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Logit Modeling of Some Factors Affecting the Academic Performance of Graduating Science Students in University Of Uyo, Nigeria

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ABSTRACT

The main objective of this study is to model some factors affecting academic performance of students using logit model. The data for this study was collected from Faculty of Science, University of Uyo. The data showed the graduating cumulative grade point average (CGPA) of 2011/2012 graduates, together with some factors affecting their academic performance which includes, gender, Mode of entry which is through jamb or remedial programme, type of secondary school attended whether it is government or private and the student's Department. The data was collected for 764 students in the Faculty of Sciences. The results of the analysis showed that female students, students who were admitted into university through the Joint Admission and Matriculation Examinations Board (JAMB) examinations and students that attended government secondary school performed better academically. The student's department has a negative effect on the academic performance of students. In conclusion, it was recommended that the is need for the total over haul of the entire Nigeria education system at all level to improve the overall performance of the system.

Key words*: Logit Model, Odd Ratio, Academic Performance and Student.*

1. INTRODUCTION

Formal education remains the vehicle for socio-economic development and social mobilization in any society. Academic institutions are increasingly interested in monitoring the performance of their students, this gives rise to the need to research, collate, analyze and interpret data, in order to have evidence to form academic policies that are formulated to improve student performance, quality teaching and creating intervention strategies to mitigate factors that will negatively affect student performance at large.

Schools, colleges and universities have no worth without student. Students are most essential asset for any educational institute. The social and economic development of the country is directly linked with student academic performance. The students' performance (academic achievement) plays an important role in producing the best quality graduates who will become great leader and manpower for the country thus responsible for the country's economic and social development Mushtaq and Khan (2012).

Undergraduate academic successfulness, predominantly measured through the grade point average is a convenient, semi-qualitative indicator that combines candidate's entire undergraduate academic performance in a single number Ozren et al (2010).

Academic performance has become a parameter for measuring student's future in the competitive world. Nowadays student are becoming more career oriented. In order to develop an identity in the society, they are becoming more and more concerned about their academic achievement. student's academic performance in institution of higher learning (university) differ from each other due to the various factors like type of secondary school the student attended, the mode of entry into the university (Jamb or remedial program), gender and the department of choice in which the student is studying. In this study, logit model was used to model these factors that can affect student's academic performance and find the probabilities of these factors affecting the academic achievement of the student.

2. LITERATURE REVIEW

Ahani et al (2010) used logistic regression model the relationship that exist between the graduating cumulative grade point average (CGPA), UME (JAMB) score, gender and age. The data was collected from Faculty of Science, University of Lagos. The study concludes that final year Grade point Average has significant effect on other variables.

Adeleke et al (2010) in their study explores the distribution of the performance of graduate distance learners in the University of Lagos. The graduating Cumulative Grade Point Average (CGPA) of five hundred and sixty-five students and their final Grade Point Average (GPA) are used for the study.

Aromolaram et al (2013) conducted a survey to determine the socio-economic factors influencing student academic performance in Yaba College of Technology, Yaba, Lagos. The students' academic performance was measured using variable CGPA categorized into two poor (CGPA between 0 and 2.49) and good (CGPA between 2.50 and 4.00). Four factors; mothers' education level, living togetherness of parents, student class and weekly income/allowance; are found to influence students' academic performance.

Pyke and Sheridant (1993) studied Logistic regression analysis and utilized it to predict the retention of 477 master's and 124 doctoral candidates at a large Canadian university. Selected demographic (e.g., sex, marital status, age, citizenship), academic (e.g., GPA, discipline, type of study, time to degree

completion) and financial support variables (e.g., funding received from internal and external scholarships and from research, graduate and teaching assistantships) were used as independent variables.

3. METHODOLOGY

The data for this study was collected from Faculty of Science, University of Uyo. The data showed the graduating cumulative grade point average (CGPA) of 2011/2012 graduates, together with some factors affecting their academic performance which includes, gender, Mode of entry which is through jamb or remedial programme, type of secondary school attended whether it is government or private and the student's Department. The data was collected for 764 students in the Faculty of Sciences.

Table 1: Description of the variables

S/N	Variable	Description
1.	CGPA	CGPA = 1, if CGPA > =2.5 CGPA = 0, if CGPA < 2.5
2.	Gender	Gender=1, if male Gender =0, if female
3.	Mode of entry into the university(mode)	Mode = 1 if the mode of entry is through jamb Mode = 0 if the mode of entry is through remedial
4.	Type of Secondary school attended (school)	school=1 if the secondary school is government school = 0 if the secondary school is private
5.	Department (dept.)	dept. = 1 if the department is Botany dept. = 2 if the department is Statistics dept. = 3 if the department is Mathematics dept. = 4 if the department is Zoology dept. = 5 if the department is Computer Science dept. = 6 if the department is Physics dept.= 7 if the department is BCM dept.= 8 if the department is Chemistry dept.= 9 if the department is Microbiology

