.00	3.50	3.00
66.	3.67	4.00	4.00	3.50	110.	2.09	2.50	2.00	4.00
67.	1.89	1.50	1.50	2.00	111.	2.83	3.50	3.00	3.00
68.	3.44	2.00	4.00	2.50	112.	3.14	3.50	3.50	3.00
69.	3.04	3.50	4.00	3.50	113.	3.34	3.50	4.00	3.50
70.	3.79	3.50	4.00	4.00	114.	2.77	4.00	3.00	3.00
71.	3.22	3.50	3.50	2.50	115.	1.74	2.00	2.50	4.00
72.	2.36	2.00	1.00	2.00	116.	2.16	3.00	1.50	4.00
73.	1.76	3.50	3.00	3.50	117.	1.93	3.00	3.50	4.00
74.	3.10	2.00	2.00	2.00	118.	2.12	3.00	3.00	3.00
75.	2.43	3.00	2.00	2.00	119.	2.26	2.00	2.50	2.50
76.	2.70	2.00	3.00	4.00	120.	2.22	2.00	3.00	4.00
77.	1.91	1.50	2.00	3.00	121.	2.02	1.50	1.50	2.50
78.	2.33	1.50	2.00	2.50	122.	2.35	2.50	3.00	2.50
79.	1.93	3.00	2.00	2.50	123.	3.15	4.00	4.00	4.00
80.	2.10	2.50	2.00	3.00	124.	2.00	2.00	2.00	2.50
81.	2.15	2.50	2.00	2.00	125.	2.15	2.00	1.50	2.00
82.	2.83	1.50	2.00	2.00	126.	3.04	3.50	2.50	3.00
83.	2.83	1.50	2.00	3.00	127.	3.12	4.00	3.50	3.00
84.	1.92	2.00	2.00	3.00	128.	2.45	3.50	3.50	4.00
85.	2.69	1.00	2.00	2.00	129.	2.47	4.00	4.00	4.00
86.	2.50	2.00	3.00	3.50	130.	2.68	3.00	3.50	3.00
87.	2.23	2.00	2.00	4.00	131.	2.34	1.50	2.00	3.00
88.	1.95	1.50	2.50	3.50	132.	2.13	2.00	2.50	3.50
89.	1.97	2.00	3.00	3.00	133.	2.53	1.50	3.00	3.50
90.	2.15	1.00	1.00	3.00	134.	2.83	4.00	4.00	2.50
91.	2.57	3.00	3.00	3.00	135.	2.21	2.00	3.00	2.00
92.	3.21	1.00	1.50	2.50	136.	3.04	3.00	3.50	4.00
93.	2.26	4.00	4.00	3.50	137.	3.43	2.00	2.50	2.00
94.	2.31	2.00	2.00	4.00	138.	1.87	2.00	2.00	3.50
95.	2.52	2.00	2.50	2.00	139.	1.58	1.50	1.50	3.00
96.	2.95	4.00	2.00	2.00	140.	1.79	1.00	2.00	2.50
97.	1.91	1.50	2.00	2.00	141.	1.95	2.00	2.50	2.00
98.	1.87	3.00	3.00	3.00	142.	3.16	2.50	3.00	3.50
99.	2.87	3.00	3.00	4.00	143.	1.75	1.50	3.00	2.50
100.	1.91	1.00	3.50	2.50	144.	2.64	2.50	3.00	2.00
101.	3.04	3.00	3.50	3.00	145.	2.52	2.50	2.00	3.00
102.	2.02	3.00	2.50	3.00	146.	2.83	2.00	2.00	2.50
103.	2.16	3.00	2.50	4.00	147.	1.97	2.50	1.00	3.00
104.	2.54	2.50	3.50	2.00	148.	1.89	2.00	3.00	4.00

