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Ordinal logistic regression in modeling the factors that causes students' poor performance in mathematics in selected secondary schools in Kogi State, Nigeria: the need for policy option.

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Keywords

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Mathematics;
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and Kogi State

Abstract

In this study, Ordinal Logistic Regression (OLR) technique was explored to model the factors that contributed to cause of poor performance of students in Mathematics in Kogi State. The two factors that are not statistically contributor to poor performance of Mathematics in Kogi State are sex and government factor with their P-values > 5% level of significance. The preliminary results from Chi square tests and logit model showed that Students negative attitude to Mathematics, types of school the students attended, anxiety and fear of Mathematics, students background, inadequate qualified teachers, obsolete of teaching methods, and inadequate of teaching materials and location are statistically significant factors that contributed to poor academic performance of students in Mathematics in Kogi State.

I. Introduction

The concerns for high rate of failure in Mathematics examination in Nigeria date back to a number of decades. Ojaleye and Bojuwoye (2000) revealed that researchers have attempted to identify various factors responsible for the high rates of failure among the students. Education in general term is considered as a tool to be used for the integration of individual into society to achieve self-realization, develop national consciousness, promote unity, and strive for socio-economic, political, scientific, cultural and technological progress. In view, Umamer (2011) considered education in Mathematics in specific term, as a bedrock and indispensable tools for scientific, technological and economic advancement of any nation. Davis and Hersh

(2012) submitted that Mathematics is an important subject not only from the point of view of getting an academic qualification at school or college but also to prepare students for the future. Unfortunately, Mathematics is generally disliked by students because it is regarded as difficult (Tshabalala and Ncube, 2012). Mathematics is the cornerstone of development of any contemporary society, hence the concern for continued poor performance by students attracts researchers to identify some possible factors contributing to the nose-diving students' performance in mathematics. In spite of the significant role that Mathematics plays, much attention has not been created on why most students find it difficult to pass the subject. The performance of students in Mathematics among secondary schools in Kogi State remained poor for many years with an average score less than 30% (K.S.E.B, 2020). Studies have been conducted on the students' poor performance in Mathematics in Nigeria but no studies have been done particularly in Kogi State to find out the modeling factors that causes the students' poor performance in the subject which hence the impetus for this study. In recognition of the value of Mathematics, the ministry of education in Nigeria has made Mathematics a compulsory subject in both primary and secondary schools in all the states in Nigeria. Despite the seriousness and various workshops for the teachers at both levels of education, the performance of students in Mathematics especially in Kogi State has remained poor which enhance the reason for this study. This study sought to establish and identify the significant modeling factors contributing to the students' poor performance in Mathematics in Kogi State. it's equally aimed at providing public policy option towards engendering improved performance of students in Mathematics. To investigate the major causes of high failure rate by students' poor performance in Mathematics in Kogi State.

II. Objective of the study

The objectives of this study are:

- To identify the factors mostly affected by students' final performance in Mathematics.
- To identify the factor(s) that is not a significant contributed to students' final performance in Mathematics.
- To determine the challenge(s) experience by teachers in the teaching and learning process of Mathematics.
- To build an Ordinal Logistic Regression Model for students' performance in Mathematics.
- To recommend strategies on policy option that can be adopted to improve the students' performance in Mathematics in Kogi State as well as in Nigeria as a whole.

III Research Methodology

3.1 Sources of data: To successfully carryout the research work, questionnaires were distributed to some selected secondary schools in Kogi State to determine the factors that contribute to students' poor performance in Mathematics in the State. The total number of questionnaires distributed was 1012 and only 700 questionnaires was recovered while 502 questionnaires were correctly filed with answered. And the remaining questionnaires were removed from the analyze.

***3.2 Ordinal logistic regression (OLR)*:** Ordinal logistic regression is used to estimate an ordinal output (response) variable given one or several input (predictor) variables. In the ordinal logistic regression, the explanatory variables may be categorical, interval or ratio scale variable. It will enable us to determine which of the independent (predictor) variables in the model have a statistically significant effect on the dependent (response) variable.

