Madras agric. J. 62 (5) : 291 — 294, May 1975

Predicting of Student Achievement in Agricultural College— A Discriminant Function Approach

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ABSTRACT

A discriminant function study was undertaken at the B. A. College of Agricuiture, Anand, (Gujarat State) to investigate whether 'pass' or 'failure' of students in the First Year B. Sc. (Agri.) examination could be predicted in *a priori* manner utilising the students' scores of the previous examination viz., the Preparatory Science (Agri.) examination. The discriminant function with the variables Chemistry (X_1), Mathematics (X_2), Botany (X_3) and General Agriculture (X_4) gave the discriminant function, $Z = 4.10\ X_1 - X_2 + 11.26\ X_3 - 2.44\ X_4$ indicating that Botany (X_3) was the best predictor. The discriminant function was found to be useful technique in predicting the 'pass' or 'failure' of the students in the succeeding examination using his achievements in the preceding examination in the function. This would help the student himself for guidance upon his future academic successes.

INTRODUCTION

"Of course I am interested in the future; afterall, that is where I will spend the remainder of my life". This near-humourous statement (which incidently has been attributed to several different sources) has been and is being echoed repeatedly by students and parents alike. In a sense the aforesaid statement is the very platform upon which educational guidance has been developed. Guidance is designed to help a student help himself in this implied 'future'. One of the ways in which it does this is to help a student interpret information himself. For a student to discover more about his present capabilities is only part of the picture. To be able to interpret this information easily and accurately in so far as it bears upon his future academic successes and failures is the remainder. For an educationist to discover more about the educational wastage, to remedy them, is another part of the picture.

By and large this educational wastage (failure) in Agricultural Colleges was found to be high in alarming proportions in the first year of the degree course (Bass, 1961, Pumper and Sledge, 1962; and Patel and Patel 1966). Murugesan and Patel (1971) showed that the wastage due to 'failures' was the highest in the Preparatory Science in Agriculture Class of the B. A. College of Agriculture, Anand (Gujarat State) and it could be checked by admitting creative candidates, with the help of discriminant function, who would pass the future examination. The present study aimed at the prediction of achievement of the

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students in the First Year B. Sc. (Ag.) annual examination using multiple measurements such as the scores obtained in different subjects of the previous year viz., Preparatory Science (Agriculture) Class by the discriminant function technique.

MATERIALS AND METHODS

The Discriminant Function was based on the models developed by Fisher (1936). The discriminant function is in the form.

$$Z = \lambda_1 X_1 + \lambda_2 X_2 + \ldots\ldots\ldots + \lambda_k X_k$$

where $X_1, X_2, \ldots\ldots\ldots X_k$ are the variables measured and $\lambda_1, \lambda_2, \ldots\ldots\ldots \lambda_k$ are the corresponding weights. The variables $X_1, X_2 \ldots\ldots X_k$ are assumed to follow a multivariate normal distribution. Assuming that the 2 groups to be discriminated are A and B and that there are n_a sets of observations in A and n_b sets of observations in B, the coefficients λ_i of the discriminant function are obtained by the well known Abbreviated Dolittle method (Snedecor and Cochran, 1968). It was postulated that the basic sciences Chemistry, Mathematics, Botany and General Agriculture in Preparatory Science (Agriculture) class would have definite influence in understanding and performance of the related subjects in the First Year B. Sc. (Agri.) class. Further it was felt that if the Z criterion developed from these four variables could predict well a year ahead of their performance in the First Year B. Sc. (Agri.) class it could very well form a guidance to the student as well as to the teacher. The group of poor performers could be paid special attention to make up the deficiency in their achievements. With the above in view, the discriminant analysis was carried out with the following variables viz., percentage of marks in the Preparatory Science (Agri.) annual examination from random samples of 40 students each among the pass group and the fail group in the First Year B. Sc. (Agri.) class of the B. A. College of Agriculture, Anand (Gujarat) of the years 1965 to 1967.

Variables in Preparatory Science (Agri.) Class.

