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Predicting the Probability of Good Academic Performance of Veterinary Science (B.V.Sc. & A.H.) Students in Tamil Nadu

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ABSTRACT

A study was undertaken to estimate the predicting the probability of good academic performance of B.V.Sc. & A.H. students of Tamil Nadu Veterinary and Animal Sciences University (TANUVAS) based on the students various factors towards study. Stratified random sampling procedure was adopted to select 280 students. Primary data were collected through personal interview using structured pre-tested interview schedules. The binary logistic regression function model was fitted to predict the probability of good academic performance of sample students. The students' academic performance was measured using variable GPA/CGPA categorized into two —poor (CGPA between 5.00 and 6.99) and good (CGPA between 7.00 and 10.00). Wald statistic obtained for the independent variables indicated that the coefficients for the variables viz., community, higher secondary marks, educational stream, school management, school location, parental involvement in studies, having personal textbooks, interest in higher studies showed significantly better performance. The board of school education also proved to be a highly significant variable. The period of data collection was from March 2016 to April 2016.

Key words: *Academic performance, B.V.Sc. & A.H. students, Binary logistic regression.*

INTRODUCTION

Students can play an important role in improving and strengthening the society. Performance is vital because the level of success students achieve from the University has far-reaching implications for their personal and professional lives[1]. Students' performances impact on their career choice, personal income and level of success, as well as the degree of participation in community life. The variability in students' performance cannot be attributed to a single factor, but it is the outcome of number of factors.

These factors can positively or negatively influence the students' performance. The academic factors are better predictors of students' academic performance than the non-academic factors[2].

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Animal husbandry and dairy development play a significant role in rural development and building the national economy, which depends on quality of service provided by the veterinarian. So veterinary science students need to get the best quality of education and training which would enable them to render competent and quality service to the nation. Hence, improving academic performance of these students is one of the ways to improve the quality service to the rural farming community.

Tamil Nadu Veterinary and Animal Sciences University (TANUVAS) has taken the vital role for impart the quality veterinary education through its four constituent colleges *viz.*, Madras Veterinary College (MVC) at Chennai, Veterinary College and Research Institutes (VCRIs) at Namakkal, Orathanadu and Tirunelveli.

This study is directed to ascertain all the possible socio-economic attributes and variables that might be influencing the performance of the B.V.Sc. & A.H. students in TANUVAS. Hence, this study may create awareness among students about their rights and responsibilities to achieve quality education.

MATERIAL AND METHODS

Sample size estimation

Out of 851 students in different years (second to fifth year), stratified random sampling was adopted for selecting a total of 280 students from four Veterinary Colleges of TANUVAS.

Sample size was estimated using of sampling table guide provided by Krejcie and Morgan (1970). As per sampling guide provided by Krejcie and Morgan (1970), 280 students were selected from four colleges with greater than 95 per cent confidence interval.

Data collection techniques

Primary data were collected from the selected students by personal interview method using structured, pre-tested interview schedules. For pre-testing pilot test conducted among 30 students other than sampling elements. The reliability of the interview schedule was assessed based on Cronbach alpha value, which was 0.697 (≈0.70). So the research instrument was reliable.

Secondary data (OGPA of the students) were collected from Education cells and student co-ordination departments of concerned colleges. The period of data collection was from March 2016 to April 2016.

The collected data were tabulated and analyzed using the Statistical Package for Social Sciences (SPSS Version 17). A binary logistic regression model of the academic performance of the student is formulated by

Logit [p (x)] =Log [p (x)/1 – p (x)] = $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \beta_{11} x_{11} + \beta_{12} x_{12} + \beta_{13} x_{13}$

Where,

p = the probability that a case is in a particular category (5-6.99 OGPA or above 7 OGPA),

β_0 = the constant of the equation and

β_i = the coefficient of the predictor variables with respect to x_i.

