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ABSTRACT

The records of 53 students in an introductory biology class at Fulton-Montgomery Community College were examined to determine the effect of selected variables on success in the course. The independent variables tested were age, sex, vocabulary and comprehensive grade placement levels (GPL) on the Nelson-Denny Reading Test, and whether or not the student had taken biology in high school. The final grade in the course served as the dependent variable. Multiple regression analysis was used to establish predictor equations for the success of various subgroups. Results indicated: (1) scores on the Nelson-Denny Reading Test showed significant positive correlations with final grade in introductory biology; (2) age interacted with reading scores to increase the prediction of success; (3) both high school grade point average and rank in graduating class were shown to be statistically significant in predicting academic success; (4) for females who had not taken high school biology, the final grade in the college introductory course was strongly dependent on the comprehension GPL; and (5) for males without high school biology, the final grade depended on vocabulary GPL rather than comprehension GPL. Two tables in the text present descriptive information on the sample of students and display partial analysis results. (DB)

An Assessment of Selected Variables Affecting Success in Community College Introductory Biology

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Running head: Selected Variables Affecting Success in Biology

Abstract

Multiple regression analysis was used to establish predictor equations for subgroups of male and female community college students with and without prior biological education. Fifty-three introductory biology students were sampled. The dependent variable of final course grade in introductory biology was shown to be positively and significantly correlated to vocabulary and comprehension scores on the Nelson-Denny Reading Test. The independent variable of age was shown to increase predictive power for each subgroup. Males and females without prior high school biology were shown to differ in the relationship of their final course grade to vocabulary and comprehension scores. Females without high school biology and males with high school biology provided the most reliable prediction categories.

An Assessment of Selected Variables Affecting Success in Community College Introductory Biology

Two year colleges are one of the most remarkable phenomena to appear on the contemporary scene of American higher education. General public awareness of the need for a college education to broaden socio-economic opportunities has motivated a demand for higher education to respond to the circumstances, needs and/or interests evident in the lives of its student population. Two-year colleges have been identified as being extremely diverse in size, organization, function, administration, support, curriculum, student body and faculty. These two year schools are variously called junior colleges, technical institutes or schools, community or city colleges, two-year colleges, or simply colleges (Hertig, Note 1).

The genesis, support and governance of two-year colleges are largely local matters; their programs are usually geared to satisfy local educational needs, both academic and occupational, and their student body is almost entirely a commuting one. These non-uniform local circumstances foster diversity in two-year colleges, but their general mission is to respond to varying local needs for educational experiences in academic and occupational areas (Hertig, Note 1). Labeled as "democracy's college"

(Thornton, 1972), two-year colleges make higher education available to every citizen, regardless of prior training and education.

The goal of educational opportunity for all has resulted in an "open-door" admissions policy in two-year colleges and in a growing number of other institutions of higher education in the United States (Cross, 1979). This relatively unrestricted opportunity for entry results in a broad spectrum of academic abilities in the student population as well as a tremendous diversity of ages, backgrounds and purposes. Described by Cross (1973) as "new learners", these students generally come from an urban setting, are first-generation college students, include a large percentage of men and women from ethnic and racial minorities, are predicted as high risks on standard achievement tests, have not fared well academically in the past, and generally cope poorly in traditional educational structures. Included also as new learners are increasing numbers of women and adult part-time students.

Unfortunately for many of these new students, the open door has been frequently characterized as a revolving door, easy admission quickly followed by a thinning out through dismissal or dropping out (Hales & Tokar, 1973). In an attempt to alleviate this problem, an increasing number of institutions are initiating assessment programs

designed to place incoming students in the most appropriate "track" and to provide developmental assistance to those who need it. There seems to be consensus among community college educators that entry-level assessment is necessary for the successful guidance of students into appropriate programs. Roueche and Snow (1977) discovered that 83 percent of community colleges offer diagnostic testing or assessment. Colleges are competing for students, including the non-traditional or high risk students, and they must assure these students a chance for success by means of effective entry-level assessment. In spite of the shortcomings of tests and the legalities involved in using the results, testing seems to be the best way of seeing where students are in relation to where they should be for success in college. Unless we can determine the readiness of students who enter our community colleges, we cannot continue to claim to be open door institutions (Roueche & Archer, 1979).

