

Academic Performance, Relationship with Gender and Mode of Admission

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Abstract: *In this paper, we examine the impact of gender, mode of admission, parental higher institutional status, family home status and campus residential status on students' level of academic performance using the concept and application of multinomial logistic regression model. The statistical analysis is carried out on a random sampling of 289 students from all the schools/faculty in FUTA. Information required for the analysis was obtained through the administration of questionnaire to answer the research questions and thereafter applied chi-square and multinomial logistic regression methodology was employed. The result showed that, gender and mode of admission significantly affect the level of performance and that more male student are more likely to have a high performance compared to the female counterpart. Also students who reside on campus tend to have a high performance compared to those who reside off campus.*

Keywords: *academic performance, multinomial logistic regression, categorical response variables.*

I. Introduction

The level of educational prowess of an individual which can be measured by the academic performance or any other parameters is a prominence feature in determining the future potential in any individual. Several scientific breakthroughs are as a result of outstanding academic performance, as a result, several studies have been conducted and are still being conducted to assess academic performance at different levels of learning. (Murtaugh et. al. 1999; Smith and Naylor 2001; Tieben et al. 2010). Students however face numerous challenges that tend to militate their performance at different levels of study in their academic environment; this can be broadly classified into student personal and non – personal factors. The non – personal factors can further be classified into school related factors, environment of the home or family related factors. (khan and Malik, 1999; Fan, 2001; Gonzalez – Pienda et. al., 2002).

Purpose

The general interest of this study is to examining the impact of some the factors that are theoretically or experimentally believed to have influence on student level of academic performance in a university system.

The research questions that governs this study is as stated below:

1. Is the level of academic performance influenced by gender?
2. Does a students' mode of admission affects the level of performance?
3. Does parental educational status have any impact on ward's academic performance?
4. Does home structure influences academic performance?
5. Does campus residential status affect academic performance?
6. Does the likelihood that a student will be a high performance, moderate performance, or poor performance student related to his/her gender, mode of admission, parental education status, home structure and campus residential status?

Theoretical Framework

Several studies have been carried out on the assessment of academic performance due to its benefit, as it relates to some of the variables studied in this study.

Many research studies have considered and studied the effect of gender on education performance (Udousoro 2011; Jansen 2004; Bruinsma 2003). Gender means more than a mere identification of sexes (Okeke 2003), it can be thought of as a psychological term employed in the behavioural and characteristics description of individuals on the basis of being born as a male or female (Umoh 2003). Eggens et. al., (2008) highlighted gender alongside some other demographic variable as a determinant of academic achievement. The decision as touching gender performance in academic is inconclusive as some research has shown that academic performance is related to gender (Adeneye and Adeleye, 2011:), while some research revealed no relationship between gender and academic performance (Abiam and Odok, 2006). This study considers gender as a predictor in order to determine if it is a significant factor as this is an unresolved matter.

In addition to the study of age, the modes of admission into tertiary institutions are also considered. In the late 90's, the mode of admission into higher institution was through a regulatory body, Joint Admission and Matriculation Board (JAMB). The body was saddle with the task of employing students into higher institution through a centralised examination, university matriculation examination (UME), which has metamorphosed over the years. This exam is taken across the states of the federation at the same time. In the early 20's several forms of admission came into existence, which are organised by different institutions with the main purpose of eradicating the deficiency carried over from secondary school system. It is theoretically and in some experimental cases believed those students admitted into the university system through other means of admission perform better than the UME counterparts (Joe et al.,2014; Adeyemi 2009).

The first source of informal learning to a child is received from the family to which the child is been born. It serves as the foundation of learning on which other formal education is built (Agulana 2000). There's been research on the influence of home structure on academic performance (Igbinosa 2014). The family structure has been a factor that affects students' academic performance, students from broken home may be psychological and emotionally be unstable which may have an adverse effect on their academic performance (Igbinosa 2014). Parents who are actively involved in their children's academic, by demonstrating to them that success is to be attained through hard work, determination and persistency gets a good result from their wards (Dubow et. al.,2009)

Due to lots of academic activities like tutorials (fellowship or interdenominational) that goes on within the campus after the day's lecture might be over, and the security enjoyed, many student prefer campus residency. But as a result of limited available number of housing facilities, accommodation on Nigerian university campus is based on first come, first serve, causing most of the student to reside off campus. Research has shown that living on campus or has lived on campus cause a positive increase in the academic performance of student (De Araujo and Murray, 2010).

