6-1-1957

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Robert B. McCarty

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A Paper

Presented To

The Faculty of the Department of Mathematics

Eastern Illinois State College

In Partial Fulfillment

of the Requirements for the Degree

Master of Science in Education

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by

Robert B. McCarty

June 1957

DATE 2 April 1957

APPROVED [redacted]

ADVISOR [redacted]

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The study reported in this paper was inspired by the curiosity of the writer in whether the use of the Orleans Geometry Prognosis Test as used in the Lawrenceville, Illinois, high school for selection of pupils for the study of geometry had any significance and if so, what some of the implications were.

The purpose of this paper is to present some of the things that should be taken into consideration in trying to predict the probable success of pupils in the study of algebra and geometry in the secondary school and to compare the results as obtained from the permanent records of the Lawrenceville High School with other studies of a similar nature which have been made.

The problem of attempting to predict the probable success of pupils in the study of algebra and geometry arises from the fact that a great percentage of students of secondary school age are enrolled in the public schools, and that many are believed to lack the ability to study the subjects to advantage and the capacity to absorb material of value from their study. The fact that many of these pupils who take the courses fail miserably and are unduly prejudiced against them for that reason cause concern for being able to identify them beforehand.

The value of proper guidance in mathematics was

clearly pointed out by Lee and Hughes when they reported:

> If a pupil does not take one subject, he will probably take another, and he will get more good from a subject in which he is successful than one in which he fails. No certain proof has been offered that one subject is more valuable than another for general educative purposes. Until such evidence exists, the administration need feel no compunction about advising a pupil not to take algebra or geometry when test data proved by statistics indicate that the pupil's chances for success, as measured by a passing mark, are nil or extremely small.[1]

Who is to say who should study algebra or geometry and on what basis? One possibility would be for the pupils to choose their studies. The decision could be made on the basis of the results of a mental test. Another method of selection could be on the recommendation of the previous mathematics teacher. The basis of selection could be the showing made by the pupils on a prognosis test.

It is generally conceded that no one of the suggested methods of selection is satisfactory in itself. The finding of Douglass[2] was that achievement in algebra and geometry may be predicted with a fair degree of accuracy only. Achievement cannot be predicted satisfactorily from any one variable for the purpose of homogeneous grouping or definite advice relative to taking or not taking geometry. Achievement is best predicted by a com-

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1 J. Murray Lee and W. Hardin Hughes, "Predicting Success in Algebra and Geometry", The School Review. 1934. Vol. 42, pp. 195-196.

2 Harl R. Douglass, "The Prediction of Pupil Success in High School Mathematics", The Mathematics Teacher. 1935. Vol. 28, p. 492.

bination of the following variables- a good prognostic test, I. Q., and average mark in previous year or two years of school work.

Various attempts have been made to construct tests that would tap more completely the abilities associated with success in geometry than do the general mental tests. Richardson[3], in a study concerned with predicting achievement in plane geometry, concluded that mental test ratings alone correlated only .50 with geometry achievement grades. The test considered in this study is the prognosis test of which the Orleans Geometry Prognosis Test is one example.

Prognosis tests are those which are given a pupil before he has had any specialized training in the particular subject for the purpose of measuring his innate ability to do the work expected of him. By using these tests, the teacher is enabled to make a prediction of the probable success the pupil will experience in his later studies.

Prognosis tests have been developed to help meet the need for a method of measuring a pupil's ability to learn algebra or geometry. This information is necessary in order to advise the pupil intelligently with respect to taking further work in mathematics.

It has been pointed out previously that the prognostic test should not be made the sole basis for prediction,

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3 H. D. Richardson, "Predicting Achievement in Plane Geometry", The Mathematics Teacher. 1935. Vol. 28, p. 314.

classification, or guidance because such absolute dependence would overlook other important factors. The faith placed in the future of prognosis tests was recorded several years ago though by Reeve when he wrote:

> The prognostic test at its best achieves quickly and with improved results that which the schools have heretofore discovered after a loss of valuable time; at its worst it leads into a determinism that is more dangerous than the extreme form of Calvinism which left each individual absolutely without hope. On the whole the tests have achieved a great and well-deserved success, and this success will be much more apparent when a new generation comes forward to correct the errors of the present one.[4]

In May of 1955 the Orleans Geometry Prognosis Test was given to 103 students in the Lawrenceville High School completing the second semester of beginning algebra for the purpose of advising each of the pupils with respect to his probable success in studying plane geometry.

