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Statistical Analysis of Students Mathematics Performance in West African Senior Secondary Certificate Examination (WASSCE) From 2018 to 2022 in Some Selected Secondary Schools of Birnin Kebbi, Kebbi State – Nigeria

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Abstract:- This research project conducted a survey in both government and private schools within the Birnin Kebbi metropolis to evaluate the performance of students in mathematics, which is a compulsory subject for students entering tertiary institutions, regardless of whether they are pursuing arts or science disciplines. The study focused on assessing the proportion of students who achieved a grade of A, B, or C in mathematics, which is considered a credit-worthy performance. The Malthusian population model was utilized to analyze the survey results. The results showed a startling finding: when considering pupils' improvement in mathematics, the Malthus parameter—which is frequently used to calculate population growth—was found to be extremely low. This implies that the students' rate of progression or advancement in their mathematics skills was sluggish, which may point to difficulties with this important subject. These results pose significant queries on the variables affecting the region's students' arithmetic performance. Regardless of the academic route that a student chooses, more investigation and interventions could be required to resolve these problems and raise their level of mathematical competency.

I. INTRODUCTION

All primary and secondary school students in Kebbi State are required to take mathematics classes. The state has also participated in national and international mathematics assessments over the years, including the National Mathematics Competition (NMC), Cowbellpedia, Nageria International Tulid Competition (NITC), and the Royal National Mathematics Olympiad Mathematics Olympiad Examination, which is run by the Mathematics Association of Nigeria. It was found that Kebbi State performed above average in certain competitions and below average in others. Due to these variations, pupils' WASSCE scores have begun to suffer. As a result, this research was suggested to address the issue and provide remedies. In order to improve student performance in mathematics and determine the impact of mathematics on graduates in the fields of science, engineering, the arts, and social sciences, this study will be carried out in ten public and private secondary schools within the Birninkebbi local government. The study of numbers, quantity, and space in abstract form or as they are applied to other fields like engineering and physics is known as mathematics.

As is commonly accepted, interest plays a critical role in mathematics learning (Heinze, Reiss, & Franziska 2005). According to Yu and Singh (2016), interest can be classified as either an individual's interest or a situation's interest. It is defined as the psychological state of engaging with or having a tendency to reengage in a particular content over time. Interest is characterized as an effective state that alludes to the individualized teaching and learning process, according to Ainkey (2006). In this study, we will compare the WASSCE results to examine the impact of students' interest on their performance in mathematics. to stop pupils from failing maths in large numbers in the Senior Secondary Certificate Examination (SSCE) in the future.

One of the most significant disciplines taught in schools across the globe is mathematics. It is a subject that directly relates to other subjects, especially the sciences and technological subjects. Another topic that is required in both primary and secondary education is mathematics. According to Umameh (2011) in Tshabalala and Ncube (2013), mathematics is a fundamental and essential instrument for any country's scientific, technological, and economic progress. Furthermore, according to Davies and Hersh (2012), mathematics is a subject that students should take seriously no matter what field they decide to pursue in the future. It is not just important from the perspective of earning an academic degree in school or college. Mefor (2014) put it all together by stating that mathematics is related to everything in the cosmos, no matter how big or little. According to Umameh (2011), mathematics is a vital component of everyone's everyday routine and long-term planning. As a result, without mathematics, education and human life cannot work as intended. Similarly, in Nigeria,

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mathematics receives the full attention it deserves in the curriculum and in all related regulations, from elementary to advanced schooling. Regarding that, the Federal Republic of Nigeria (FGN) declared in 2004 that mathematics is a fundamental subject that should be studied by all students in primary and secondary education. In addition, before being admitted to any postsecondary institution in Nigeria, students must pass mathematics as one of the required subjects at the credit level. The following goals for secondary school mathematics have been established by the Comparative Education Study and Adaptation Center (CESAC) (1982):

- To improve computational abilities and cultivate a desire and capacity for accuracy to the extent that it relates to the issue at hand.
- To cultivate exact, rational, and abstract thought.
- To improve one's capacity to identify issues and apply mathematical knowledge to solve them.
- To give the basis in mathematics that is required for higher education.
- To pique the learner's curiosity, inventiveness, and inventiveness

However, it is disappointing to learn that despite the value placed on mathematics in Nigeria's educational system, low performance has recently been noted in public exams. Despite FGN's (1998) emphasis on a 60:40 ratio favoring the sciences in the field of admission to higher education, low performance in mathematics is one of the main causes of the fall in science and technology courses and development. According to Ukeje (1977) and Ojimba (2012), science cannot exist without mathematics, and contemporary technology cannot exist without science. Likewise, modern civilization cannot exist without modern technology. All parties involved in education place a high value on mathematics, yet senior secondary school pupils continue to do poorly in the subject.