Variable	Subject
X_1	Chemistry
X_2	Mathematics
X_3	Botany
X_4	General Agriculture

RESULTS AND DISCUSSION :

The mean values based on 40 observations each and the discriminating power (d/s) of the individual variable in the 'pass' and 'fail' groups of students in the First Year B. Sc. (Agri.) class are given in Table 1. It was found that Botany (X_3) was the single predictor having the highest discriminating power followed by Mathematics (X_2). However, the combined use of all the variables in the Discriminant Function would give a best solution in classificatory problems. The discriminant function developed from these four variables X_1, X_2, X_3 and X_4 was

$$Z = 0.001087\ X_1 - 0.000265\ X_2 + 0.002982\ X_3 - 0.000647\ X_4 \ldots\ldots\ldots (1)$$

and with the relative weights of the X's function was reduced to the form,

$$Z = 4.10\ X_1 - X_2 + 11.26\ X_3 - 2.44\ X_4 \ldots\ldots\ldots (2)$$

TABLE 1. Observed Mean values for the 'Pass' and 'Fail' Groups and the discriminating power of individual variable

[Preparatory Science (Agri.)] (x_i)	Pass group	Fail group	Difference (d_i)	Within sample variance (s_i)	Discriminating power (d_i/s_i)
Chemistry (x_1)	55.37	49.65	5.72	7.06	0.81
Mathematics (x_2)	56.60	46.00	10.60	11.90	0.89
Botany (x_3)	51.42	44.95	6.47	5.38	1.20
General Agriculture (x_4)	50.60	48.42	2.18	5.39	0.40

The multivariate t-test, known as Hotelling's T^2 test, carried out has revealed that the discriminant function is statistically significant at $P = 0.01$, thus providing empirical evidence that the parent populations from which the two groups were composed are in fact distinct in respect of their locations. The combined discriminating power of the function was 1.30 with an estimated probability of misclassification of 25.9 per cent. In such classificatory problems the groups overlap to large extent so that even by following the best procedure the probability of misclassification remains high. By increasing the number of variables this percentage could be made smaller and smaller but not always below an irreducible minimum because of the correlations between the variables (Rao, 1952).

Utility of the Discriminant Function: It can be seen from the discriminant function (2) that Botany (X_3) has got the highest weight in the discriminant function followed by Chemistry (X_1). For classification purpose of the 'pass' or 'fail' in the First Year B. Sc. (Agri.) class with *a priori* information of the Preparatory Science (Agri.) examination marks in Chemistry (X_1), Mathematics (X_2), Botany (X_3) and General Agriculture (X_4) it must be known whether an individual belongs to one or other of the two groups. The discriminant function,

$$Z = 4.10\,X_1 - X_2 + 11.26\,X_3 - 2.44\,X_4$$

has the mean values 626 and 546 for the 'pass' and 'fail' groups respectively, with 586 as the middle value. The students with Z scores above 586 would be assigned to the 'pass' group and all the others to the 'fail' group. In practical applications the function can be utilised to guide the students in advance, one year ahead, for preparing well for the subsequent examination. It would also be possible to group together the students whose likely future performance was found to be poor and to give special coaching to them. Any predictions based upon the Discriminant Function pre-suppose that the quality and nature of the course as well as the method of determining the final marks or ratings have not changed. Since both do not change widely in Agricultural Colleges excepting when a new pattern of evaluation system is introduced, the discriminant function can be usefully employed for

prediction purposes. It is worthwhile to undertake investigations with more variables which may be possible with the aid of an electronic computer.

ACKNOWLEDGEMENT

This paper forms part of the M. Sc. (Ag.) thesis of the first author accepted by the Sardar Patel University. The authors are thankful to Dr. R. M. Patel, M. S., Ph. D. (Wisc), Director, Institute of Agriculture Anand and to Dr. B. V. Mehta, Ph. D., Principal, B. A. College of Agriculture, Anand for providing all facilities for the investigations. The first author gratefully acknowledges the Government of Tamil Nadu for granting him study leave for the M. Sc. (Ag.) course.

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