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Title of Study: PREDICTING GRADE AVERAGES FROM FRESHMAN TEST SCORES
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Major Field: Natural Science
Scope and Method of Study:

This study was made to determine whether or not the grade averages of freshmen could be determined from a previously derived formula for predicting chemistry grades. The formula used is as follows:

$$Y = 0.2139 X_1 + 0.1507 X_2 + 0.1881 X_3 - 36.17. \quad (\pm 6.2)$$

In the formula Y is the final grade; X_1 is the quantitative score on the Cooperative College Ability Test; X_2 is the verbal score on the Cooperative College Ability Test; X_3 is the score on the Cooperative Elementary Algebra Test, revised Form Z; and 36.17 is a constant.

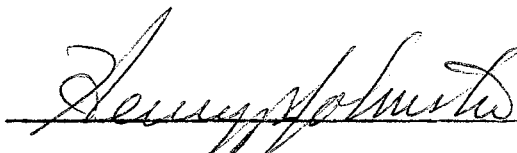
One hundred and two students were selected at random with the only qualifications being that they be of freshman classification and that they had taken the freshman entrance examinations.

Findings and Conclusions:

It was found that the grade average of the student can be predicted with an accuracy of 63.5% using all grades received. Those with three grades reported were found to have an accuracy of 57.1%; those with two grades reported were found to have an accuracy of 63.2%; those with one grade reported were found to have an accuracy of 69.3%.

In addition it was found that the chemistry grade could be predicted with an accuracy of 70.8%; the english grade with an accuracy of 63.3%; and the mathematics grade with an accuracy of 46.0%.

ADVISER'S APPROVAL



PREDICTING GRADE AVERAGES FROM
FRESHMAN TEST SCORES

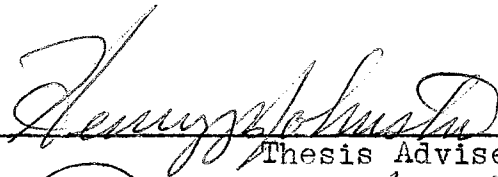
By

JOE HAROLD BOATTENHAMER

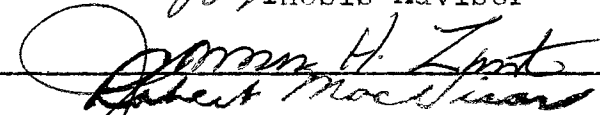
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PREDICTING GRADE AVERAGES FROM
FRESHMAN TEST SCORES



Thesis Adviser



Dean of the Graduate School

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Indebtedness is acknowledged to Dr. Henry P. Johnston, who suggested the study; to Dr. James H. Zant for his valuable counseling and guidance; to the Testing Bureau of Oklahoma State University for their cooperation in making results of freshman test scores available; and to the many members of the English, Mathematics, and Chemistry departments of Oklahoma State University for their time and trouble contributed in replying to the inquiries which were sent to them.

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CHAPTER I

THE PROBLEM

Introduction

The problem was to determine whether or not the grade average of freshman students enrolled at Oklahoma State University could be determined from a formula derived for predicting the grade of freshman students of chemistry who had had no previous schooling in chemistry.

Innumerable studies have been made to determine the correlation between educational aptitude, as revealed by aptitude tests, and success in college as measured by the student's average grade, grade point average, or honor points ratio. These correlations generally range between 0.40 and 0.50, although considerably lower or higher coefficients have been reported at various times.¹

Purposes of the Study

The purposes of the study are: (1) to provide evidence of the relationship of the scores of the individual on the

¹Albert B. Crawford and Paul S. Burnham, Forecasting College Achievement, (New Haven, 1946), p. 89.

college entrance tests to his performance in his freshman year of college; and (2) to report this evidence in such a manner that it might prove helpful to high school, college, and university teachers who counsel students.

Need for the Study

Throughout the nation's highschools, colleges, and universities, training is given in many fields. A student's success in any given field is dependent upon his abilities which were acquired in previous training.

