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How Secondary Education Affects Performance in College

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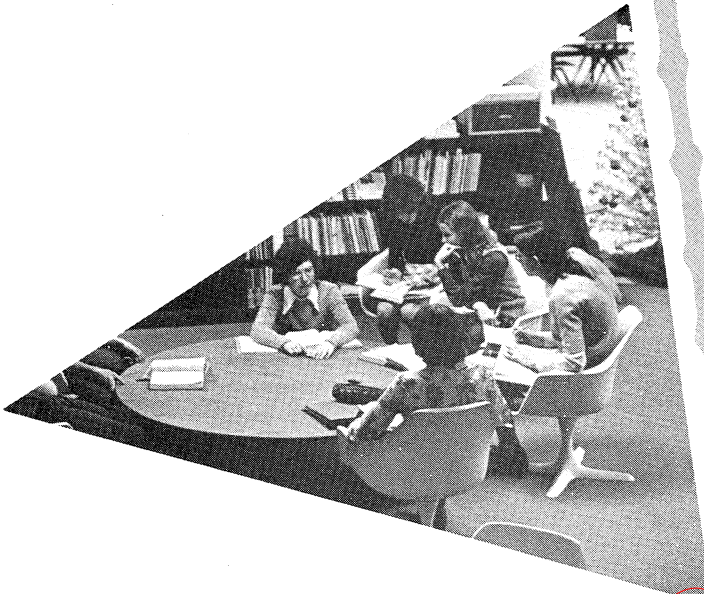
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how secondary education affects performance in college

Cooperative Extension Service
Purdue University
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How Secondary Education Affects Performance in College

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INTRODUCTION

College administrators and others have long held the belief that inadequate performance of beginning college students was at least partially related to inadequate training at the secondary level -- that the high school did not provide the educational opportunities to meet the needs of the student and therefore provide an adequate basis for college work. The present discussion examines:

(1) the extent to which performance of beginning college students can be attributed to variation in previous educational opportunities provided by public high schools.

(2) the extent to which the performance of college freshmen is related to variables such as advanced course work taken by the student while in high school.

(3) relationships between educational opportunities provided by the school and scores on selected standardized tests of achievement, and

(4) the extent to which standardized test scores are useful as predictors of grade-point averages of college freshmen.

Academic achievement is hypothesized to be related to the educational opportunities provided by the public school system.

Achievement is also presumed to be related to the student's genetic ability as well as to characteristics of the student's family and community. The analysis was therefore designed to separate the impacts of the school from the impacts of socioeconomic and other variables.

DATA

Basic data for analysis consisted of information on 2652 Purdue freshmen from all schools in the University who entered college during the fall semester of 1971. These data were supplied by the Purdue admissions and registrar's offices and consisted of information on grade-point averages, Scholastic Aptitude Test Scores (SAT), College Entrance Examination Board Scores (CEEB), courses taken while in high school, rank in the high school graduating class, high school attended, school the student was enrolled in at Purdue, and other information.

Differences in educational opportunities provided by public high schools have been measured by (1) the number of high school courses that are available, (2) experience of teachers, (3) percent of teachers who hold advanced degrees, and (4) student/teacher ratios. Accordingly, data on these measures of educational opportunity for each school system were obtained from the Indiana Department of Public Instruction.

Since most Purdue freshmen are required to take courses in English, mathematics and science, information on course offerings consisted of a count of the number of courses offered by the high school in these subject matter areas. Similarly, data on experience and the percent of teachers holding

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graduate degrees were obtained for each teacher in the three major subject matter areas.

It is often asserted that public school systems which pay high average salaries are able to attract teachers with special qualifications not measureable by experience or degrees held (for example, a school system that wishes to attract a beginning teacher who graduated in the upper 10 percent of his graduating class may need to pay relatively high salary). Accordingly information on salaries paid to teachers in English, mathematics and science was obtained for Indiana high schools.