It should be noted that the mathematics curriculum in the Lawrenceville High School has included in it two different courses in geometry. One of these courses is the traditional college preparatory course and is known as regular geometry. The other course consists of more work in geometric design, work in construction and use of models and topics of special value to the weaker student in mathematics and is known as laboratory geometry. It is not intended for those students who are preparing for college.

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4 William D. Reeve, Improvement of Tests in Mathematics. (The First Yearbook, The National Council of Teachers of Mathematics. 1926) p. 108.

The possible score on this test was 96. The general recommendations based on the scores of the prognosis test were that those pupils with scores falling below 20 should not take geometry, those falling between 20 and 34 should be placed in laboratory geometry, and the others should be in regular geometry. Three pupils with scores falling between 20 and 34 were enrolled in regular geometry and three pupils scoring over 35 were placed in laboratory geometry due either to teacher recommendations or student preference. The particular facts of these cases were not available to the writer during the period of this study.

Out of the group taking the prognostic test, 73 were recommended for regular geometry, 21 were recommended for laboratory geometry, and 9 were advised not to enroll in any geometry class. Forty seven of the group recommended for regular geometry enrolled in the course and 4 pupils were enrolled in the laboratory geometry course. One of these dropped the laboratory course at the end of the first semester and is not included in this study.

An examination of Table I shows the Orleans Geometry Prognosis Test score for each pupil enrolled in geometry as well as the two semester grades earned in beginning algebra. Opposite each of these are the corresponding marks received for the two semesters of geometry. Those pupils enrolled in laboratory geometry are indicated with geometry grades in red lead but the grades were not differentiated for the pur-

pose of determining correlation of scores and grades earned.

Table II contains various coefficients of correlation as calculated from the data appearing in Table I. Upon examining the data appearing in Table II it appears the best method of predicting success in geometry by far is the success in algebra as determined by the teacher's marks.

Thinking the extremely high correlation was due to chance and not particularly significant, the correlation between final marks in algebra and in geometry for the previous two years was calculated[5] and found to be .69. Except for the correlation as determined by the two geometry grades which could be expected to be rather high, this figure is still as high as any of the other correlations determined in this study and tend to verify the findings of Richardson[6] in that second semester algebra grades are the best single predictive factor for predicting success in plane geometry.

The results of similar studies made by Lee and Hughes[7] differ considerably in that their results show clearly that the aptitude tests give the best single prediction of achievement as measured by standardized tests, both in algebra and geometry.

The achievements of the pupils in this study were meas-

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5 The method of selecting geometry students reported in this study has been in use for several years which tends to make this a valid figure.

6 Richardson, op. cit., Vol. 28, p. 314.

7 Lee, op. cit., Vol. 42, p. 189.

ured by examinations and tests constructed by the teachers of algebra and geometry rather than by the use of standardized tests which could account for the difference in findings with Lee and Hughes. As Richardson[8] points out though, it is the teacher's mark for the subject which is recorded on the permanent file for the pupil that is sent to colleges and prospective employers on the pupils'transcripts instead of scores on standardized tests so this means of comparison is valid.

The correlation of Orleans Geometry Prognosis Test scores with the teachers' marks in geometry, especially at the end of the first semester, seem significantally small. It should be pointed out, however, that 64 per cent of the students recommended for regular geometry were enrolled, only 14 per cent of the laboratory geometry recommendations were enrolled, and that no pupils enrolled for geometry whose score was below the recommended cutoff score of 20. It is felt that the correlation would have been considerably higher had all students who passed beginning algebra been enrolled in geometry.

The results as obtained from this study are not much different from those obtained from a study[9] of 135 students where a correlation between first semester geometry grades and second semester algebra grades of .70 was obtained.

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8 Richardson, op. cit., Vol. 28, p. 313.
9 Ibid., Vol. 28, p. 314.

A correlation of .67 existed between first semester geometry grades and prognosis test scores while the correlation between first semester geometry grades and first semester algebra grades was found to be .63.