Every response in ordinal logistic regression has its own cut point or intercept but similar regression coefficient.

3.3 Ordinal logistic regression model

If

$$\pi_i = P(Y = 1 \quad X = x_i) = \frac{e^{\beta_0+\beta_1 x_1+\cdots+\beta_k x_k}}{1 + e^{\beta_0+\beta_1 x_1+\cdots+\beta_k x_k}}$$

and

$$1 - \pi_i = e^{\beta_0+\beta_1 x_1+\cdots+\beta_k x_k}$$

Then,

The odd ratio

$$log\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k$$

Where

β_0 *constant and* $\beta_1, \beta_2 \ldots \beta_k$ *are regression coefficients of* $x_1, x_2 \ldots x_k$ *respectively.*

3.4 Choice of reference or baseline category:

The choice of baseline or reference category varies from one study to another, though a school of thought would prefer the group with the highest grade while other would prefer the group with the lowest grade. However, this may not always be the case as a particular category of interest may sometimes be chosen as the reference category for specific consideration. Hence, this research work makes use of dependent variable of final grade where Fail (5) is the lowest grade for any secondary school students in Nigeria. Therefore, Fail serves as the "Reference Category" in this study but the baseline for other factors is randomly chosen since ordinal logistic regression provides a technique for interpreting the factors irrespective of the choice of baseline category. Ordinal logistic regression provides a set of co-efficient for each comparison. The coefficients for both reference category and baseline category are all zeros, similar to the coefficients for the baseline category for a dummy coded variable.

***3.5 The link function*:** The link function is the function of the probability that results in a linear model in the parameters. It is the link between the random and systematic components. The random component is the equation in the right side while the systematic component is in the left side. It is a link that connects the distribution of response and linear independent variables together. It is a transformation probability that allows the estimation of the model to be determined. In ordinal logistic regression, the major link functions used are Logit, Normit(Probit), Gompit, Cauchit and Negative log-log.

$$g(X, i) = \theta_i + X^i\beta, where\ i = 1, 2, 3, \ldots i - 1$$

Table 1:The Link functions

Name	Link Function	Distribution	Application
Logit	$g(x) = \lambda\left(\frac{x}{1-x}\right)$	Logistic	Evenly distributed categories
Normit(Probit)	$g(x) = \theta^{-1}(x)$	Normal	Normally distributed latent Variable
Gompit	$g(x) = log\lambda(-log\lambda(1-x)$	Gompertz	Higher categories are more Probable
Cauchit	$g(x) = tan\left((p-\frac{1}{2})\right)\pi$	Lorentz	Outcomewithmanyextreme values
Negative log-log	$g(x) = -log(x)$	Exponential/Beta	Lower categories are more Probable

Source: The Link Function

The two components of link function is given as

Random component: It is the probability distribution of an output variable of Y

Systematic component: It specifies the predictor variables $(x_1, x_2 \ldots x_k)$ in the model and their combination in creating the linear predictors of $\beta_0, \beta_1 \ldots \beta_k$ in linear regression (Ombui et at, 2011).

***3.6* Model fitting information:** The model tells us if there is an improvement of introducing any variable in the model when the intercept model has been fitted.

3.7 Deviance G^2

It measures the extent at which the current model deviate from saturated model. It gives the deviance Statistic a comparison between the full and nested models of the ordinal logistic regression. Therefore, the small value of Deviance gives a better model.

$$D = -2\,Log\left(\frac{lo}{lf}\right)$$
$$= -2(In(nested\ model) - In(full\ model))$$

Where $l_n$represents likelihood estimate of nested model and $l_f$represents likelihood estimate of the full model when explanatory parameters are involved.

3.8Pseudo R^2

This is a measure of variation in the dependent variable that is explained by the independent variables. The formula of Pseudo R^2 is given as follows.

$$Rseudo\ R^2 = \left(\frac{b_{min} - l_b}{b_{min}}\right)$$

3.9 Measure of predictive strength: In Ordinal Regression Model, it not possible to compute the same R^2–Statistic as in Linear Regression so the three approximations are computed instead which include: Cox and Snell, Nagelkerke and Mc F added.

