



ISSN: 2319-5967

ISO 9001:2008 Certified

International Journal of Engineering Science and Innovative Technology (IJESIT)

Volume 2, Issue 4, July 2013

Binary Logistic Regression of Students Academic Performance in Tertiary Institution in Nigeria by Socio-Demographic and Economic Factors

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Abstract— Formal education remains the vehicle for socio-economic development and social mobilization in any society. This work is an empirical survey study conducted to determine the socio-economic factors influencing student academic performance in Yaba College of Technology, Yaba, Lagos. The data used for this work was collected from six hundred (600) students across the different departments and class study using a 28 item structured questionnaire, administered by quota sampling method, a non-probability sampling technique. Data collected was analyzed using statistical package for social science by descriptive statistics, Pearson correlation test of existence of linear relationship between variable of study, chi square test for association of factors, and a four predictor binary logistic regression was fitted to the data. The students' academic performance was measured using variable GPA/CGPA categorized into two "poor" (GPA/CGPA between 0 and 2.49) and "good" (GPA/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. The four factors are fitted into predictive binary logistic regression model for the

log-odds in favour of poor performance as $\text{Log}_e \left\{ \frac{1-\pi}{\pi} \right\} = 0.122 - 0.092X_1 + 0.479X_2 - 0.383X_3 - 0.411X_4$. A number of recommendations like rendering of financial support to students in need of such, family planning orientation while in school, and teaching of effect demographic and socio-economic factors on student academic performance should be regularly emphasized to students.

Index Terms—Academic –Performance, Logistic-regression, Socio-economic factors, Students, Tertiary-institution.

I. INTRODUCTION

The abysmal students' performance in tertiary institutions has been and is still a source of great concern and research interest to the higher education managers, government and parents. 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 inform academic policies that are formulate to improve student performance, quality teaching and support resources, or creating intervention strategies to mitigate factors that will positively affect student performance at large. This desire for a high level of achievement puts a lot of pressure on students, teachers, and schools and in general the educational system itself. It is no more a denying fact that the whole system of education revolves round the academic achievement of students, though various other outcomes are also expected from the system. Hence, a lot of the school resources are committed to help students achieve better in their scholastic endeavours.

II. LITERATURE REVIEW

The importance of academic achievement on the part of students in tertiary institution has prompt this desire to provide answers to the following questions. What factors hinders academic performance among students in tertiary institution? How far do the different factors contribute towards academic achievement? Can student academic performance be predicted on the knowledge of these factors? A number of research findings have shown that student performance may be affected by different factors like intelligence, study habits, and attitudes of student towards school, different aspects of their personality, socio economic status, etc. [1] and [2] in separate studies stated that social economic status is most commonly determined by combining parent 'educational level,



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occupational status and income level. In most of the studies done on academic performance of students, it is not surprising that social economic status is one of the major factors studied while predicting academic performance. [3], argue that according to the cultural capital theory one could expect students from families who are closest to the academic culture to have greatest success. It is believed that low social economic status negatively affects academic achievement because low social economic status prevents access to vital resources and creates additional stress at home.

[4] identified certain parental factors (socioeconomic status of parents in terms of income, education, nature of occupation and position in the society determine the type of attention and involvement they have with their children.) as socioeconomic and concluded that the students' academic performance is significantly influenced by the socioeconomic background of their parents.