Perhaps the most significant thing about this study is that with the exception of one student in the laboratory geometry who dropped the course at the end of the first semester, all pupils received a passing mark for the course. This in itself seems to support the use of the Orleans Geometry Prognosis Test as a valid means of predicting the probable success of pupils in the study of geometry.

Table I

Orleans Geometry Prognosis Score	Algebra I Grades		Geometry Grades		Orleans Geometry Prognosis Score	Algebra I Grades		Geometry Grades	
80	A	A	A	A	48	C	C	C	C
79	A	A	A	A	48	C	B	B	B
78	A	A	A	A	47	B	B	B	B
77	A	A	A	A	47	C	B	B	A
75	B	A	A	A	46	C	C	C	C
71	B	B	B	B	45	C	C	D	D
69	B	B	C	B	44	C	C	D	C
68	D	C	D	D	43	C	C	D	C
65	A	A	B	A	43	B	C	C	B
64	B	B	C	C	43	C	B	B	B
63	B	B	B	A	43	C	B	C	C
63	A	A	B	A	42	C	C	C	C
63	B	B	B	B	41	B	B	D	C
61	B	B	D	C	41	D	D	C	D
59	A	B	B	B	39	C	C	C	C
59	C	C	D	C	37	B	B	C	C
57	B	B	C	B	36	B	B	D	B
57	A	A	A	A	36	B	B	B	B
56	B	C	B	B	36	A	B	B	B
56	A	B	C	C	36	B	C	C	C
54	C	A	A	A	31	C	C	D	D
53	B	B	A	A	29	D	C	D	D
51	A	A	A	A	25	C	C	D	D
51	C	C	B	B	23	D	D	C	D
51	C	B	C	D					
49	B	B	A	A					

Table II

Coefficients of Correlation as Calculated from Table I

	First Semester Geometry Grades	Second Semester Geometry Grades
Orleans Geometry Prognosis Test Score	.52	.58
First Semester Algebra I Grade	.57	.69
Second Semester Algebra I Grade	.69	.98
First Semester Geometry Grade	...	.93

Table III

Orleans Score	First Semester Geometry Grade	Computation of coefficient of correlation for first case (typical example)				
X	Y	X'	Y'	X'Y'	X'^2	Y'^2
80	5	30	2	60	900	4
79	5	29	2	58	841	4
78	5	28	2	56	784	4
77	5	27	2	54	729	4
75	5	25	2	50	625	4
71	4	21	1	21	441	1
69	3	19	0	0	361	0
68	2	18	-1	-18	324	1
65	4	15	1	15	225	1
64	3	14	0	0	196	0
63	4	13	1	13	169	1
63	4	13	1	13	169	1
63	4	13	1	13	169	1
61	2	11	-1	-11	121	1
59	4	9	1	9	81	1
59	2	9	-1	-9	81	1
57	3	7	0	0	49	0
57	5	7	2	14	49	4
56	4	6	1	6	36	1
56	3	6	0	0	36	0
54	5	4	2	8	16	4
53	5	3	2	6	9	4
51	5	1	2	2	1	4
51	4	1	1	1	1	1
51	3	1	0	0	1	0
49	5	-1	2	-2	1	4

Table III Cont'd

Orleans Score	First Semester Geometry Grade	$r = \frac{50x422-78x23}{\sqrt{(50x10170-78^2)(50x65-23^2)}} = .52$				
X	Y	X'	Y'	X'Y'	X'^2	Y'^2
48	3	-2	0	0	4	0
48	4	-2	1	-2	4	1
47	4	-3	1	-3	9	1
47	4	-3	1	-3	9	1
46	3	-4	0	0	16	0
45	2	-5	-1	5	25	1
44	2	-6	-1	6	36	1
43	2	-7	-1	7	49	1
43	3	-7	0	0	49	0
43	4	-7	1	-7	49	1
43	3	-7	0	0	49	0
42	3	-8	0	0	64	0
41	2	-9	-1	9	81	1
41	3	-9	0	0	81	0
39	3	-11	0	0	121	0
37	3	-13	0	0	169	0
36	2	-14	-1	14	196	1
36	4	-14	1	-14	196	1
36	4	-14	1	-14	196	1
36	3	-14	0	0	196	0
31	2	-19	-1	19	361	1
29	2	-21	-1	21	441	1
25	2	-25	-1	25	625	1
23	3	-27	0	0	729	0
		78	23	422	10170	65

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