Although the formula upon which this study is based was formulated for beginning students in freshman chemistry, it is thought that a prognosis in other fields, or in overall success would be invaluable to any teacher, professor, or counsellor who might be called upon to advise students as to their probable success in college.

In today's colleges and universities, far too little space is available for learning, and if some of the students who would be acknowledged failures were discouraged from enrolling, the situation of the colleges and universities would be eased, as well as saving the prospective student time, effort, money, and embarrassment at failing.

The findings at Oklahoma State University, in the sense that they may indicate trends, could be of use to other interested groups.

CHAPTER II

LITERATURE ON THE PROBLEM

Historical Background

Most educators and administrators have felt for many years the need for an instrument with which to measure the probable success of a student in his work in school. Numerous problems have arisen which tend to make valid findings difficult to arrive at. Some of these problems are: (1) how can achievement be measured, (2) how can one compensate for variations in the marking systems between schools or between the individual teachers in the same school, and (3) how can personal factors such as ambition, persistence, and desire be measured?

It is commonly agreed that there is a need for an instrument with which to predict the success of the student whether he be endeavoring in a specialized field or in a general one. The ultimate value of such an instrument lies in the beneficial guidance of the individual student because, regardless of what course he is pursuing, discrepancies between his predicted success and actual achievement are often indications of maladjustments.¹

¹Robert M. W. Travers, "Prediction of Success," Measurement of Student Adjustment, eds. Wilma T. Donahue, Clyde H. Coombs, and Robert M. W. Travers (Ann Arbor, 1949), p. 147.

From an administrative standpoint there would be several advantages to having some sort of predictive instrument by which to go. In one instance, there are many failures in the first semester of a course which results in an imbalance the second semester in teacher load and usage of space and equipment. Some administrators feel that if those who were apt to fail were excluded from the course in the first place this situation could be alleviated.²

On the other hand a more humane attitude is adopted by other administrators who feel that it is more efficient to use the teacher's time to teach those who would profit most by the course and to assign students who need more background to teachers who can give them an adequate preparation.

It has long been assumed that failure in college work is to be expected by a large percentage of those who pass the minimum requirements for admission. Failure is unpleasant for the student, his parents, and the high school from which he graduated. Much of a student's success depends upon his application of his abilities and whether or not he can adjust himself to college work. The maturity and scholastic abilities should be indicated by some sort of predictor. According to conclusions reached by Hazel and Oberly, this is most likely to be the case where admission is based on standards such as are provided by secondary school records rather than scores on an adequate entrance examination. They hold that,

²Nelson W. Hovey and Albertine Krohn, "Predicting Failures in General Chemistry," J. Chem. Ed., 35 (1958), 507-9.

When a student is admitted to a course it is implied that he has the necessary qualifications to pass it. This view is taken, more often than not, by student, parent, and preparatory school. Failures will occur and mistakes are certain to be made. It is not too much to expect that these be kept at a minimum, however. In order to approach this goal, practical predictors of success must be found and then applied as an admission requirement.³

It is true, they affirm, that on admission to college a student enters a new educational environment, and much of his success depends on whether he can adjust himself to it.

An extremely complex problem which presents itself in this consideration is one of denial of admission to students who fail to pass the requirements of the predictive instrument. At the moment, this is of particular concern to admission officers who have stated,

A few of the state colleges, required by law to admit all graduates of accredited high schools within the state, admit students in the lower fourth of their graduating class on a probational basis. This practice may result in the admission to college of more potential failures and may also create psychological and social problems for the students so admitted. It would appear more reasonable, and surely more charitable, to admit to college students of low high school achievement only on the basis of supporting evidence indicating that academic success is at least a possibility.⁴

Implications From the Literature

Evidence from the literature is in accord on only one subject, and that is that there is a dire need for some sort

³Fred Hazel and H. Sherman Oberly, "Selection and Performance of Students," J. Chem. Ed., 27 (1950), 27-31.