Information was also obtained from the 1970 U.S. Census of population on the socioeconomic characteristics of the population residing within individual school corporations in Indiana. These data included information on family income and education levels.

From the data supplied by the Purdue admissions and registrar's offices on the high school that each student attended, it was then possible to match each Purdue freshman with the information on high school characteristics supplied by the Indiana Department of Public Instruction, as well as with socioeconomic data from the U.S. Bureau of the Census.

Regression analysis was used to identify factors influencing the grade-point averages of the college freshmen and scores on standardized tests of achievement. From the basic sample of 2652 Purdue freshmen, two samples, each consisting of approximately 400 students, were drawn. The sampling was done in such a way as to insure that a maximum number of Indiana high schools would be represented. Replications of the same set of statistical tests on both samples substantially reduced the chance of spurious conclusions.

Results of the analysis may appear to be limited because data on only a select group of high school graduates (Purdue University freshmen) were used. Specifically, the question of how the high school influences

the performance of students who do not attend college is not approached. However, it is the authors' belief that students who plan to attend college receive the major benefit from an advanced course in high school or a teacher with advanced training in a subject matter area. Consequently, if a relationship exists between student performance and measures of educational opportunity used in the analysis, the relationship should be revealed by the analysis of data for students in the sample.

FACTORS INFLUENCING GRADE-POINT AVERAGES

Educational Opportunities Provided by the High School

Information in Table 1 provides a summary of the factors found to be related to first semester grade-point averages of Purdue freshmen.

The analysis provided no evidence to support the contention that first semester grade-point averages are partially determined by the educational opportunities provided by the high school. The relationship between grade-point averages, qualifications and salaries of high school teachers in three major subject matter areas (English, mathematics, and science) were examined. No evidence was found to support the belief that high schools which have teachers who are highly paid, have many years of experience, or hold graduate degrees produce a student better suited for college work than do high schools with teachers who are less highly paid, have less experience, or have few graduate degrees. These findings suggest that all high schools in Indiana have faculties with sufficient training and experience to prepare students for college work.

Relationships were analyzed between the number of courses offered by the high school in each subject matter area (English, mathematics and science) and performance of college freshmen. No evidence was found to suggest that high schools which offered a large number of advanced courses in these

subject matter areas produced a student better able to perform in a college environment. One explanation of this would suggest that all high schools are providing a sufficient number of courses in each area to prepare students for college.

Student Characteristics

Substantial evidence was found of a relationship between a student's characteristics and his (her) performance as a freshman at Purdue. A student's rank in the high school graduating class, regardless of the high school attended, was found to be the best predictor of how well he (she) did at

Table 1. Variables Influencing First Semester Grade-Point Averages of Freshmen at Purdue, 1970-71.*

School Variables	Relationship to total grade-point average
Pupil/teacher ratio in high school	none
Salary of English teachers	none
Salary of math teachers	none
Salary of science teachers	none
Degrees of English teachers	none
Degrees of math teachers	none
Degrees of science teachers	none
Experience of English teachers	none
Experience of math teachers	none
Experience of science teachers	none
Extra salary for year of experience	none
Extra salary for Master's degree	none
<u>Student Characteristics</u>	
Rank of student in his high school graduating class	+++
Semesters of English a student took while in high school	none
Semesters of math a student took while in high school	+
Income of residents in the community	none
Percent of people in the community who graduated from college	+
Race of the student	none

*a "none" denotes that no relationship was found.
 a "+++" denotes a positive relationship statistically significant at the .05 level.
 a "+" denotes a positive relationship statistically significant at the .20 level.

Purdue. It can be argued that class rank is an indication of the combined effect of the student's inherited ability and his home environment.

Another factor that was found to be significantly related to grade-point averages was the semesters of mathematics the student took while in high school. However, students who took additional semesters of math while in high school were not necessarily found only in those schools that offered a large number of mathematics courses.