Cox and Snell (R^2cs) : $R^2_{CS} = 1 - \left(\frac{L_m}{L_0}\right)^{\frac{2}{n}}$

Nagelkerke (R^2N): $R^2 = \left(\frac{\frac{1-L(M_{Intercept})^{2/n}}{L(M_{Full})}}{1-L(M_{Intercept})^{2/n}}\right)$

Mc Fadden (R^2_{MF}): $R^2 = 1 - \left(\frac{In(L_m)}{In(L_0)}\right)$

***3.10 Parameter estimates of the co-efficicents*:** The parameter estimate tells us specifically the relationship between the input and output variables. The response coefficients are the constants which are not interpreted individually. This is the point in term of logit where students might be predicted or interpreted based on the reference category used in this particular research work.

***3.11 Test of parallelism*:** There are so many assumptions under the Ordinal Logistic Regression but the most important one is that the ordinal logistic regression coefficients are the same across the categories. If the parallelism assumption is rejected, it implies that there is no association among response categories and lines of the same slope are parallel.

3.12 Odds-ratios and model interpretation: The interpretation of the estimated parameter of $\beta_0, \beta_1, \ldots, \beta_k$ is not very easy but with help of odds-ratios which is denoted as $(\theta_j) = e^{\beta_j}$ provides a much easier interpretation. The (θ_j) can be converted to its complement by dividing the θ_j by 1 ***(i.e*** $\frac{1}{\theta_j}$***).*** The positive ***(+)*** or negative ***(∠)*** signs represent positive or negative in the odds ratio (OR) which respectively reflected to increase more likely (increased or higher risk) or less likely (reduced or lower risk) chance of any student in graduating with good performance in Mathematics.

Table 2: List of Variables Used in this Research Work to Compare the Model

S/no:	Variables	Type	Scale	Comment
1	Sex	Input variable	Nominal	Male (1) andfemale (2)
2	Students'Negative Attitude to Mathematics	Input variable	Nominal	Yes (1) and No (2)
3	Types of School Students Attended	Input variable	Nominal	Private (1) and Public (2)
4	Anxiety and Fear of Mathematics	Input variable	Nominal	Yes (1) andNo (2)
5	Students Background	Input variable	Ordinal	Best (1), Better (2), Good (3) and Poor (4)
6	Inadequate Qualified Teachers	Input variable	Nominal	Yes (1) and No (2)
7	InadequateTeaching Methods	Input variable	Nominal	Yes (1) and No (2)
8	Inadequate Teaching materials	Input variable	Nominal	Yes (1) and No (2)
9	Government Factors	Input variable	Nominal	Yes (1) and No (2)
10	Location	Input variable	Nominal	Central (1), West (2) and East (3)
11	Grade	OutputVariable	Ordinal	A (1), B+ (2), C+ (3), D+ (4) and F (5)

Source: Field Survey, 2021

The data set above holds 11 categorical variables altogether. Moreover, there are 10 independent variables (Input variables) and 1 dependent variable (Output variable)

3.13 The model: The ordinal logistic model was used to perform the impact of socio-demographical factors that causes students' poor performance in Mathematics in Kogi State. The ordinal dependent variable was measured on 5 categories of students' final grade in secondary school.

$$Y = \begin{cases} 1 \rightarrow A \\ 2 \rightarrow B+ \\ 3 \rightarrow C+ \\ 4 \rightarrow D+ \\ 5 \rightarrow F \end{cases}$$

The proportional odds assumption states that the number added to each set of logarithms to get the next is the same for every case to form an arithmetic sequence. The reference category is $5(F = Fail)$ which equals to reference group and non-reference k categories that have a linear regression function with regression parameter.