[5] Studied socio-economic factors influencing student's academic performance in Nigeria using some explanation from a local survey. The study revealed that insufficient parental income, family type and lack of funding by governments are factors influencing students' academic performance. [6], [1], [7] carried out separate study on social economic status in education research and policy, found that social economic background remains one of the major sources of educational inequality and adds that one's educational success depends very strongly on the social economic status of one's parents. [8] agree with [9], in their study on the influence of social and economic disadvantage in the academic performance of school students in Australia found that families where the parents are advantaged socially, educationally and economically foster a higher level of achievement in their children. They also found that these parents provide higher levels of psychological support for their children through environments that encourage the development of skills necessary for success at school. On the contrary [10] in their study on educational and social economic background of undergraduates and academic performance at a Brazilian university, found that students coming from disadvantaged socioeconomic and educational homes perform relatively better than those coming from higher socioeconomic and educational strata. They called this phenomenal educational resilience. This could be true considering that different countries have different parameters of categorizing social economic status. What a developed country categorizes as low social economic status may be different from the definition of low social economic status of a developing country. Additionally students do not form a homogenous group and one measure of social economic disadvantage may not suit all sub groups equally. [11] in his study concurs with [8] agree with [10], that within the same school, a student who comes from a higher socio-economic group will achieve better test results than a student from a lower socio-economic group. [10] also stated that there is a significant relationship between the economic status and academic achievements of student, those from lower income houses score significantly lower than children from higher income households [11] Argued that in virtually all nations, children of parents high on the educational, occupation and social scale have far better chance of getting into good secondary schools and from there into the best colleges and universities than equally bright children of ordinary workers or farmers. [11] adds that the findings of many empirical studies suggest that children whose parents are at the bottom of the social economic hierarchy are not as inclined to seek or gain access to available educational facilities as the children with families are located at the middle or top of the hierarchy. [12] shared similar view with [11] from her study that students from the bottom quartile consistently perform below students from the top quartile of socioeconomic status. Also, [3], studied the impact of class origin on grades among all first year students and higher level graduates in Norwegian universities. Their findings showed that students originating in classes that score high with respect to cultural capital tend to receive the highest grades. [13] opined that social economic status is comprised of three major dimensions: education, occupation and income and therefore in developing indicators appropriate for high education context, researchers should study each dimension of social economic status separately. They add that education, occupation and income are moderately correlated therefore it is inappropriate to treat them interchangeably in the higher education context. [2] submitted that family income has a profound influence on the educational opportunities available to adolescents and on their chances of educational success. Parental socio-economic status and educational background significantly affect students' academic performance, [15].

It is further stated that due to residential stratification and segregation, low-income students usually attend schools with lower funding levels, have reduced achievement motivation and much higher risk of educational failure. When compared with their more affluent counterparts, low-income adolescents receive lower grades, earn lower scores on standardized test and are much more likely to drop out of school.



ISSN: 2319-5967

ISO 9001:2008 Certified

International Journal of Engineering Science and Innovative Technology (IJESIT)

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[14] is in agreement with [12] and [16] who argued that social class determines what school a child will attend and whether the child will pass the examinations.

A. Aim and Objective of the Study

The aim of this work is to determine what socio-economic and demographic factors affect the students' academic performance in Yaba College of Technology, with specific objectives of testing if there exist association between demographic factors, economic factors and the student academic performance measured by the grade point aggregate/cumulative grade point aggregate. It will also fit a regression mode of relationship between academic performance and the socio-economic factors that associated significantly.

II. RESEARCH METHODOLOGY AND MATERIALS

This work is an empirical survey study conducted on students of Yaba College of Technology, Yaba, Lagos, Nigeria. The research used a non-random sampling technique, quota sampling method to select respondents for the study, due to lack of control over the students initially selected based on stratified random sampling method. There were a total of seven schools from which between 85 to 87 questionnaires were administered to students willing to participate in the study after brief enlightenment address on the objective of the study.

A 28 item, structured questionnaires, administered on 680 students across departments and class was used in the data gathering process for the study. An IBM statistical package for social science (SPSS, version 20) was used for the various statistical data analysis conducted (frequency distribution, correlation test, chi-square, and Logistics Regression). An association test between academic performance and certain factors were conducted and factors found significant in association were formulated in a regression model. A binary logistic regression model of the academic performance of the student is formulated by

$$Li = \ln (Pi / (1-Pi)) = \alpha + \beta X_1 + \beta X_2 + \beta X_3 + \beta X_4 + U_i$$

Where, $Li = 1$ if the grade point is between 0 -2.49

Pi = the probability of the student having poor academic performance

- X_3 rep. mother's education level
- X_1 rep. weekly income/allowance
- X_2 rep. parents living together
- X_4 year

III. DATA PRESENTATION AND ANALYSES

The questionnaire administered were collated, sorted and processed using statistical package for social science IBM-SPSS version 20. A frequency and percentage distribution presentation of the data was carried out as displayed in the table below. Out of 680 questionnaires administered, 600 were returned giving a response rate of 88.24% Analyses carried out were in three stages, correlation test of linearity relationship, chi-square test of hypotheses stated below and the formulation of binary logistic regression of the dependent variable academic performance measured by the variable GPA/CGPA against the categorical independent variables like (class of student; weekly income/allowance; parents living together; and position in the family).