A review of the literature indicates that knowledge of a student's past performance can more accurately direct the student's future academic needs. But individual research investigators are interested in different variables, they ask different questions or essentially the same question in different ways, they sample different populations, and they report their findings in a number of forms. The

uniqueness of each individual two-year college student population precludes a standard measure of success prediction in all courses for all students in all colleges.

Chesson's (1974) study of three North Carolina Community Colleges showed that predictability of performance was not uniform for students in the different colleges taking the same course. Demas (1977), in a study of three community colleges in Michigan, found the student populations sufficiently similar that a single composite regression equation could be used. While the two investigators used some of the same variables (high school rank, mathematics score on a standardized test) other variables were found to also be significant in each study.

The use of the same variable in different colleges led to divergent results in some instances. Jenkins (1966) showed that the use of the Watson-Glaser Critical Thinking Appraisal was a valid predictor of success in freshman biology while Flora (1966) found that this same test was not helpful in predicting overall academic success. Spurlin (1968) found that sex was a significant factor in predicting achievement in freshman biology while Jenkins (1966) found no significant relationship between sex and success in freshman biology. Chumbley (1976) found that sex was not a significant factor in the prediction of grades for a Micronesian college population. While several studies

(Chesson, 1974; Jenkins, 1966; Spurlin, 1968) showed reading ability to be a valid success predictor in biology, Hannah (1974) found that reading ability as measured by the Iowa Silent Reading Test would not be a good predictor for biology achievement but was a potentially useful predictor for physical science achievement. Chesson (1974) found previous biology background nonsignificant while Spurlin (1968) showed prior biological education to be extremely significant. Most of the studies reviewed did not mention age as an independent variable but the study by Demas (1977) did show age to be of significance.

Within this framework of differing student populations, the need for each college to use its own set of measures to determine predictive relationships becomes clear. And, as Cross (1968, 1979) has stated, since the population of the community college continues to change, research of this type should be a continuing effort. The purpose of the present study is to determine the effect of selected variables on prediction of success in a community college introductory biology course. The independent variables tested were: age, sex, vocabulary and comprehension grade placement levels on the Nelson-Denny Reading Test, and whether or not the student had taken biology in high school. The final grade in the course served as the dependent variable.

Method

The study was conducted at Fulton-Montgomery Community College, located in Johnstown, New York. Fulton-Montgomery is a public community college with an enrollment of approximately 1,000 full time day students and approximately 500 part-time and evening students. There are 67 full time faculty members. Fulton-Montgomery is one of the thirty community colleges in New York State which are part of the State University of New York system.

About 70 percent of the student body comes from Fulton and Montgomery counties which are rural to semi rural areas. For the last ten to fifteen years there has been very little growth in the population or the economy of these areas. Little growth is projected in either category for the next twenty years.

The course chosen for study was SC 141, Introductory Biology. SC 141 is a three semester hour course, consisting of two hours of lecture and three hours of laboratory each week. The course extends over one semester, which is normally fifteen to sixteen weeks in duration. Designed for non-science majors, the course emphasizes the human relevance and social implications of biology. Cellular anatomy, physiology and energetics are discussed in both genetic and ecological perspectives (Fulton-Montgomery

Community College Catalog, 1979).

SC 141 was chosen for this study for two reasons: it is usually the first college science course attempted by many students and it is the biology course with the highest failure rate.

The test sample consisted of 53 students who were enrolled in SC 141 during the Fall 1978 day session. A total of 82 students received grades in the course but complete records could be found for only 53 students. This represents a 65 percent sample of the population. Inspection of the records of all 82 students did not reveal any systematic omissions and thus the sample may be considered representative of the population in general.

Stepwise multiple regression was conducted to test the validity of the null hypothesis of no significance between success in SC 141 and the five independent variables. Success was defined as completing the course with a grade of "D" or better. Multiple regression is an extension of the bivariate correlation coefficient to multivariate analysis. It allows a researcher to study the linear relationship between a set of independent variables and a dependent variable while taking into account the interrelationships among the independent variables. The basic goal of multiple regression is to produce a linear combination of independent variables which will correlate

as highly as possible with the dependent variable. This linear combination can then be used to "predict" values of the dependent variable. It also allows the researcher to assess the importance of each of the independent variables in that prediction (Nie, Hull, Jenkins, Steinbrenner & Bent, 1975). A linear prediction equation was generated and cross validated using data from the class of 1977.