⁴Vivian R. Boughter, John E. Warner, and Emil A. Holtz, "Probation, Suspension, and Related Problems," The N.C.A. Quarterly, 31 (1957), 249-55.

of instrument with which the success of the college student may be predicted.

Could not existing entrance examination scores be used to predict the performance of the student? Could not the formula in existence for prediction of chemistry grades be used to predict the over all grade average of the student?

CHAPTER III

DESIGN OF THE EXPERIMENT

Selection of a Population

To obtain a representative population for this study the master roll for Chemistry 114 for the spring semester, 1959-60, at Oklahoma State University was used.

One hundred and two names were selected at random from the master roll (approximately every seventh name) with the only requirement for acceptance for the study being that the names so selected be those of freshmen.

Obtaining the Data

After the selection of the one hundred and two names was completed a mimeographed copy of the list was sent to the professors in the English, Chemistry, and Mathematics Departments of Oklahoma State University. Along with the mimeographed list of names a mimeographed letter was enclosed which explained the nature of the study being made and a request that the numerical grade average of the students on the list which they had in their classes be recorded. In addition to this the grades made by the freshmen on their college entrance examinations were obtained from the Testing

Bureau of Oklahoma State University.

The tests used by the Testing Bureau were the Cooperative College Ability Test and the Cooperative Elementary Algebra Test, Revised Form Z. The scores obtained were the scores made by the freshmen on the Quantitative and Verbal sections of the Cooperative College Ability Test and the scores made on the Cooperative Elementary Algebra Test, Revised Form Z.

The Regression Equation Used

For the purposes of this study a regression equation derived by Dr. Elbert L. Griffin was used. Dr. Griffin received his Doctor's degree in Education from Oklahoma State University, Stillwater, Oklahoma in August, 1959. His major was in Chemical Education and the equation was derived for the purpose of predicting the grade of freshman students in General Chemistry 114 at Oklahoma State University and who had had no previous chemistry courses in high school.

Dr. Griffin made his study over a four year period, beginning with the 1954 Fall class in chemistry, and concluding with the 1957 Fall class.

Dr. Griffin's final equation is as follows:

$$Y = 0.2139 X_1 + 0.1507 X_2 + 0.1881 X_3 - 36.17$$

In the formula, Y is the final grade in chemistry; X_1 is the quantitative score on the Cooperative College Ability Test; X_2 is the verbal score on the Cooperative College Ability Test; X_3 is the score on the Cooperative Elementary Algebra Test; and 36.17 is a constant.

In his study Dr. Griffin determined that the correlation coefficient by use of this formula was 0.73.

The following hypothetical example is offered as a guide. If the quantitative score were 304, the linguistic or verbal score were 290, and the algebra score were 25, the following is obtained:

$$Y = (.2139 \times 304) + (.1507 \times 290) + (.1881 \times 25) - 36.17.$$

Multiplying and rounding off gives:

$$65.0 + 43.7 + 4.7 - 36.2 = 77.2.$$

Since the standard error of estimate was found to be ± 6.2 , a person with these particular scores, over two times out of three would make a grade in the course that would not be below 71.0, and not above 83.4.

CHAPTER IV

FINDINGS

Treatment of the Data

With the cooperation of the Testing Bureau of Oklahoma State University the test scores of the verbal and quantitative sections of the Cooperative College Ability Test and the test scores of the algebra section of the Cooperative Elementary Algebra Test of the one hundred and two selected freshmen were recorded.

After this recording, by using Dr. Griffin's equation for prediction of chemistry grades in Chemistry 114, the grade average (predicted) of the students were calculated. Dr. Griffin's equation is as follows:

$$Y = 0.2139 X_1 + 0.1507 X_2 + 0.1881 X_3 - 36.17.$$

Replies to inquiries sent to the various professors made available at least one grade for ninety-six of the one hundred and two students selected.

Of the ninety-six replies, one grade only was furnished for twenty-six of the students; two grades only were furnished for forty-nine of the students; and three grades were furnished for twenty-one of the students.