149.	1.36	2.00	2.50	2.00	193.	2.78	4.00	4.00	4.00
150.	3.10	2.50	2.00	3.00	194.	2.14	1.50	2.50	1.50
151.	2.70	2.50	2.00	4.00	195.	1.93	1.00	1.50	4.00
152.	3.17	2.00	4.00	3.50	196.	2.47	2.00	2.50	2.50
153.	2.56	4.00	3.00	2.00	197.	1.50	1.00	2.00	2.00
154.	2.27	3.00	4.00	3.50	198.	2.43	2.00	3.00	2.50
155.	2.25	3.00	2.50	3.00	199.	2.31	2.50	1.50	2.00
156.	1.87	1.50	1.50	2.00	200.	2.58	2.50	3.00	3.50
157.	3.16	2.00	4.00	3.50	201.	1.80	2.00	2.00	2.00
158.	1.86	1.50	1.00	3.00	202.	3.66	3.00	4.00	3.00
159.	3.14	3.50	4.00	3.00	203.	3.42	4.00	4.00	3.50
160.	2.96	3.00	4.00	3.50	204.	2.12	2.00	3.00	2.50
161.	3.41	3.00	3.50	3.00	205.	2.04	2.50	1.00	2.50
162.	2.62	2.00	2.00	3.00	206.	2.00	1.50	1.50	3.50
163.	2.00	2.00	1.50	2.50	207.	2.76	3.00	2.00	2.50
164.	3.15	4.00	3.50	4.00	208.	2.85	4.00	4.00	3.00
165.	1.86	2.00	1.50	2.00	209.	2.36	1.50	2.00	2.00
166.	2.14	1.50	3.00	2.50	210.	3.72	4.00	3.00	4.00
167.	3.60	4.00	4.00	4.00	211.	2.56	2.00	2.00	3.50
168.	1.93	2.00	1.50	4.00	212.	2.10	3.00	2.00	3.00
169.	2.31	1.50	2.50	1.50	213.	2.51	2.00	1.00	3.00
170.	2.27	4.00	3.00	4.00	214.	3.14	4.00	3.00	3.00
171.	2.33	2.00	2.00	2.00	215.	2.25	2.50	2.50	3.50
172.	2.23	1.50	2.00	3.00	216.	1.73	1.50	1.50	3.00
173.	2.02	3.00	2.50	3.00	217.	1.89	1.00	1.50	3.50
174.	2.36	1.50	3.00	3.50	218.	2.71	2.00	2.50	2.00
175.	3.74	2.00	3.00	2.50	219.	2.58	3.00	3.00	2.00
176.	2.29	2.20	2.50	1.50	220.	3.00	1.50	1.00	3.50
177.	2.19	1.50	2.50	2.50	221.	3.34	2.00	3.00	3.00
178.	3.04	2.50	3.50	3.50	222.	3.06	1.50	1.50	2.00
179.	2.00	3.50	2.50	3.00	223.	3.66	3.00	4.00	3.50
180.	3.31	4.00	4.00	3.00	224.	2.08	2.00	2.00	2.00
181.	2.50	3.00	2.50	3.50	225.	2.39	2.00	2.00	2.00
182.	2.27	2.50	1.50	1.00	226.	2.33	2.50	2.50	3.50
183.	3.02	3.00	3.00	3.00	227.	2.24	4.00	3.50	3.00
184.	3.33	3.00	4.00	3.00	228.	2.33	2.00	3.50	4.00
185.	1.62	3.00	2.50	2.50	229.	1.91	2.50	2.50	2.00
186.	2.93	1.00	2.00	2.00	230.	2.04	3.00	3.00	3.50
187.	2.52	1.50	2.00	4.00	231.	2.60	2.50	2.00	2.50
188.	3.02	4.00	4.00	2.50	232.	1.90	3.00	2.50	4.00
189.	3.37	3.50	4.00	2.50	233.	1.81	1.50	1.00	1.50
190.	2.70	2.00	2.50	3.00	234.	3.28	2.50	3.00	3.50
191.	1.32	2.00	1.50	3.00	235.	2.06	2.00	1.50	2.50
192.	2.13	2.00	1.50	1.50	236.	1.95	2.00	2.00	2.00