The coefficient of determination (r^2) for the predictor equation was also computed. This statistic indicates the proportion of variance in one set of scores that can be accounted for from the other set of scores (Linton & Gallo, 1975). It is a measure of the proportion of variance in the dependent variable that is linearly explained by the independent variables. This statistic gives an indication of the strength of the relationship rather than the direction (Nie et. al., 1975). Table 1 provides a summary profile of the 1978 SC 141 class.

Insert Table 1 about here

Results & Discussion

The results of the study are summarized in Table 2. As shown in the summary profile (Table 1), vocabulary, comprehension, and total reading grade placement level scores (GPL) were positively and significantly correlated to the dependent variable of final course grade at the .05 level of significance. All three reading GPL were also significant at .01. Only the vocabulary and comprehension GPL were used in the computation of the regression equations since the total reading score combines the vocabulary and comprehension scores unequally. Both high school grade point average and rank in graduating class were shown to be statistically significant at the .01 level. These two variables were not included in the equations due to their smaller sample size.

Four separate regression equations are provided in Table 2. The regression equation for females who have not taken a course in high school biology gives the greatest predictability. This equation accounts for nearly 65 percent ($r^2 = .647$) of the sample variance. The comprehension GPL coefficient for this group shows that the final grade in SC 141 is strongly dependent on this independent variable. But the final grade in SC 141 is not dependent on the vocabulary GPL for this group.

Insert Table 2 about here

For males who have not taken high school biology, final grades in SC 141 depend strongly on vocabulary GPL and not on comprehension GPL. These results may reflect a difference in the manner in which males and females approach the study of biology when they have no prior biological education. Final course grade is dependent on comprehension GPL and not on vocabulary GPL for both males and females who have taken a high school biology course. Final grade in SC 141 is dependent on age for three of four equations. But removal of the age variable decreases the predictive power of all four regression equations.

Closer inspection of the data showed that, in general, older males are slightly more predictable than older females while younger females are more predictable than younger males. When the factors of age and sex are excluded from consideration, students who have taken a high school biology course are slightly more predictable than students who have not. Removal of the factors of age and prior biological education reduce overall predictive power and result in no statistically significant differences

in predictability of males and females.

Conclusions

1. Scores on the Nelson-Denny Reading Test show significant positive correlation with final grade in introductory biology at a community college.
2. The factor of age interacts with reading scores to increase prediction of success in introductory biology.
3. Success in introductory biology for males and females with prior biological education depends on comprehension rather than vocabulary scores in this study.
4. Males and females without prior biological education differ in their dependence on comprehension and vocabulary scores for success in introductory biology in this study.

Reference Note

1. Hertig, W. H., Jr. Biology in the two-year college (Publication No. 26). Washington, D.C.: Commission on Undergraduate Education in the Biological Sciences, April 1969.

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Footnotes

1. This work was supported in part by N.S.F. Grant No. SED 78-09893.
2. The author wishes to thank Mr. Robin D. Ader for his assistance and advice.

Table 1

Selected Characteristics of 1978 Biology Class[a]

		Pearson's r
Age		.118
Range	17-35	
Mean	19.1	
Sex		.199
Male	53%	
Female	47%	
Reading Scores (Nelson-Denny Reading Test)		
Vocabulary	10.68	.347*
Comprehension	9.91	.451*
Total	10.16	.407*
High School Biology		.145
Yes	51%	
No	49%	
High School Rank[b]		.476*
High School GPA[b]		.719*
Range	65.8-91.9	
Mean	74.26	

[a] n= 53

[b] n= 25

*Significant at .05 level

Table 2

Regression Coefficients of Selected Variables

	High School Biology		No High School Biology	
	Male[a]	Female[b]	Male[c]	Female[c]
Constant	1.06634	-7.87206	-8.65372	-0.19005
Age	-0.18459	.33243	.35423	.11457
Vocabulary	-0.19728	-0.17665	.53573	-0.95100
Comprehension	.63319	.44464	-0.27906	.97147
Standard Error	.87934	1.27647	.88260	.91241
Multiple R	.73117	.64438	.59233	.80442
r^2	.53461	.41522	.35086	.64710

[a] n = 15

[b] n = 12

[c] n = 13