The grades received for the students were averaged and were then compared to those which had been predicted. The

computations were made with the use of a slide rule. All computations were rounded off to the nearest tenth.

In addition to predicting the final grade average, comparisons were made of the predicted grade average and the grades received in english, chemistry, and mathematics courses separately. These comparisons were made by using the same formula, data, and methods as employed in computing the final grade averages.

TABLE I
ACHIEVEMENT TEST SCORES AND
PREDICTED GRADE AVERAGES

STUDENT NUMBER	VERBAL SCORE	QUANTITATIVE SCORE	ALGEBRA SCORE	PREDICTED AVERAGE
1	301	323	52	88.0
2	290	299	24	76.0
3	290	311	26	78.9
4	287	317	27	80.0
5	313	305	36	82.8
6	288	305	38	79.5
7	301	330	46	88.0
8	312	327	47	89.6
9	288	319	52	85.1
10	292	291	27	75.2
11	291	302	28	77.1
12	309	324	49	89.0
13	309	336	53	92.4
14	298	260	5	65.3
15	305	307	36	82.1
16	298	308	28	80.1
17	296	323	42	85.3
18	294	324	59	88.6
19	294	307	24	78.1
20	300	307	27	79.7
21	331	316	44	89.7
22	292	324	48	86.2
23	277	313	30	78.1
24	301	327	50	88.6
25	307	324	50	88.5
26	296	314	34	82.0
27	284	323	32	81.6
28	294	305	32	79.1
29	305	289	0	71.6
30	286	299	40	78.4
31	308	336	58	91.7
32	331	317	51	90.9
33	306	317	51	87.1
34	306	310	36	83.2
35	287	314	39	81.9
36	286	307	18	75.8
37	298	307	24	78.8
38	271	308	23	74.9
39	314	306	17	80.4
40	303	310	42	83.8
41	291	313	30	80.2
42	300	313	40	83.5
43	290	304	45	81.0

TABLE I, CONTINUED

44	306	288	9	73.3
45	298	317	34	82.7
46	303	313	19	80.1
47	296	324	40	85.3
48	290	316	33	81.3
49	301	316	38	84.0
50	292	297	21	75.2
51	309	288	32	78.0
52	279	299	18	73.2
53	287	313	39	81.7
54	262	296	33	73.0
55	301	324	50	87.9
56	305	321	38	75.7
57	287	268	5	65.7
58	295	319	47	85.0
59	290	310	34	80.3
60	290	333	50	88.2
61	277	308	24	76.0
62	290	330	52	87.9
63	294	316	44	84.0
64	316	327	52	91.3
65	314	298	10	76.7
66	284	316	41	81.9
67	287	300	26	76.5
68	295	319	45	84.7
69	284	308	39	79.9
70	294	309	31	80.1
71	286	294	29	75.4
72	306	317	27	82.6
73	271	323	27	78.7
74	279	300	18	73.4
75	286	305	31	77.7
76	291	311	37	81.1
77	307	333	40	88.9
78	303	319	46	85.9
79	296	307	41	81.6
80	286	299	39	78.2
81	303	310	32	81.9
82	277	302	20	73.6
83	296	296	44	80.1
84	288	308	48	82.3
85	313	308	16	80.0
86	317	308	28	82.8
87	277	314	36	79.6
88	308	333	53	90.1
89	266	313	41	78.5
90	295	310	23	79.0
91	313	299	18	78.4
92	306	330	52	90.4
93	314	323	48	89.1
94	308	333	55	90.4

TABLE I, CONTINUED

95	307	321	44	89.1
96	294	321	44	87.1
97	292	313	19	78.4
98	312	333	49	91.3
99	295	300	24	77.0
100	299	319	47	85.6
101	275	313	7	73.5
102	277	314	42	80.7