Logit Regression is a technique which allows for estimating the probability that an event occurs or not, by predicting a binary dependent outcome from a set of explanatory variables. In this study, the academic performance of the student measures through CGPA of the graduating student is the dependent variable while the factors that affect academic performance are the explanatory variable. The model in explicit stochastic equation form is

$$P_i = E(Y = 1/X_i) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_5 X_5 + U_i \quad (1)$$

Where Y is the probability of a student having CGPA > = 2.5, X's are the factors affecting academic performance, β's are known as the parameters of the model, $U_i$is the stochastic or error term

$$P_i = E(Y = 1/X_i) = \frac{1}{1 + \exp(-Z_i)} \quad (2)$$

Where $Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_5 X_5$

Equation 2 is known as (cumulative) logistic distribution function. Here Z_i ranges from - ∞ to + ∞, P_i ranges between 0 and 1. P_i is not linearly related to Z_i.

The probability of a student having a CGPA < 2.5 is

$$1 - P_i = \frac{1}{1 + \exp(Z_i)} \quad (3)$$

Therefore, one can write

$$\frac{1+\exp(Z_i)}{1+\exp(-Z_i)} = \frac{P_i}{1-P_i} \quad (4)$$

Equation 4 is the odd ratio that is the ratio of probability that the student has CGPA > = 2.5 to the probability that the student has a CGPA < 2.5

$$L_i = ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_5 X_5 + U_i \quad (5)$$

Where L_i is called the logit. The estimation of the logit parameters is done using maximum likelihood method.

4. RESULTS AND DISCUSSION

The estimate of the logit model is given in Table 1.

Table 2: Logit model estimation

CGPA	Coef.	Std. Err.	z	P>|z|	[95% Conf.Interval]	
cons	.1500949	.2935205	0.51	0.609	-.4251947	.7253845
gender	-.0847345	.1475141	-0.57	0.566	-.3738568	.2043879
mode	.3418749	.1604913	2.13	0.033	.0273177	.6564321
school	.1184534	.1511365	0.78	0.433	-.1777687	.4146755
dept.	-.0449717	.0320998	-1.40	0.161	-.1078861	.0179428
Log likelihood = -524.27691				Pseudo R2 =	0.0072	
Prob > chi2 =	0.1092			LR chi2(4) =	7.56	

The estimated probability model on CGPA and some factors influencing students' academic performance is given below

$$L_i = ln\left(\frac{P_i}{1-P_i}\right) = 0.1501 - 0.0847gender + 0.3419mode + 0.1185school - 0.0450dept.$$

From Table 2, the intercept of 0.1501 gives the probability that a student's CGPA is greater than or equal to 2.5 when all the independent variables are kept constant. The partial slope coefficient measures the change in estimated Logit for a unit change in the value of the regressor (holding other regressors constant). Thus the coefficient -0.0847 for gender means that with other variables held constant, as the gender increases by a unit, on the average the estimated Logit decreases by about 0.08 units, suggesting a negative (an inverse) relationship between the gender and the probability of a student having a CGPA> =2.5.Mode of admission, secondary school attended has a positive relationship with the probability of the student having a CGPA > = 2.5 with a coefficient of 0.3419 and 0.1185 for mode of admission and secondary school attended. Although statistically only mode of admission is significant at 5% and 10% level of significance respectively, together all the regressor have a significant impact on the probability of the student having CGPA > 2.5 at 10% level of significance as shown by LR statistic which is 7.56 with a probability value of 0.1092. The R^2 = 0.0072 showed that 0.72% of the variation in the dependent variable can be explained by the explanatory variables. This is however not surprising. According to Gujarati and Porter (2009) in binary regression models, goodness of fit is of secondary importance. What matters is the expected signs of the regression coefficients and their statistical and/or practical significance.

Table 3: Odd ratios of logit estimation

CGPA	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
gender	.9187562	.1355295	-0.57	0.566	.6880754	1.226774
mode	1.407584	.225905	2.13	0.033	1.027694	1.927901
school	1.125754	.1701426	0.78	0.433	.837136	1.513879
dept.	.9560246	.0306882	-1.40	0.161	.8977299	1.018105
Log likelihood = -524.27691				Pseudo R2 =	0.0072	
Prob > chi2 =	0.1092			LR chi2(4) =	7.56	

The odds ratio gives the amount of change expected in the probability of the student having a CGPA >=2.5 when there is a unit change in one factor affecting student's academic performance holding other factors in the model constant. The odd ratio is non-negative. The odds ratios are the exponential of the Logit coefficients. If the odds ratio is greater than one then the odd of the probability of the student having CGPA > 2.5 increases. If the odd is less than one then the odd of the probability of the student having CGPA > 2.5 decreases.