To form the model on regression co-efficient and explanatory variables, this can be written a

$$\ln \frac{p(Y \text{TM} G_j)}{p(Y \succ G_j)} \quad X_{0j} \Gamma_{1} i_1 \Gamma_{2} i_2 \Gamma \ldots . \Gamma_{p} i_p \Gamma £_j$$

If there are p predictors in the response variable then there will be $p-1$ models which have parallel lines as only the intercept. $£_j$ is the error term. For this study, p = 5 categories which imply that 4 models will be considered as: θ_1, θ_2, θ_3 and θ_4 known as pooled categories.

$$\theta_1 = \frac{pr(grade1)}{pr(grade2or3or4or5)}$$

$$\theta_2 = \frac{pr(grade1or2)}{pr(grade3or4\ or\ 5)} \quad , \theta_3 = \frac{pr(grade1or2or3)}{pr(grade4\ or\ 5)} a$$

$$nd\theta_4 = \frac{pr(grade\ 1or2or3or4)}{pr(grade\ 5)}$$

The last category 5 does not have an odd associated with it since the probability of scoring up to and including the last score is 1. Hence, the last category serves as the baseline or reference category.

Definition of variables

Dependent Variable Y : The dependent variable used is the overall performance of students who are polytechnic graduates. The grades have been categorized into 5 categories with the lowest grade F being used as the reference grade.

i) A (1)
ii) B+ (2)
iii) C+ (3)
iv) D+ (4)
v) F (5)

Independent Variables X: The Independent variables used in this research work consist the following variables below:

i) Sex = (S)(X_1)
ii) Students' Negative Attitude to Mathematics = (SNAM) (X_2)
iii) Types of School Students' Attended = (TSSA) (X_3)
iv) Anxiety and Fear of Mathematics = (AFM) (X_4)
v) Students' Background = (SB) (X_5)
vi) Inadequate of Qualified Teachers = (IQT) (X_6)
vii) Inadequate of Teaching Methods = (ITM) (X_7)
viii) Inadequate of Teaching Materials = (ITML) (X_8)
ix) Government Factors = (GF) (X_9)
x) Location = (L) (X_{10})

IV Literature Review

This section deals with the collection of other relevant research works that will provide bases for the present research on the collection, collation and co-ordination of literatures which are paramount important in every research work. It is apposite to begin every research work particularly in ordinal logistic regression modelling by outlining how other relevant literatures were consulted, more importantly, as a necessary guild as well as a basis for further research activities. Review of related literatures in statistical research is sometimes very important and necessary due to its vast areas of applications. Academic performance is a vital tool in measuring the students' academic achievements during or on the completion of a program.

Kenneth (2018) carried out a study to analyze the overall performance of students at Kenya Certificate of Primary Education (KCSE) level in Kiambu County. The subject used in the study included Mathematics, English, Swahili, Biology and Chemistry and other factors as gender, type of school students attended which are categorical. Ordinal logistic regression was the method used in analyzing the students' performance for two-year academic sessions 2014/2015 and 2015/2016. A stratified random sampling technique was used for collecting the data. After the analysis, the findings showed that the subjects that contributed the most to the students' overall performance in both years were Swahili and

Biology. Mathematics did not contribute much. Students gender did significantly have an effect on the student' overall grade.

Samuel (2014) conducted a study to model the factors that have determinants on students' performance in Kenya Certificate of Secondary School Education Examination within Kiambe County. Ordinal Logistic Regression model was used to determine the factors that contributed to learner's performance. The results revealed that gender, secondary school category and certificate of primary education examination point had a significant impact on the students' performance in Kenya with significant values of 0.002, 0.001 and 0.000 respectively.

Scherko and Nozad (2018) conducted a research to show the factors that affect students' performance, the First Attempt Examination in the first final examination of students after their first academic year. The factors considered include; Sex, Car ownership, Relationship, Smoking, Hours of study, Facebook use, Father alive, Mother Education and Father Education. They employed the Ordinal Logistic Regression to determine the factors that contributed to students' performance. The results showed that female factor has a high effect on the results of First Attempts Examination as females were more likely to pass the first attempts examination than the males. Also, students with car, relationship, who smoke, use of Facebook and whose mother have high level of education negatively had poor performance while mother alive, higher level of father education, hours of study positively affected the students' academic performance.