It does not necessarily follow that students who intend to enroll at Purdue should take as many semesters of mathematics as possible while still in high school. It is not clear from this analysis whether the extra courses in math at the high school level are helpful to college freshmen, or whether the number of courses in math merely reflects a student's interest in and motivation to do advanced work in mathematics.

No evidence was found of a significant relationship between the semesters of science or English a student took while in high school and grade-point averages. There is very little variation in the amount of high school English taken by entering Purdue freshmen, with nearly all completing eight semesters of English. There existed somewhat greater variation in the semesters of science taken by students.

An analysis was also conducted to test for differences in the degree of difficulty of obtaining a given grade-point average in various schools in the University. No discernable pattern was found. In other words, the likelihood of a student attaining a given grade-point average is the same regardless of the school in the University in which he is enrolled.

FACTORS INFLUENCING SCORES ON STANDARDIZED TESTS

All beginning freshmen at Purdue are required to take both the Scholastic Aptitude Test (SAT) and the Achievement tests of the

College Entrance Examination Board (CEEB) in English, mathematics and chemistry. The SAT exams are used as part of the criteria for admission, while the CEEB exams are used as a device for placing students in appropriate English, mathematics and chemistry courses. An analysis was conducted in an effort to determine how measures of educational opportunity provided by the high school and the student characteristics influenced performance on standardized test scores. Standardized tests used in the analysis consisted of scores on both the verbal and quantitative sections of the SAT exam as well as scores on the English, mathematics and chemistry CEEB exams. A summary of factors influencing scores on SAT and CEEB exams is presented in Table 2 and Table 3.

Educational Opportunities Provided by the High School

The analysis of factors influencing scores on the SAT and CEEB exams provided no evidence to suggest that performance on standardized tests was related to measures that were used as indices of educational opportunities provided by the high school. Qualifications of high school teachers in mathematics were not found to be related to either scores on the quantitative section of the SAT exam or the mathematics section of the CEEB exam. Qualifications of high school teachers in English were not found to be related to scores on the verbal section of the SAT exam or on the English section of the CEEB exam. Qualifications of high school science teachers were not found to act as a determinant of scores on the CEEB exam in chemistry. The number of courses in English, science, and mathematics offered by the high school was not found to be related to the standardized test scores in any of the exams.

Student Characteristics

A number of student characteristics were found to be related to scores on SAT

and CEEB exams. The student's rank in his high school graduating class was found to be the variable most strongly related to the student's score on the verbal section of the SAT exam and on the English section of the CEEB exams. The semesters of mathematics a student took while in high school were found to be most strongly related to scores on the quantitative section of the SAT exams and the mathematics section of the CEEB exams.

Table 2. Variables Influencing Scores on the Scholastic Aptitude Test, 1970-71.*

School Variables	Relationship to --	
	Verbal SAT	Quantitative SAT
Pupil/teacher ratio in high school	none	none
Salary of English teachers	none	not ex.
Salary of math teachers	not ex.	none
Degrees of English teachers	none	not ex.
Degrees of math teachers	not ex.	none
Experience of English teachers	none	not ex.
Experience of math teachers	not ex.	none
Extra salary for Master's degree	none	none
Extra salary for year of experience	none	none
<u>Student Characteristics</u>		
Rank of student in his high school graduating class	+++	+++
Semesters of English a student took while in high school	none	not ex.
Semesters of math a student took while in high school	not ex.	+++
Income of residents in the community	none	none
Percent of people in the community who graduated from college	+++	+
Race of the student	---	---

*a "not ex." denotes a relationship not examined.
 a "none" denotes no relationship.
 a "+++ " denotes a positive relationship statistically significant at the .05 level.
 a "+" denotes a positive relationship statistically significant at the .20 level.
 a "---" denotes a negative relationship statistically significant at the .05 level.