A. Statement of Test Hypothesis

- i) H_0 : There is no association between student academic performance (GPA/CGPA) and the student class of study
- ii) H_0 : There is no association between student academic performance (GPA/CGPA) and weekly income or allowance
- iii) H_0 : There is no association between student academic performance (CGPA/GPA) and student parents living together
- iv) H_0 : There is no association between student academic performance (GPA/CGPA) and the number of children the family has
- v) H_0 : There is no association between the student academic performance (GPA/CGPA) and the position of the student in the family.



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Table 1. Demographic Information of the Respondents

S/N	Characteristic Components	Frequency (F)	Percentage (%)
1	Gender:		
	Male	331	55.2
	Female	269	44.8
2	Age:		
	Less than 20 years	75	12.5
	21 – 25	247	41.2
	26 – 30	223	37.2
	31 and Above	55	9.2
3	Class:		
	ND	169	28.2
	HND	431	71.8
4	Marital Status:		
	Single	541	90.2
	Married	56	9.3
	Divorced	3	.5
5	School:		
	Science	86	14.3
	Technology	87	14.5
	Management	85	14.2
	Engineering	87	14.5
	Environmental	85	14.2
	Liberal Studies	85	14.2
	Art, Design & Printing	85	14.2
6	Mode of Residence:		
	Campus Hostel	368	61.3
	Off Campus Hostels	91	15.2
	Family Home	82	13.7
	Other	59	9.8

Remark Table 1: A total of 600 questionnaires were retrieved out of 680 administered on the respondents, giving 88.23% response rate. Bulk of the respondents, 71.8% are from the HND classes due to knowledge of the subject matter. The average age range of the respondents is 21-25 years, while 61.3% of the respondents claimed to be residing in the institution campus hostel.

Table 2. Educational and Economic Background of the Respondents

S/N	Characteristic Components	Frequency (F)	Percentage (%)
1	Present GPA/CGPA:		
	Poor (0 -2.49)	91	15.2
	Good (2.50 – 4.00)	509	84.8
2	IF HND student, ND CGPA:		
	Poor (0 -2.49)	22	5.3
	Good (2.50 – 4.00)	395	94.7
3	Educational Sponsor:		
	Self	125	20.8
	Parent/Guardian	475	79.2
4	Weekly income/allowance range:		
	Less than N1000	87	14.5
	Btw. N1000 and N1999	132	22.0
	Btw. N2000 and N2999	159	26.5
	Above N3000	222	37.0
5	Do you belong to any club and society in school?		
	Yes	172	28.7



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	No	428	71.3
6	Do you participate in any sporting activity?		
	Yes	158	26.3
	No	442	73.7

Table 3. Correlation Test of Linearity Relationship

	1. Year of Study	2. Present GPA/CGPA	3. Weekly income/allow.	4. Position in Family	5. Parent No. of children
1	1.000	.104*	.112**	.030	.058
2	.104*	1.000	.035	-0.020	.007
3	.112**	.035	1.000	.004	.139**
4	.030	-.020	0.004	1.000	.577**
5	.058	.007	.139**	.577**	1.000

*Correlation is significant at the .05 level (2tailed) ** at the 0.01 (2tailed)

Remark table 2: The student academic performance is categorized into two 'poor' and 'good'. Those students whose GPA/CGPA range between 0.00 – 2.49 are categorized as being poor, while those whose GPA/CGPA range between 2.50 – 4.00 are categorized as 'good'. Those students with GPA/CGPA between 2.50 -4.00 are 94.7% of the total respondents and those in the category 0.00 -2.40 are 15.2%. This implies that the bulk of the respondents are in the good academic standing grade. The average weekly income/allowance of the respondents is N2000 – N2999.

Remark table 3: The table above shows that there are significant relationship at both 0.01 and 0.05 levels of significant between the dependent and the different independent variables.