It is evident that despite the use of the same research approach (e.g. quantitative, qualitative, ordinal logistic regression, multinomial logistic regression, logistic and binary logistic regression) in these studies, there is divergence in the findings. The variance in the results might be due to sample size, study population and sample characteristics (factors). Hence, education and academic policy makers may find it difficult sometimes to ascribe the factors that causes poor students' performance in Mathematics due to these various inconsistencies. These inconsistencies necessitate an in-depth study aimed at assessing the comparative study of students' performance into the various institutions in Nigeria.

V Data analysis and Interpretations

Table 3:Chi-Square distribution between grade and factors that cause poor performance of students in Mathematics

Factors	Pearson	Df	Sig	Comment
Grade &Sex	.743	4	.946	**Sex** does not determine students' final grade at 2.5% level of significance.
Grade &SNAM	70.127	4	<0.001	**SNAM** determines students' final grade at 2.5% level of significance.
Grade & TSSA	93.025	4	<0.001	**TSSA** determines students' final grade at 2.5% level of significance.
Grade &AFM	95.983	4	<0.001	**AFM** determines students' final grade at 2.5% level of significance.
Grade &SB	275.659	12	<0.001	**SB** determines students' final grade at 2.5% level of significance.

Grade & IQT	67.580	4	<0.001	**IQT** determines students' final grade at 2.5% level of significance.
Grade &ITM	51.817	4	<0.001	**ITM** determines students' final grade at 2.5% level of significance.
Grade &ITML	39.437	4	<0.001	**ITML** determines students 'final grade at 2.5% level of significance.
Grade &GF	.629	3	.548	**GF** does not determine students' final grade at 2.5% level of significance.
Grade &Location	156.589	8	<0.001	**Location** determines students' final grade at 2.5% level of significance.

Source: Field Survey, 2021

Table 4: Parameter Estimate

Factor Levels	**Estimate**	**Exp(β)**	**Df**	**Sig**	**% Change in OR**	**Sig**
A	-7.315		1	< 0.001		< 0.001
B+	-5.861		1	< 0.001		< 0.001
C+	-3.603		1	< 0.001		< 0.001
D+	-1.085		1	<0.001		<0.001
F (ref)						0
[Sex 1 Male]	0.307	1.3593	1	0.110	+35.9	0.110
[Sex 2 Female] (ref)						0
[SNAM 1 YES]	-0.039	0.9618	1	0.026	-4.0	0.946
[SNAM 2 NO] (ref)						0
[TSSA1 PRIVATE]	-1.039	0.3538	1	< 0.001	-64.6	< 0.001
[TSSA 2 PUBLIC] Ref)						0
[AFM1 YES]	0.742	2.1001	1	< .0.001	+1.1	<
[AFM 2 NO] (ref)						.0.001
						0
[SB 1 BEST]	-3.403	0.0333	1	< 0.001	-66,7	< 0.001
[SB 2 BETTER]	-2.414	0.0895	1	< 0.001	-91.1	< 0.001
[SB 3 GOOD]	-1.640	0.1940	1	< 0.001	-80.6	< 0.001
[SB 4 POOR] (ref)						0
[IQT 1 YES]	0.436	1.5465	1	0.013	+54.7	0.279
[IQT 2 NO] (ref)						0
[ITM 1 YES]	0.309	1.3621	1	0.018	+36.2	0.388
[ITM 2 NO] (ref)						0
[ITML1 YES]	0.372	1.4506	1	0.043	+45.1	0.105
[ITML2 NO] (ref)						0
[GF 1 YES]	-1.388	0.2496	1	0.335	-75.0	<0.001
[GF 2 NO] (ref)						0
[LOCATION1CENTRAL]	-2.058	0.1277	1	< 0.001	-87.2	< 0.001
[LOCATION 2 WEST}	-1.590	0.2039	1	< 0.001	-79.6	< 0.001
LOCATION 3 EAST] (ref)						0

Source: Field Survey, 2021

The positive (+) or negative (−) signs represent positive or negative %changes in the OR which, respectively, reflected an increased or decreased risk of passing Mathematics in secondary schools in Kogi due to the impact of the associated factor levels.