237.	2.02	2.00	2.00	2.00	281.	2.80	1.00	0.50	2.00
238.	2.12	2.00	2.00	3.50	282.	1.78	2.00	1.50	2.50
239.	2.10	3.00	1.50	3.50	283.	3.70	3.50	4.00	3.00
240.	2.02	1.00	2.00	2.50	284.	2.53	2.00	2.00	3.00
241.	1.76	2.00	1.50	2.50	285.	2.34	2.00	2.00	3.00
242.	2.92	4.00	4.00	4.00	286.	1.86	2.00	1.50	2.00
243.	2.71	3.50	2.50	3.50	287.	3.22	3.50	3.50	4.00
244.	3.63	4.00	4.00	4.00	288.	2.21	2.00	2.00	2.00
245.	1.73	2.00	1.50	3.50	289.	1.97	2.00	2.50	3.00
246.	1.46	2.50	1.50	3.00	290.	2.44	3.00	4.00	3.50
247.	2.61	3.00	3.50	4.00	291.	1.88	2.00	1.50	2.50
248.	4.00	4.00	4.00	4.00	292.	2.26	1.50	2.00	3.00
249.	2.36	2.50	2.50	4.00	293.	3.05	3.50	3.50	3.50
250.	2.82	4.00	4.00	3.50	294.	1.70	1.00	2.00	1.00
251.	1.87	1.00	1.50	3.00	295.	2.95	2.00	2.00	2.50
252.	1.86	2.00	1.50	2.00	296.	2.90	3.00	4.00	4.00
253.	2.36	2.00	2.50	2.50	297.	2.72	2.50	3.00	3.50
254.	3.16	2.50	2.50	3.50	298.	3.69	3.00	4.00	4.00
255.	2.13	1.50	1.50	1.50	299.	2.31	2.00	2.50	3.00
256.	3.21	3.00	4.00	3.00	300.	2.91	2.50	2.00	4.00
257.	2.39	2.50	4.00	2.00	301.	2.02	2.00	3.00	3.50
258.	2.75	3.00	3.00	3.50	302.	2.34	2.50	2.00	1.00
259.	2.39	2.00	2.50	3.00	303.	2.55	1.00	2.00	3.00
260.	3.04	1.50	3.00	2.00	304.	2.00	2.00	2.00	3.00
261.	3.17	3.00	4.00	4.00	305.	2.08	2.00	2.00	2.00
262.	1.72	2.00	3.00	4.00	306.	2.06	2.50	2.50	2.50
263.	1.67	3.50	3.00	3.00	307.	2.13	2.00	3.00	4.00
264.	2.12	2.50	3.00	2.50	308.	2.06	3.00	1.50	2.50
265.	1.87	2.00	1.00	2.50	309.	2.70	1.00	2.00	2.00
266.	2.89	2.00	2.50	2.50	310.	2.20	2.50	2.00	4.00
267.	1.80	2.00	2.00	2.50	311.	2.53	1.50	2.00	3.00
268.	3.49	4.00	4.00	3.50	312.	1.50	1.50	1.50	4.00
269.	2.02	2.00	1.50	1.50	313.	3.11	3.00	3.00	2.00
270.	1.89	2.00	1.50	3.00	314.	2.21	3.00	2.00	4.00
271.	2.16	1.00	2.00	2.00	315.	2.58	2.00	2.00	2.00
272.	2.77	1.50	1.50	2.50	316.	1.23	3.00	2.50	3.50
273.	2.04	2.50	3.00	2.50	317.	2.22	2.50	2.00	3.00
274.	2.00	1.00	2.00	3.00	318.	3.61	4.00	3.00	3.50
275.	2.37	3.00	3.00	3.00	319.	2.10	2.50	2.50	4.00
276.	2.53	1.50	4.00	3.50	320.	2.14	2.00	2.50	3.50
277.	2.10	2.50	2.00	3.50	321.	2.60	3.50	2.50	4.00
278.	2.46	2.00	4.00	3.50	322.	2.60	3.50	2.50	4.00
279.	2.18	2.00	2.00	3.00	323.	1.84	2.00	2.50	3.00
280.	2.21	3.00	2.00	1.50	324.	1.91	1.00	1.50	2.00

325.	2.11	2.00	1.50	3.00
326.	2.35	2.50	3.00	3.00
327.	2.60	3.50	3.00	3.50
328.	3.09	2.50	2.00	4.00
329.	2.37	2.00	2.00	2.00
330.	2.38	2.50	3.00	4.00
331.	3.24	4.00	4.00	3.50
332.	2.16	0.50	1.50	3.00
333.	2.02	1.50	3.00	2.00
334.	2.18	2.00	2.00	4.00
335.	2.68	3.00	4.00	4.00
336.	3.41	3.50	4.00	2.00
337.	3.53	4.00	4.00	3.50
338.	2.66	4.00	3.00	4.00
339.	2.06	1.50	2.00	3.00
340.	1.98	0.50	0.50	3.00
341.	1.73	2.00	2.00	3.50
342.	2.12	1.00	1.00	1.00
343.	3.44	3.50	3.50	3.00
344.	2.18	2.00	2.00	2.00
345.	2.10	1.00	2.00	2.50
346.	3.54	4.00	4.00	3.50
347.	2.13	3.00	2.00	4.00
348.	1.92	1.00	2.00	3.00
349.	2.50	2.00	2.00	3.50