From Table 3, a unit change in mode of admission and type of secondary school attended increases the odds of the probability of a student's CGPA >= 2.5 by 1.4076 and 1.1256 respectively. Also, a unit change in gender and Department decreases the odds of the probability of the student having a CGPA >= 2.5 by 0.9188 and 0.9560 respectively. From the results, when the student is admitted through Jamb the odds of the probability of the student having a CGPA >= 2.5 increases. This is however not surprising as students admitted through the Jamb tend to perform better than students admitted through remedial programme. Thus as the admission of students through jamb increases the odds of the probability of the student having a CGPA > 2.5 also increases. This might be as a result of the fact that students admitted through Jamb are more studious which reflects in their CGPA being >=2.5. Also a unit change in type of secondary school attended favours the odds of the probability of the student having CGPA >=2.5. From the result, it can be seen that the type of secondary school a student attended has influence on his or her CGPA being > 2.5.

From the results obtained so far, it is therefore clear that gender and the student's dept. decreases the probability of the student having CGPA >= 2.5. Since gender is coded 1 for the male, it means that the male students' probability of having a CGPA >=2.5 is very small. This can be attributed to the fact that the male in the Southern Nigeria are more interested in business than in education. Most of them in school still have to combine their academics with their respective businesses since they are the bread winners in their respective families and this reduces their chances of having CGPA > 2.5. This confirms the findings of Ahani et al (2010) that female students performs better than their male counter parts based on their CGPA's.

Also, the students' dept. decreases the probability of the student having a CGPA > 2.5 from our analysis this can be attributed to the fact that this departments are in the Faculty of Science and in Nigeria generally, students perform poorly most times in science based courses as a result of poor background in primary and secondary schools. This however, has equally affected the student in their tertiary education since the probability of their CGPA >=2.5 are very small. The students department or programme reduces the odd that the students will have a CGPA >= 2.5 this is however negates Pyke and Sheridant (1993) that showed that the students programme is positively related to the students' academic performance. This is however not surprising as their study was based on Masters and PhD students in Canada unlike ours that looked at the undergraduate programme in the faculty of science in a Nigerian university. Generally sciences are perceived to be difficult in Nigeria because of lack of equipment for the practical's and lack of adequately trained personnel to teach students. This can be attributed to the reason while the students department reduces the odd of the student having a CGPA >= 2.5

Furthermore, the mode of entry and type of secondary school the student attended as a positive influence of the student's CGPA with the likelihood of the CGPA >= 2.5 being very high. This is however not surprising as mode of admission is through Jamb or remedial studies with Jamb coded 1. This

implies that students admitted through Jamb are more likely to have a CGPA >=2.5 than the students admitted through remedial. It is worthy of note that students admitted through remedial are student who are deficiency in either English or Mathematics or any other subject in their O'Levels. From our analysis both the logit and probit models suggested a positive relationship between students admitted through Jamb and students having CGPA >= 2.5, this correlates with the findings of previous research like Afemikhe (2005), Achor et al (2010) and Ogbebor (2012). Their findings attested to the fact that students admitted into the university through JAMB perform better than those admitted through other means (remedial programme)

Also, the type of secondary school the student attended affects the student's academic performance. Thus students' that attended government secondary schools are more likely to have a CGPA > 2.5. This can be attributed to the fact that in recent past the private secondary schools has become a business venture with the proprietor's and the school owners doing everything to make sure their students' pass even to the extent of examination malpractices to promote the image of their schools. Thus the students' that attend such school are likely to perform poorly in high institutions when malpractices are checked. Little wonder the probability of students' that attended government school having a CGPA >2.5 being very high.

5. RECOMMENDATIONS AND CONCLUSION

The following recommendation have been made on the basis of the study

The government should reward academic excellence through scholarship for students who have excelled in their various disciplines as this will awake the consciousness of the male students to improve upon their academic performance. Also, the financial pressure on the male students can as well be cushioned through bursaries as most of the male students are engage in one form of business or the other to make ends meet. This distracts them and makes them to pay less attention to their academics.

Government should find a way of regulating the activities of private secondary schools as most of them are now purely business ventures engaging in one form of examination malpractices or the other.

The use of remedial mode admission for getting admission into Nigerian university should be seriously looked into by all concern. Since it is not everybody that may have the flare for university education deficient students academically should be channel to other areas that the can be more productive like craft, sports, entertainment etc.

Since the study of science is the bedrock of scientific and technological advancement, the study of science in Nigerian university should be given the serious attention that it deserves. This is need for training and retraining of the academic staff in line with global best practices as most of the academic staff in the faculty of sciences in Nigerian universities still teach with their lecture notes of 1970's and 1980's that obsolete and outdated. There is equally the need for government to bring the equipment in the faculty of science up to date with global stand. If these recommendation are strictly implemented the will be an improvement in the academic performance of our students in higher institutions.

Nigeria's vision of becoming one of the top twenty economies of the world by the year 2020 can only be a mirage except education is given its proper pride of place. Since no country can develop beyond the level of her education all hands must be on deck to develop our educational system at all levels in line with our vision and national philosophy as a nation. Our education system should strive to liberate the minds of the students this will invariable lead to an improved academic performance.

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