The influence of each factor on the levels of students' grade to the causes of poor performance of students in Mathematics is determined by the percentage change in its odds ratios (OR) as presented in the last column of Table 4.

Except for sex and Government factor, logistic regression results in Table 4 generally revealed significant relationship between the grade levels and all the identified factors used in this research work with ($P< 0.05$).

According to the results in Table 4, students' negative attitude to Mathematics are positively associated with the students' grade. More specifically, students who say YESshave 4% risk of passing Mathematics in secondary school than students with NO response with (OR= 0.9618, P = 0.026).

In terms of type of school students attended, results revealed that students admitted through private schools have 65% reduced risk of passing mathematics in their secondary school than those who went to public schools with (OR= 0.3694, P< 0.001).

Students who say YES to anxiety and Fear in Mathematics have11% higher chance of passing Mathematics than those who say NO with (OR= 2.1001, P< 0.001).

The students background is another factor that contributed to student's poor performance in mathematics in Kogi State. Students with Best and Better backgrounds have 67% and 91% reduced risk of passing Mathematics their secondary schools with (OR=0.0333, P<0.001) and(OR=0.0895, P<0.001) respectively. Also, those with good background have 81% reduced risk of passing Mathematics than those with poor background with (OR=0.1940, P< 0.001).

In term of inadequate qualified teachers, result showed that 55% of those who response with YES have higher chance of passing Mathematics than those who say NO response with (OR= 1.5465, P= 0.013).

Also, students who say YES to inadequate of teaching methods in Mathematics have 36% higher chance of passing Mathematics than those who say NO with (OR=1.3621, P = 0.018).

In the same note, students who say YES to inadequate of teaching materials in Mathematics have 45% higher chance of passing Mathematics than students who say NO with (OR= 1.4506, P= 0.043).

Furthermore, considering the government factor, the students who say YES showed that 75% of them will have reduced risk of passing Mathematics than those who say No with (OR= 0.2496, P=0.335).

Lastly, students in Central and West have 87% and 80% reduced risk of passing Mathematics than those students in East with (OR= 0.1277, P<0.001) and (OR=0.2039, P<0.001) respectively.

Table 5: Model Fitting Information

Model	-2Log Likelihood	Chi-Square	Df	Sig
Intercept Only	1302.799			
Final	836.486	466.313	13	< 0.001

Source: The Link Function: Logit

The Significant Chi- Square Statistic in this model fitting information indicates that the final model gives a significant improvement over the baseline intercept only model because (P-value < 0.05). This tells us that the model gives better predictions than if we just guess based on the marginal probabilities for the outcome categories in the model.

Table 6: Goodness of Fit Statistic

	Chi-Square	Df	Sig
Pearson	1353.177	1155	0.642
Deviance	762.917	1155	1.000

Source: The Link Function: Logit

The deviance is a measure of lack of fit between the data and the model. Table 6 above shows that P – value is greater than 5% level of significance which implies that H_0 is accepted with conclusion that the observed data used in this research work is consistent with the estimated value in the fitted model.

Table 7: Pseudo R-Square

Cox and Snell	0.605
Nagerlkerke	0.644
Mc Fadden	0.332

Source: The Link Function: Logit

In Table 7 above, the results revealed that all the three Pseudo R–Square values are greater than 0.332. This model implies that at least 33.2% of the variation in the Students' final grade in mathematics is explained by all explanatory variables used in this research work.

Table 8: Test of Parallel Line (Parallelism)

Model	-2Log Likelihood	Chi-Square	Df	Sig
Null Hypothesis	836.486			
General	807.161	29.325	39	0.870

Source: The Link Function: Logit

Form the test of parallelism in Table 8 above shows that the Null Hypothesis is accepted because the P-value = 0.870 is greater than 5% level of significance. This implies that the location parameters are the same across the response categories, and lines of the slope are parallel. Hence, the link function used is appropriate.