Table 4. Chi-Square Analyses of Hypotheses statements

S/N	Null Hypotheses statement (Ho)	χ^2	p-value	Decision
1.	There is no association between academic performance (CGPA) and the student class	50.907	0.000	Reject Ho
2.	There is no association between academic performance and weekly income/allowance	23.166	0.026	Reject Ho
3.	There is no association between academic performance and the student parent living together	11.469	0.022	Reject Ho
4.	There is no association between academic performance and number of children the family has	83.285	0.010	Reject Ho
5.	There is no association between academic performance and the student position in the family.	64.294	0.001	Reject Ho

Decision Rule: if the p-value < $\alpha = 0.05$, the null hypothesis should be rejected and if otherwise it will be accepted.

B. Regression model

Table 5. Parameter Estimates

What is your present GPA/CGPA? ^a	B	Std. Error	Wald	Df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
							Lower Bound	Upper Bound
0.00-2.49 (poor)	Intercept	-.122	.621	.039	1	.844		
	X ₁	-.092	.108	.719	1	.396	.738	1.128
	X ₂	.479	.282	2.889	1	.089	1.614	2.802



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X ₃	-.383	.134	8.215	1	.004	.682	.525	.886
X ₄	-.411	.123	11.192	1	.001	.663	.521	.843

a. The reference category is: 2.50-4.00 (Good).

Let X₃ rep. mother's education level - X₁ rep. weekly income/allowance
 X₂ rep. parents living together - X₄ year

The regression model for the log-odds in favour of poor performance from the table above is:

$$\text{Log}_e \left\{ \frac{\pi}{1-\pi} \right\} = 0.122 - 0.092X_1 + 0.479X_2 - 0.383X_3 - 0.411X_4$$

To estimate odds, the model is exponentiated as

$$\frac{\pi}{1-\pi} = e^{0.122 - 0.092X_1 + 0.479X_2 - 0.383X_3 - 0.411X_4}$$

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

$$e^{0.122 - 0.092X_1 + 0.479X_2 - 0.383X_3 - 0.411X_4}$$

$$\Pi = \frac{e^{0.122 - 0.092X_1 + 0.479X_2 - 0.383X_3 - 0.411X_4}}{1 + e^{0.122 - 0.092X_1 + 0.479X_2 - 0.383X_3 - 0.411X_4}}$$

To determine the predictive efficiency of the model, The Wald chi-square statistics in table 5 is made use of. Out of the four predictors, mother's education level and class of the students are very significant (i.e. p-values of 0.004 and 0.001). The findings table 4 showed that there exist an association between the students' academic performance and class, number of children in the student family, student position in the family, weekly income/allowance, and the student parent living together.

IV. DISCUSSION AND RECOMMENDATION

A. Discussion

The study was conducted to determine what socio-economic and demographic factors are capable of influencing student academic performance in Yaba College of Technology, Nigeria. Findings showed five factors to influence the student academic performance, the students' class/year of study; weekly income/allowances; parents living together; number of children parent has and the student position in the family(see table 4). Out of the five identified factors, four factors (year of study; mothers' education level and parent living together) were found to have significant effect on the predictive binary logistic regression model fitted (see table 5). These findings are corroborated by the works done by [1] and [2] in their separate work that stated social economic status is most commonly determined by combining parent 'educational level, occupational status and income level. Also, [12] argued that in virtually all nations, children of parents high on the educational, occupation and social scale have far better chance of getting into good secondary schools and from there into the best colleges and universities than equally bright children of ordinary workers or farmers. One can understand the influence of class/year as being that as student gets more into the educational system; their understanding of purpose for being in the institution gets clearer and become better focused. The influence of weekly income/allowances can be attributed to the metropolitan nature of the institution environment. This factor may not be uniform with students in other institutions not situated in metropolitan environment like the case study

B. Recommendation

This study provides some information regarding the socio-economic and demographic factors influencing academic performance of students of Yaba College of technology. Hence, the following recommendations are being suggested;

- The students should be orientated on the possible factors (both demographic and soci-economic) that may impede their success in academic pursuit
- Tertiary institutions should promote family planning education to include the effect of marriage on children academic future.
- The funding assistance to students in financial need, particularly at the tertiary educational level.



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