II. Methodology

Sample

The study was conducted in one of Nigerian's most prestigious university, Federal University of Technology Akure. The university was selected as a study area due to its vision of becoming the world best university of technology. The participants were informed of their right to choose to participate or not, they were also informed that participation in this research will in no way infringe on their human right and all information provided will only be used for research purpose only. A primary dataset was collected through the administration of questionnaire to a random selection of 289 undergraduate students spanning over all the schools and years. The questionnaire involves several variables studied as related academic performances. Out of the 289 questionnaire administered and returned, 188 (65%) of the respondent were male, 99(34%) were female and 3(1%) did not specify their gender.

Materials

Gender

Gender as used in this study refers to the sex of the respondent which is a dichotomous variable coded as:

- 0 = male
- 1 = female

Level of Performance (LoP)

The long existing means of assessing student performance in tertiary institutions is the cumulative grade point assessment (Eggen et al 2008). Student academic performance in Federal University of Technology Akure (FUTA) is measured on a Grade Point Average (GPA) scale of 1.00 – 5.00 as used by most convectional universities in Nigeria. The scale is categorised into five classes of degree: First class (4.50 – 5.00), Second class upper division (3.50 – 4.49), Second class lower division (2.40 – 3.49), Third class (1.50 – 2.39), and Pass (1.00 – 1.49). Due to the sensitivity of this variable, most respondent keep their GPA secret because it shows the level of academic performance of a student. In order to get the required information and at the same time protect the privacy of the respondent, a level of performance was used to measure academic performance. It is coded as shown below;

- 1 = high performance (GPA between 5.00 – 4.00)
- 2 = moderate performance (GPA between 3.99 – 3.00)
- 3 = poor performance (GPA between 2.99 – 1.00)

It is a self reported information captured through the questionnaire as a polychotomous categorical variable. Out of the 289 respondent, 55 (19%) had high performance, 144 (approx. 50%) half of the population had moderate performance, 89 (approx. 31%) had poor performance while 2 (0.7%) respondent did not provide this information.

Parental Education Status (PES)

This is a dichotomous categorical variable which provides information respondent’s parent education status. It is coded as;

- 1 = educated,
- 2 = not educated

Out of the 289 respondent that participated in this study, 134 (46.2%) respondent’s parent were educated while 150 (51.7%) parent had no formal education with 6 (2.1%) missing information

Mode of Admission (MoA)

In the past years, the mode of entrance into higher institution in Nigeria has evolved; the known and recognised mode of admission in the 19th century was through University matriculation examination (UME). In the early 20th century, other forms of admission came into existence in order the stripe the Joint Admission Matriculation Board (JAMB) of their autonomy power and give the prospective student a feel of what they will be expecting in their first year. Variants of mode of admission into higher institution in Nigeria considered in this study are Pre-Degree Programme (PDS), Joint University Preliminary Examination Board (JUPEB), and University Advance Basic Studies (UABS). Due to a relatively low number of respondents in the other forms of admission, a variable “other” was created which combine all other mode of admission. The coding is as follows;

- 1 = *UME*,
- 2 = *Others*

169 (58.3%) of the whole population considered had admission through UME, 119 (41%) came into the university system through other forms of admission has approved by the National University Commission (NUC)

Family Home Structure (FHS)

This is dichotomous categorical variable identifies if a respondent came from a broken home or intact home. It is coded as follows;

- 1 = *broken home*
- 2 = *Intact home*

90 (31%) of the total respondent that participated in the study came from broken home, not living with any of their parents, 199 (68.6%) came from intact home, living with both parents, 1(0.3%) left the question unanswered.

Campus Residential Status (CRS)

This categorical variable identifies whether a participant resides on campus or off-campus. As a result of great turn up of numbers of admitted student every year, the housing facilities in most universities in Nigeria (with the exception of Private University) is often insufficient, hence students are allowed to secure accommodation outside the school walls. This variable is a dichotomous variable which is coded as;

- 1 = *On Campus*
- 2 = *Off Campus*

Out of the 289 respondent that participated in this study, 73 (25.2%) had their residency on campus, 199 (68.6%) had their residency off-campus, 18 (6.2%) left the question unanswered.