APPENDIX B

WORKSHEET

NAME	Freshman accumulative grade point	Grades received in 9th grade math	Grades received in 9th grade English	Grades received in 9th grade P.E.

APPENDIX C

SPECIAL FORM

Col. No.					
1-2-3-4	I.D.	0	0	0	1
5-6-7-8-9-10	Blank				
11		9			
12-13-14	Fr. Cu.	1.	7	2	
15-16-17	9th. Math.	1.	0	0	
18-19-20	9th. English	1.	0	0	
21		0			
22-23-24	9th. P.E.	2.	0	0	
25-26-27		0	0	0	
28-29-30		0	0	0	

The above special form was filled in using example No. 1 in Appendix A.

APPENDIX D

FORMULAS

$$\bar{x} = \frac{\Sigma x}{N}$$

$$\sigma_x = \sqrt{\frac{\Sigma x^2}{N}}$$

$$r = \frac{\Sigma x y}{\sqrt{\Sigma x^2 \cdot \Sigma y^2}}$$

$$b_{xy} = \bar{x} + \frac{\sigma_x}{\sigma_y} r (y - \bar{y})$$

$$\sigma_{x.y} = \sigma_x \sqrt{1 - r^2}$$

$$\sigma_r = \frac{(1 - r^2)}{\sqrt{N - 1}}$$

$\bar{x}$ Arithmetic mean.

σ_x Standard deviation of scores on x.

r Correlation coefficient. Pearson product-moment correlation.

$b_{x.y}$ Regression coefficient of x on y, used to predict x from y.

$\sigma_{x.y}$ Standard error of estimate of x from y.

σ_r Standard error of the coefficient of correlation.

N Number of cases.

Σ Sum of, indicating that quantities following Σ are to be added.

APPENDIX E

WORKSHEET USED BY DR. DVORAK

	2	3	4
2	1.0000	.6290	.3431
3	.6290	1.0000	.3792
4	.3431	.3792	1.0000
T	1.9721	2.0082	1.7223

	1ry	2ry	3ry	4ry
2	.4886	(.1286	.0000	(.0509)
3	(.5724)	.0000	(-.0809)	.0000
4	.2060	-.0111	-.0552	-.0245
T	1.2670	.1175	-.1361	.0264
		.1175	-.1361	.0264
R^2		.34417972	.35072453	.35331534

	5ry	6ry	7ry	8ry	9ry	10ry	11ry
2	.0000	(.0144)	.0000	(.0159)	.0000	(.0063)	.0000
3	-.0320	-.0161	(-.0252)	.0000	(-.0100)	.0000	(-.0040)
4	(-.0420)	.0000	-.0049	.0047	-.0008	.0030	.0008
T	-.0740	-.0017	-.0301	.0206	-.0108	.0093	-.0032
	-.0740	-.0017	-.0301	.0205	-.0108	.0093	-.0031
R^2	.35507934	.3552	.3559	.356175	.356275	.3563	.35633

	12ry	13ry	14ry	15ry	B	
2	(.0025)	.0000	.0010	.0003	.2186	R^2 = .35634369
3	.0000	(-.0016	.0000	(-.0008)	.4499	$R_{1(234)}$ = .597
4	.0023	.0014	(.0020)	.0000	-.0420	
T	.0047	.0002	.0030	-.0005		
	.0049	.0000	.0032	-.0003		
R^2	.356336	.356339		.35634369		

Regression equation -

$$X_1\ .2186\ \frac{.54}{.87}\ (X_2-2.39)\ .4499\ \frac{.54}{.88}\ (X_3-2.52)\ -.0420\ \frac{.54}{.75}\ (X_4-2.93)\ 2.43$$