TABLE II
 PREDICTED AND ACTUAL
 GRADE AVERAGES

STUDENT NUMBER	PREDICTED AVERAGE	ACTUAL AVERAGE
1	88.0	82.0
2	76.0	78.3
3	78.9	71.0
4	80.0	94.0
5	82.8	86.0
6	79.5	71.0
7	88.0	92.0
8	89.6	89.5
9	85.1	83.0
10	75.2	62.0
11	77.1	76.0
12	89.0	88.2
13	92.4	96.3
14	65.3	none
15	82.1	82.7
16	80.1	76.0
17	85.3	76.5
18	88.6	none
19	78.1	83.0
20	79.7	77.0
21	89.7	83.5
22	86.2	84.7
23	78.1	74.0
24	88.6	94.0
25	88.0	84.0
26	82.0	85.0
27	81.6	77.5
28	79.1	79.5
29	71.6	78.0
30	78.4	77.3
31	91.7	97.5
32	90.9	89.0
33	87.1	92.0
34	83.2	69.5
35	81.9	74.0
36	75.8	none
37	78.8	79.0
38	74.9	75.0
39	80.4	85.0
40	83.8	81.0
41	80.2	66.3
42	83.5	77.0
43	81.0	88.3

TABLE II, CONTINUED

44	73.3	46.0
45	82.7	83.0
46	80.1	none
47	85.3	81.3
48	81.3	85.5
49	84.0	75.5
50	75.2	89.0
51	78.0	80.0
52	73.2	69.0
53	81.7	89.7
54	73.0	80.0
55	87.9	87.5
56	75.7	77.5
57	65.7	78.5
58	85.0	77.7
59	80.3	73.0
60	88.2	79.0
61	76.0	72.5
62	87.9	94.0
63	84.0	67.5
64	91.3	80.0
65	76.7	75.5
66	81.9	86.0
67	76.5	77.3
68	84.7	79.0
69	79.9	94.7
70	80.1	83.0
71	75.4	85.0
72	82.6	91.5
73	78.7	69.5
74	73.4	75.5
75	77.7	74.3
76	81.1	87.5
77	88.9	96.0
78	85.9	79.0
79	81.6	none
80	78.2	73.0
81	81.9	none
82	73.6	82.3
83	80.1	81.3
84	82.3	93.0
85	80.0	73.0
86	82.8	81.0
87	79.6	87.0
88	90.1	90.0
89	78.5	91.0
90	79.0	80.0
91	78.4	74.0
92	90.4	91.7
93	89.1	93.0
94	90.4	98.0

TABLE II, CONTINUED

95	89.1	68.0
96	87.1	82.3
97	78.4	85.0
98	91.3	71.5
99	77.0	83.0
100	85.6	87.0
101	73.5	75.5
102	80.7	85.0

Results

Of the one hundred and two inquiries which were sent out, replies were received with grades for a total of ninety-six students.

After checking the predicted grade averages of these ninety-six students against their actual grade averages, it was found that 63.5% accuracy was achieved.

Of the ninety-six replies, there were twenty-one students who had three grades reported; forty-nine students who had two grades reported; and twenty-six students who had one grade only reported.

Of the twenty-one who had three grades reported, twelve of these were within their predicted grade average, giving an accuracy of 57.1%.

Of the forty-nine who had two grades reported, thirty-one of these were within their predicted grade average, giving an accuracy of 63.2%.

Of the twenty-six who had one grade only reported, eighteen of these were within their predicted grade average, giving an accuracy of 69.2%.

Of the ninety-six replies, ninety-six had their chemistry grades reported; sixty-three had their mathematics grades reported; and thirty had their english grades reported.

Of the ninety-six chemistry replies, sixty-eight were within their predicted grade average, giving an accuracy of

70.8%.

Of the sixty-three replies which reported mathematics grades, twenty-nine of these were within their predicted grade average, giving an accuracy of 46.0%.

Of the thirty which had their english grades reported, nineteen of these were within their predicted grade average, giving an accuracy of 63.3%.