The Performances as related to the variables under consideration are shown in Tables 1 through 5. According to table 1, male student are more classified into high, moderate and poor performance than the female students. Table 2 revealed that more student whose parent are not educated are more classified into high and moderate performance that their counterpart, while student whose parent are educated are more classified into poor performance. Table 3 showed that student who came in through other modes of admission are more classified into high performance, while those that came in through UME are classified into moderate and poor performance more than other modes of admission. Table 4 showed that student who came from a broken home are less classified into the three levels of performance than their counterparts. While the relationship between campus residence and performance revealed that more students who reside off campus do well compare to their counterparts who stay on campus.

Table 1: Gender and Academic Performance Distribution

Level of Performance	Gender		Total
	male	female	
High performance	46	9	55
Moderate Performance	82	61	143
Poor performance	59	29	88

Table 2: Parental Education Status and Academic Performance Distribution

Level of Performance	Parental Education Status (PES)		Total
	Educated	Not Educated	
High performance	25	28	53
Moderate Performance	63	81	144
Poor performance	46	41	87

Table 3: Mode of Admission and Academic Performance Distribution

Level of Performance	Mode of Admission (MOA)		Total
	UME	OTHERS	
High performance	20	35	55
Moderate Performance	87	56	143
Poor performance	47	42	89

Table 4: Family Home Structure and Academic Performance Distribution

Level of Performance	Family Home Structure (FHS)		Total
	Broken Home	Intact Home	
High performance	18	37	55
Moderate Performance	41	103	144
Poor performance	31	58	89

Table 5: Campus Residential Status and Academic Performance Distribution

Level of Performance	Campus Residential Status (CRS)		Total
	On campus	Off campus	
High performance	16	37	53
Moderate Performance	41	91	132
Poor performance	16	70	86

Multinomial Logistic Regression Model

In order to answer the fifth research question stated above, a multinomial logistic regression model was used. The hypothesis to address the fifth research question is set as follows;

H_{06} = the likelihood that a student will graduate with any of the level of performance is not related to any of the predictors

H_{16} = the likelihood that a student will graduate with any of the level of performance is related to at least one of the predictors

The methodology was deemed suitable and adopted to answer the research question because of the following reasons;

1. The response variable, level of performance is a polychotomous categorical response (i.e. have more than two levels of responses).
2. It provides an efficient way of obtaining the probabilities that a participant will belong to a class of degree and the corresponding odd ratios (Peng and Nichols, 2003; Peng et. al, 2002; Peng et. al, 2001; Scott et. al, 1999).
3. It also provides an overall or aggregate effect of the predictive variables on a categorical dependent variable (Peng and Nichols, 2003; Morgan and Teachman, 1988).

Multinomial logistic regression model is an advanced form of logistic regression model with three or more levels of dependent variables. It expresses the logarithm of the odds of a categorical dependent variable as a function depending on the explanatory variables which can be categorical, continuous or both. In this study, we consider five levels of responses, and the modification to the general form of the methodology is as shown below.

Let y denote the level of performance, therefore;

$y = 1$: high performance

$y = 2$: moderate performance

$y = 3$: poor performance

Let P_{ij} denote the probability that a student i will have a j th performance.

Where,

$i = 1, 2, \dots, 289$ and $j = 1, 2, 3$

The modified general form of multinomial logistic regression model is as shown below;

$$\left. \begin{aligned} \log \left[\frac{P(y_i = 1|x_{iG}, \dots, x_{iCRS})}{P(y_i = 3|x_{iG}, \dots, x_{iCRS})} \right] &= \beta_{10} + \beta_{11}x_{iG} + \beta_{12}x_{iMOA} + \beta_{13}x_{iPES} + \beta_{14}x_{iFHS} + \beta_{15}x_{iCRS} \\ \log \left[\frac{P(y_i = 2|x_{iG}, \dots, x_{iCRS})}{P(y_i = 3|x_{iG}, \dots, x_{iCRS})} \right] &= \beta_{20} + \beta_{21}x_{iG} + \beta_{22}x_{iMOA} + \beta_{23}x_{iPES} + \beta_{24}x_{iFHS} + \beta_{25}x_{iCRS} \end{aligned} \right\} (1)$$