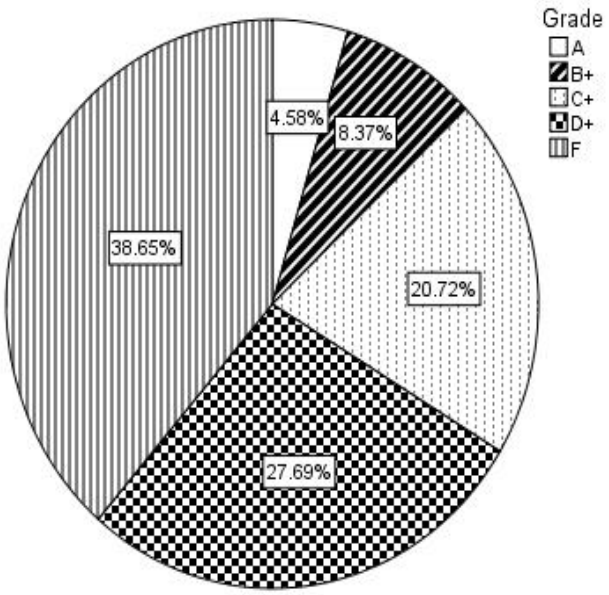

Figure1:The Pie chart of the grade in Kogi State
Source: Field Survey, 2021

VI The need for policy option

Every responsible government is expected to create enabling environment and opportunities for its citizen to acquire quality education. It should be noted that the poor performance in Mathematics observed in this work is not limited to the subject alone. Other areas especially in areas of sciences are of concern to this work, because science and technology are the bedrock for which break through and innovation that would transform the society from poverty to posterity could be achieved.

Therefore, there must be a deliberate policy initiative by government in particular to drive the interest of student in the areas of science subject especially Mathematics. in this direction, the following suggestions are put forward for consideration.

- There is the urgent need to expand and upgrade the current state of science equipment and infrastructure through deliberate funding. Budgetary provision currently inexistence is not only inadequate but totally unrealistic to the yearning gap in terms of need. It is not only bogus budget that is required, but the political will to release fund as contained in the budget fully.
- Teachers who are meant to deliver the teaching requires adequate and frequent training so that new skills and knowledge can be readily acquired. In this regard government should deliberate effort at training and retraining of teachers.
- Government should create opportunities for those who are interested in Mathematics and other sciences as a way of stimulating interest even at a tender age. Mathematics teachers should be encouraged by way of additional remunerations and special grade allowances be made as part of their salary.
- There is the urgent public sensitization to create awareness to students in all schools.
- Guidance and counseling units of schools should be reinvigorated by the government so that students would be guided on a good career parts that would be beneficial to the individual and the society at large.

VII Conclusion

This research was conducted to investigate the factors that causes the students' academic poor performance in Kogi State. According to the results, sex and government factor were the factors in the model not significantly contributor to student's final performance.

The factors such as Students negative attitude to mathematics, types of school the students attended, anxiety and fear to mathematics, students background, inadequate of qualified teachers, inadequate of teaching methods, inadequate of teaching materials and location are statistically significant factors that contributed to poor academic performance of students in Mathematics in Kogi State.

VIII Recommendations

Based on the results of this research work, we recommend a series of highlights to be put in place in all private and public secondary schools in Kogi State in order to improve the academic performance of students in Mathematics.

i) All secondary schools in Kogi State should give emphasis on those factors causes the students' poor performance in Mathematics (Based on the existing and questionnaire data used in this research work).
ii) Students should be advised to go for extra moral classes after their closing hours.
iii) All Principals and teachers in various secondary schools in Kogi State should pay attention to the factors responsible for students poor performance in mathematics.
iv) The management of all secondary schools should counsel the students the importance of having good grade in Mathematics.
v) Government and management should provide a conducive academic atmosphere for students so as to improve the academic performance in Mathematics.
vi) Since Mathematics is the bedrock and vehicle for scientific and technological development, students should be given serious attention that it deserves.
vii) Government should find a way of regulating the activities of public secondary schools as most of them are not ready to engage their students in a serious study especially in Mathematics.
viii) Teachers especially in mathematics should be given additional incentives to encourage their commitment.
ix) In order to find out whether the model is effective and applicable to all secondary schools in Nigeria, similar research should be conducted in other State.

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