TABLE III
RESULTS

NUMBER OF GRADES	PERCENT ACCURACY
All Grades	63.5
Three Grades	57.1
Two Grades	63.2
One Grade	69.3

TABLE IV
RESULTS BY TYPE
OF GRADE

CLASS	PERCENT ACCURACY
Chemistry	70.8
Mathematics	46.0
English	63.3

CHAPTER V

DISCUSSION AND CONCLUSIONS

Discussion

This study was done with the purpose of determining whether or not a regression equation previously derived for students at Oklahoma State University, Stillwater, Oklahoma, who were enrolled in Chemistry 114 and were of freshman classification, could be used to predict final grade averages.

While this equation was derived to predict grade averages in chemistry, it was wondered if the equation could not be used to predict grade averages on an over-all basis.

For this study students were required to have been in the freshman class; to have taken the freshman entrance examinations; and it was necessary that these test scores be recorded for each of the students involved.

Of the original one hundred and two students selected, ninety-six were still in school and had grades recorded for them the spring semester of 1959-60. This would indicate a drop rate of 5.88%.

It is hoped that this study will indicate the usefulness of psychological examinations in predicting the success of the student in his school work.

Conclusions

Taking the grade averages of all replies received it was found that there was a correlation coefficient of .64, which is between the range of .60 and .70. When a coefficient falls in this range it is considered to be significant.

From this premise it is concluded that the regression equation used is valid and is highly significant in predicting the grade average of students enrolled in college.

Using only those replies which recorded three grades for the students it was found that there was a correlation coefficient of .57, which is not in the highly significant range, yet is fairly significant.

Using only those replies which recorded only two grades for the students it was found that there was a correlation coefficient of .63, which falls in the highly significant range.

Using only those replies which recorded only one grade for the students it was found that there was a correlation coefficient of .69, which falls in the highly significant range.

Upon classifying the results by type of grades recorded it was found that for those with a chemistry grade recorded there was a correlation coefficient of .71, which is very highly significant.

Using those replies which classified the grades in the english category it was found that there was a correlation coefficient of .63, which again, falls in the highly

significant range.

Using those replies which classified the grades in the mathematics category it was found that there was a correlation coefficient of .46, which is not highly significant.

It was concluded that the regression equation used was capable of producing significant predictions, and that it was even more significant in predicting the chemistry grade alone.

While this study is not meant to be a cure for properly categorizing students upon their enrollment in college, it is meant to be an aid. It is thought that with the aid of this study counsellors and administrators could guide their students with more accuracy into fields of study where they might be more successful and could be used to discourage their entry into fields of study where they might meet with dissapointment and failure.

It is recognized that there are more factors which determine a student's success in academic work than his scores on entrance examinations. These problems and situations must be taken care of by trained personnel, but it is also recognized that the study tends to indicate that there is a certain amount of accuracy possible in predicting grade averages for groups of students.

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University of Michigan Press, 1949).

VITA

Joe Harold Boattenhamer

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Master of Science

Report: PREDICTING GRADE AVERAGES FROM FRESHMAN TEST SCORES

Major Field: Natural Science

Biographical:

Personal Data: Born at Oklahoma City, Oklahoma, December 7, 1929, the son of Lloyd and Alvina Boattenhamer.

Education: Attended grade school in Oklahoma City, Oklahoma, graduate from Classen High School, Oklahoma City, 1947. Attended Central State College, Edmond, Oklahoma and graduated from there 1957. Also attended Central State College the summers of 1957 and 1958. Attended Kansas State Teachers College, Emporia, Kansas the summer of 1959. Received Master of Science degree from Oklahoma State University, Stillwater, Oklahoma, May, 1960.

Professional Experience:

Taught high school mathematics at Northwest Classen, Oklahoma City, Oklahoma 1956-57. Taught high school science at Lamar, Colorado, 1957-58. Taught high school science and mathematics at Parsons, Kansas, 1958-59.

Professional Organizations: Member Kansas State Teachers Association, National Educationa Association.