The equation above gives the odd ratio of a student having a level of performance relative to a reference level of performance (poor), hereby provided a $j - 1$ non – redundant set of equations. Hence the probabilities are given as;

$$\left. \begin{aligned} p_{i,high\ performance} &= \frac{\exp(\beta_1^T X_i)}{1 + \sum_{j=1}^3 \exp(\beta_j^T X_i)} \\ p_{i,moderate\ performance} &= \frac{\exp(\beta_2^T X_i)}{1 + \sum_{j=1}^3 \exp(\beta_j^T X_i)} \\ p_{i,poor\ performance} &= \frac{\exp(\beta_3^T X_i)}{1 + \sum_{j=1}^3 \exp(\beta_j^T X_i)} \end{aligned} \right\} (2)$$

III. Results

Statistical Package for Social Sciences (SPSS) was used in the analyses (SPSS Inc., 1993). To answer the first five research questions, a chi-square analysis to test for relationship was carried out. The result are discussed below

Research Question One

The hypothesis is as stated below;

H_{01} = Academic performance is not dependent on gender

H_{11} = Academic performance is dependent gender

The result indicates a high significant relationship between gender and performance ($\chi^2 = 12.289$, $p - \text{value} = 0.002$). In order word, performance can be attributed to gender of a student.

Research Question Two

The hypothesis is stated as shown below;

H_{02} = Academic performance is not dependent mode of admission

H_{12} = Academic performance is dependent mode of admission

The result shows a significant relationship between the mode of admission and academic performance ($\chi^2 = 9.607$, $p - \text{value} = 0.008$)

Research Question Three

The hypothesis is stated as shown below;

H_{03} = Academic performance is not dependent on parental educational status

H_{13} = Academic performance is dependent on parental educational status

The result shows no significant relationship between academic performance and parental educational status ($\chi^2 = 1.812$, $p - \text{value} = 0.404$)

Research Question Four

The hypothesis is stated as shown below;

H_{04} = Academic performance is not dependent on home structure

H_{14} = Academic performance is dependent on home studdture

The result shows no significant relationship between academic performance and family home structure ($\chi^2 = 1.104$, $p - \text{value} = 0.576$)

Research Question Five

The hypothesis is stated as shown below;

H_{05} = Academic performance is not dependent on campus residential status

H_{15} = Academic performance is dependent on campus residential status

The result shows no significant relationship between academic performance and family home structure ($\chi^2 = 4.459$, $p - \text{value} = 0.108$)

The result obtained from the model fitting information table in SPSS prompt the acceptance of the alternative hypothesis stated earlier on in order to answer research question six. The p-value is 0.001 which a chi-square

value of 30.746. This implies that some or all of the explanatory variables predicts level of performance. To ascertain which of the explanatory variable contribute significantly to the prediction, a likelihood ratio test was carried out and gender and mode of admission were found to contribute significantly to the prediction of level of performance.

Table 6 presents the parameter coefficients of the multinomial logistic regression analysis carried out using SPSS. The significant parameters are indicated by asterisks as defined in the table footnote. The estimates in the second and the fourth column are the parameter that measures the contrast of the student with high performance relative to poor performance and the contrast of student with moderate performance relative to poor performance respectively. The standard errors are in column three and five respectively. The table shows several findings that need to be highlighted. First, of the entire explanatory variable considered, only gender categories significantly affect both high performance and moderate performance. Second, UME mode of admission is significantly different from that of others which consist of PDS, UABS, JUPEB and Direct Entry in high performance contrasted by poor performance at 0.1 probability level, similarly On campus resident differs from off campus in high performance as contrasted by poor performance at 0.1 probability level. Finally, parental educational status, family home Structure and Campus residential status does not seems to affect performance.

Table 6. Coefficient of multinomial logistic regression

Explanatory Variables	Multinomial Logit Model			
	High performance versus poor performance		Moderate performance versus poor performance	
	β	SE	β	SE
Gender				
Male	1.336**	.481	-.329*	.303
Female ^{RC}	(0)	(0)	(0)	(0)
Mode of Admission				
UME	-.707*	.373	.229	.288
OTHERS ^{RC}	(0)	(0)	(0)	(0)
Parental Education Status				
Educated	-.092	.370	-.435	.290
Not Educated ^{RC}	(0)	(0)	(0)	(0)
Family Home Structure				
Broken Home	.076	.386	-.377	.308
Intact Home ^{RC}	(0)	(0)	(0)	(0)
Campus Residential Status				
On Campus	.749*	.432	.500	.346
Off Campus ^{RC}	(0)	(0)	(0)	(0)

^{RC} reference category.