Binary Logistic Regression Model

"Binary logistic regression model is used when the dependent variable is a dichotomous variable and the independents are of any type". It has been used for predicting the outcome of a categorical variable (in the present case 5-6.99 OGPA and 7-10 OGPA), and dependent variable is based on one or more predictor variables. The goal was to find the "best set of regression coefficients" so that cases that belong to a particular category would, when using the equation, have a very high estimated probability that they will be allocated to that category. This would enable new cases to be classified with a reasonably high degree of accuracy as well.

A binary logistic model was used for causal analysis to find the determinants of type of students (5-6.99 OGPA or 7-10 OGPA) based on demographic and socio-economic variables. Logit (p) is the log (to base e) of the odds ratio or likelihood ratio that the dependent variable is 1.

Symbolically it is defined as:

$$\text{logit}(p) = \log[p / (1- p)] = \ln[p / (1- p)]$$

Whereas, p can only range from 0 to 1, logit (p) scale ranges from negative infinity to positive infinity and is symmetrical around the logit of 0.5 (which is zero).

The logistic regression equation of the following model was used for present study:

$$\ln(pi/(1-pi))=\beta 0+ \beta_1 x_1+ \beta_2 x_2 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \ldots\ldots + \beta_k x_k$$

Where, p_i was the probability of the i^{th} students with better academic performance (7-10 OGPA) and X_K was the k^{th} explanatory variable. The dependent variable, $\ln(p_i/(1-p_i))$, in the equation was the log-odds ratio in favor of high academic performance.

Consideration of model variables

The definitions of the most important variables expected to influence the academic performance are given in the following Table 1

.

Table 1: Factors expected to influence the sample students

Variables		**Definition**
Dependent variable		0=below 5.00-6.99 OGPA; Otherwise 1
X_1	Gender	0=Male; Otherwise 1
X_2	Community	0=SC,ST ; Otherwise 1
X_3	Medium of Instruction	0=except English (Tamil or other languages); 1= English
X_4	Higher Secondary Marks	0=<90 per cent ; Otherwise 1
X_5	Educational stream	0=Vocational education; Otherwise 1
X_6	School Management	0=Government or Government aided ; Otherwise 1
X_7	School location	0=Rural; Otherwise 1
X_8	Educational board	0=State board; Otherwise 1
X_9	Special quota	0= Special quota candidate; Otherwise 0
X_{10}	Scholarship	0= non-scholarship holders; Otherwise 1
X_{11}	Difficulty in understanding topics	0=Agree; Otherwise 1
X_{12}	Parental involvement in studies	0=Disagree; Otherwise 1
X_{13}	Having personal textbook	1=Agree; Otherwise 0
X_{14}	Studying after class hours	1=Agree; Otherwise 0
X_{15}	Mother's secondary education	1=10^{th} or above 10^{th}standard; Otherwise 0
X_{16}	Interest in higher education	1=Agree; Otherwise 0

Following these, the following binary logistic regression model was postulated, as

$$\text{Logit}[p(x)] = \text{Log}[p(x)/1 - p(x)] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \beta_{11} x_{11} + \beta_{12} x_{12} + \beta_{13} x_{13}$$

Where,

p = the probability that a case is in a particular category (5-6.99 OGPA or above 7 OGPA),

exp = the base of natural logarithms (approx 2.72),

β_0 = the constant of the equation and

β_i = the coefficient of the predictor variables with respect to x_i.

RESULTS

The results of the logistic regression function model fitted to predict the probability of good academic performance of sample students is presented in Table 2. As it could be seen from the table, Wald statistic obtained for the independent variables indicated that the coefficients for the variables *viz.*, community, higher secondary marks, educational stream, school management, school location, parental involvement in studies, having personal textbooks, interest in higher studies were found to be significant.