The race of the student was also found to be related to scores on standardized tests. With all other variables (including class rank) held constant, non-whites had scores

Table 3. Variables Influencing Scores on College Entrance Examination Board Tests, 1970-71.*

	Relationship to --		
	English CEEB	Math CEEB	Chem. CEEB
<u>School Variables</u>			
Pupil/teacher ratio in high school	none	none	none
Salary of English teachers	none	not ex.	not ex.
Salary of math teachers	not ex.	none	not ex.
Salary of science teachers	not ex.	not ex.	none
Degrees of English teachers	none	not ex.	not ex.
Degrees of math teachers	not ex.	none	not ex.
Degrees of science teachers	not ex.	not ex.	none
Experience of English teachers	+	not ex.	not ex.
Experience of math teachers	not ex.	none	not ex.
Experience of science teachers	not ex.	not ex.	none
Extra salary for year of experience	none	none	none
Extra salary for Master's degree	none	none	none
<u>Student Characteristics</u>			
Rank of student in his high school graduating class	+++	+++	+++
Semesters of English a student took while in high school	none	not ex.	not ex.
Semesters of science a student took while in high school	not ex.	not ex.	+++
Semesters of math taken by student while in high school	not ex.	+++	not ex.
Income of residents in the community	none	none	none
Percent of people in the community who graduated from college	none	none	+++
Race of the student	- - -	none	none

*a "not ex." denotes a relationship not examined.
 a "none" denotes no relationship.
 a "+++ " denotes a positive relationship statistical-ly significant at the .05 level.
 a "+" denotes a positive relationship statistically significant at the .20 level.
 a "- - -" denotes a negative relationship statistical-ly significant at the .05 level.

on the SAT exams from 58 to 90 points lower, and on the CEEB exams from 35 to 140 points lower than whites.

Students whose homes were in high income communities, or in communities where a high proportion of the population had graduated from college did better on the standardized tests than did other students. This adds some support to the belief that these tests have a white middle class societal bias which does not reflect differences in ability. Neither the race of the student nor the socioeconomic characteristics of his community were found to be related to first semester grade-point averages.

STANDARDIZED TEST SCORES AS PREDICTORS OF SUCCESS IN COLLEGE

Further analysis was also conducted in this study in an attempt to assess the usefulness of standardized test scores as tools to gauge a student's capacity for doing college work. Scores on all of the standardized achievement tests used in the analysis were found to be positively correlated (related) to first semester grade-point averages. None of the standardized test scores appeared to be clearly superior to the others as a predictor of grade-point averages. However, a student's rank in his graduating class was found to be more strongly correlated and thus a better predictor of grade-point averages than any of the standardized test scores.

CONCLUDING COMMENTS

1. It is not necessary for a high school to offer a large number of advanced courses or to hire large numbers of teachers with advanced degrees in order to provide the educational opportunities needed to prepare students for college. In other words, all high schools in the state appear to be above the minimum required to adequately prepare students for college. No evidence was found to suggest that the variables measuring educational opportunities provided by the high school were related to grade-point averages of college freshmen.

2. High schools that have highly qualified, well-paid staff or offer large numbers of advanced courses do not necessarily produce students that score higher on the SAT or CEEB exams than do other high schools. The primary determinant of scores on standardized tests may be the motivation and ability of the student, not the salaries or qualifications of teachers in the school.

3. Information on the rank in the high school graduating class and the semesters of mathematics a student took while in high school provide the most reliable indicators of how well a freshman will do during his (her) first semester in college.

4. The use of standardized test scores as a criterion for the admission of students to Purdue should be questioned. These exams are costly to the student and do not

provide more information on the student's ability and motivation than does class rank and courses taken while in high school.

5. Results of this study suggest that in general there are no strong relationships between educational opportunity and educational achievement as they are now measured. The measures of educational opportunity used were selected because they are often used in comparing schools and because they are the policy variables under the control of the local board and administrator. The measures of educational achievement were selected because they have been widely used for evaluation. No evidence was found to support the belief that the policy variables under the control of the local school administrator, if altered, could influence achievement measures of students used in the analysis.

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