** significant categories at 0.05 probability level

* significant categories at 0.1 probability level

Table 7 shows the odd risk which measure the risk index associated with each category of explanatory variable relative to level of performance. Considering the first explanatory variable in table 7 below, it is observed that more male student are more likely to have a high performance relative to poor performance than the female counterpart with a significant Odd ratio of 3.803. in order words, a male student is approximately four times more likely to have a high performance than a female student. Considering the odd ratio for moderate performance, a male student is less likely going to have a moderate performance relative to a poor performance than a female student, that is a female student is more likely to have a moderate performance than a male student though not significant. Students who came into the university with UME are less likely to have a high performance relative to poor than those who came in through other means of admission with odd ratio of 0.493. In order words, student who came in through other means are more likely to have a high performance than those who came in through UME with odd ratio 2.028 at 0.1 probability level. They are more likely to have a moderate performance than their counterpart, though not significant. Lastly, student who live on campus are more likely to have a high performance than their counterpart who lived off campus with odd ratio of 2.114 at 0.1 probability level.

Table 7. Odds Ratio for the Various Categories of Variables Relative to the Reference Category for the multinomial Logit Model

Explanatory Variables	Multinomial Logit Model	
	High performance versus poor performance	Moderate performance versus poor performance
Gender		
Male	3.803**	0.720
Female ^{RC}	(1)	(1)
Mode of Admission		
UME	0.493*	1.257
OTHERS ^{RC}	(1)	(1)
Parental Education Status		
Educated	0.912	0.647
Not Educated ^{RC}	(1)	(1)
Family Home Structure		
Broken Home	1.079	0.686
Intact Home ^{RC}	(1)	(1)
Campus Residential Status		
On Campus	2.114*	1.648
Off Campus ^{RC}	(1)	(1)

^{RC} reference category.

** significant categories at 0.05 probability level.

* significant categories at 0.1 probability level.

IV. Conclusion

This study was conducted in Federal University of Technology Akure, Nigeria, the best University of Technology in Nigeria (citation) to investigate the effect of the explanatory variables that affect student academic performance. Multinomial logistic model was used to evaluate chances of level of academic performance. The result of the study showed that chance of occurrence of a high performance is more for the male students, students who came in through other modes of admission. The decision concerning the sixth research question is to accept the alternate hypothesis which states that the likelihood that the occurrence of a student having high performance or moderate performance of poor performance is significantly associated to some of the variables which are gender and mode of admission. Despite the wide application and popularity of logistic regression methodology to different fields of research study (Lilian et. al., 2008; Peng et. al., 2002; Peng et. al., 2001; Maiti and Bhattacharjee 199), few studies has demonstrated in detail the preferred pattern in which the methodology can be applied (Peng and Nichols 2003). Hence it is with great desire we hope that this paper has demonstrated in detail that multinomial logistic method can be very effective in educational research.

V. Recommendations

The following recommendations are made, based on the findings of this study. More attention and resource should be channel towards other forms of admission, which comprises of direct entry, pre-degree science (PDS), University Advance Basic Studies (UABS) and Joint University Preliminary Examination Board (JUPEB).

An upward review of the number of admission through other forms of admission should be considered, as student coming in through this mode of admission perform better academically compared to the UME counterparts, more attention in area of financing other forms of admission should be considered, in order to retain the quality of service and result obtained.

Also programs that will motivate the female counterpart, to strive for a better academic performance should be embarked on.

Limitations

The variables considered in this research are all self reported variables obtained through questionnaire, as a result of this, the response/dependent variable (academic performance) may be bias or influenced by some random factors (Spector, 1992; Coyne, 1994; Burke et. al., 1993). Though this biasness was reduced through the use of a categorical academic performance variable (LoP), which conceals a student's actual academic performance by specifying an interval in which a student's actual performance falls.

Also, the sample size considered is relatively small due to interest of participant in the study and other logistics. A large sample can be used, in order to generalise the result obtain for a wider inference.

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