The regression model for the log-odds in favor of good performance of sample students is detailed below;

$$\text{Log}_e\left(\frac{P_i}{1-P_i}\right) = 3.31\text{-}0.07X_1\text{-}0.98X_2\text{-}0.63X_3\text{-}0.86X_4\text{-}1.71X_5\text{+}0.95X_6\text{-}0.79X_7\text{-}1.17X_8\text{+}0.23X_9\text{-}0.55X_{10}\text{+}0.51X_{11}\text{+}2.04X_{12}\text{-}0.65X_{13}\text{-}0.36X_{14}\text{-}0.68X_{15}\text{-}1.06X_{16}$$

To estimate odds, the model was exponentiated as,

$$\frac{P_i}{1-P_i} = e^{3.31-0.07X1-0.98X2-0.63X3-0.86X4-1.71X5+0.95X6-0.79X7-1.17X8+0.23X9-0.55X10+0.51X11+2.04X12-0.65X13-0.36X14-0.68X15-1.06X16}$$

The probability of good performance is obtained by applying the logistic transformation:

$$P_i = \frac{e^{3.31-0.07X1-0.98X2-0.63X3-0.86X4-1.71X5+0.95X6-0.79X7-1.17X8+0.23X9-0.55X10+0.51X11+2.04X12-0.65X13-0.36X14-0.68X15-1.06X16}}{1+e^{3.31-0.07X1-0.98X2-0.63X3-0.86X4-1.71X5+0.95X6-0.79X7-1.17X8+0.23X9-0.55X10+0.51X11+2.04X12-0.65X13-0.36X14-0.68X15-1.06X16}}$$

The values of Cox and Snell R^2 and Nagelkerke R^2 were 0.291 and 0.421, respectively, indicating that exponential model was a good fit.

Among various variables, board of school education was found to be highly significant ($p \leq 0.01$). From the table 2, it could be inferred that the log odds of the academic performance of sample students would be enhanced by 0.38 times, when the community dummy is changed from 0 to 1. Similarly, the log odds of the variables *viz.*, higher secondary marks, educational stream, school management, school location, having personal text book, interest in higher studies changed from 0 to 1, the academic performance of the sample students increased by 0.02, 0.05, 0.03, 0.03, 0.03, 0.07, and 0.34 units, respectively.

Table 2: Predicting the probability of good academic performance of sample students

X_i	Variable	Coefficient estimate	Std. Error	Wald statistic	p value	Exp(B)
X_1	Gender	-0.07	-0.09	0.06	0.81	0.92
X_2	Community	-0.98	-0.98	5.36*	0.02	0.38
X_3	Medium of Instruction	-0.63	-0.63	1.67	0.20	0.53
X_4	Higher Secondary Marks	-0.86	-0.86	4.01*	0.05	0.43
X_5	Educational stream	-1.71	-1.71	4.64*	0.03	0.18
X_6	School Management	0.95	0.95	4.87*	0.03	2.57
X_7	School location	-0.79	-0.80	4.68*	0.03	0.45
X_8	Educational board	-1.17	-1.17	6.70**	0.01	0.31
X_9	Special quota	0.23	0.23	0.14	0.71	1.26
X_{10}	Scholarship	-0.55	-0.55	2.19	0.14	0.59
X_{11}	Difficulty in understanding topics	0.51	0.51	2.21	0.14	1.67
X_{12}	Parental involvement in studies	2.04	2.04	6.36*	0.01	7.68
X_{13}	Having personal textbook	-0.65	-0.65	3.41*	0.07	0.52
X_{14}	Study/day	-0.36	-0.36	1.01	0.32	0.7
X_{15}	Mother's education	-0.68	-0.68	3.74	0.05	0.51
X_{16}	Interest in higher studies	-1.06	-1.08	6.36*	0.01	0.34
Constant		3.31	3.30	18.65	0.00	27.23
Dependent variable		OGPA (1 = greater than or equal to 7, 0 = less than 7)				
Model Chi – square		76.228**				
Log likelihood		232.907				
Cox & Snell R Square		0.291				
Nagelkerke R Square		0.421				
*		Significant at five per cent level of probability				
**		Significant at one per cent level of probability				

CONCLUSIONS

Community, higher secondary marks, educational stream, school management, school location, parental involvement in studies, having personal textbooks, interest in higher studies showed significantly better performance. The board of school education also proved to be a highly significant variable.

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