Sa'ad and Usman (2014) quoted The Daily Trust on Wednesday, August 25, 2010 to claim that : “seventy-five per cent of candidates who sat for May/June WAEC 2010 examinations failed to meet the minimum entry requirement into tertiary institutions. Again, the Daily Trust of 21st August, 2014 in Sa’ad and Rabiu (2014) reveals that the recently released WAEC results indicated that over seventy percent fail in November/December results. 86,612 candidates, representing 29.17 percent of the total number of candidates who sat for the NOV/DEC examinations of West African Examination Council (WAEC), obtained credits in five subjects and above, including Mathematics and English language. Again, the WAEC has released its May/June 2014 WASSCE results, recording mass failure in mathematics and English language. Head of National Office, WAEC Charles Eguridu, while announcing the results said ”. A total of 31.28 percent, or 529,425 candidates, were granted credits. According to him, there was a slight decline in the performance of applicants in the May/June WASSCEs in 2012 and 2013, with 38.81 percent in the former and 36.57 percent in the latter.The low arithmetic performance of senior secondary school students can be attributed to problems with schools, students, teachers, and the government. To date, though, a great deal of effort has been invested in an attempt to resolve this problem permanently.

Umameh (2011), for example, noted that occasions such as the Benin Conference (1977), the National Critique Workshop in Onitsha, the Comparative Education Study and Adaptation Center (1976), which addressed the secondary level mathematics syllabus, and most recently, the National Mathematics Center, all made a significant contribution to resolving the issue of subpar arithmetic performance. As was previously said, there are numerous reasons why senior secondary school pupils score poorly in mathematics.

According to Bakare (1994) and Asikhia (2010), there are four main categories of factors that work against a kid achieving a strong academic performance: reasons that are inherent in the child, such as cognitive abilities, physical and health issues, psycho-emotional concerns, and disinterest in the school curriculum.

- Family-based factors, such as early cognitive stimulation and fundamental intuition; the nature of punishment at home; the absence of a role model; and financial circumstances.
- Factors inherent in the school, like the physical location and layout of the buildings, as well as the staff members' relationships with one another.
- Social factors such unstable educational policies, inadequate funding for the field of education, poor leadership, and job losses.

In particular, numerous research and authority have identified numerous reasons why pupils perform poorly in mathematics. For example, according to Vudla (2012) in Tshabalala and Ncube (2013), there is a lack of qualified teachers, inadequate classroom space, insufficient funding to buy necessary supplies, low-quality textbooks, large class sizes, unmotivated teachers, a lack of laboratories and libraries, poorly organized oversight activities, civil service intervention in the school system, frequent changes in principals and teachers, student promotions without teacher input, the detrimental effects of public exams on the teaching and learning process, and unequal access to education all pose obstacles to the seamless acquisition of mathematical knowledge. Apart from the above mentioned reasons behind subpar performance in mathematics, STAN (2002), as referenced by Ojimba (2012), was In particular, numerous research and authority have identified numerous reasons why pupils perform poorly in mathematics. For example, Vudla (2012) in Tshabalala and Ncube (2013) was of the opinion that key causes of low performance in mathematics are: a lack of well-trained teachers; inadequate instructional facilities; and a lack of funding. Others are:

- A severe lack of certified math teachers in the workforce.
- A lot of math teachers have demonstrated a lack of understanding of the subject matter.
- Overcrowded classrooms teaching mathematics.
- Students' unfavorable attitude toward mathematics.

- An excessive focus on memorizing mathematics curriculum material at the price of really understanding the material.
- Inadequate labs and facilities for mathematics

Similarly, Shield and Kelly (1999) in National Institute for Educational Development (NIED) (2010) discovered in Britain that, from the perspective of principals, the following factors contribute to low performance in mathematics:

- Insufficient support for learning;
- Principals' discontent with the in-career training of teachers in mathematics;
- Perceived deficiency of instructional materials for teaching mathematics;
- Students instructed by educators who have not engaged in professional development;
- A partial understanding of the material in mathematics. A small number of areas using numbers are emphasized.

Senior secondary school students' low performance in mathematics can also be attributed to fear and anxiety, as well as a belief that the subject is difficult. According to Wikipedia Free Encyclopedia (2014), children frequently experience mathematical anxiety in the classroom because they are taught by teachers who frequently experience worry related to their own mathematical proficiency. According to Attwood (2014), dyscalculia, inadequate instruction, interrupted instruction, and parental attitudes are the main causes of low arithmetic achievement. Karue and Amukowa (2013) identified the primary factors contributing to low mathematics performance in the Kenya Certificate of Secondary Examination in the Embu District. These factors included a lack of a relevant library and laboratory, qualified teachers, home environmental factors, family backgrounds, and a lack of parental involvement in their children's education. Numerous approaches have been put forth by educators, learners, and groups like STAN and the National Mathematical Center to improve students' math proficiency. Edukugho (2010) claims that the government recognized mathematics' importance in all areas of human understanding, not simply science and technology. For this reason, the government established and has been funding the National Mathematical Center, one of its parastatals. Furthermore, MAN is actively promoting efficient and successful mathematics instruction and research. Mbugua, Kibet, Muthaa, and Nkonke (2012) state that improving student performance in mathematics can be achieved by proper staffing, curriculum, teaching and learning resources, incentives and attitudes, and taxes and levies. However, Gitaari, Nyaga, Muthaa, and Reche believed that the following strategies could help students perform better in mathematics: fostering a positive attitude toward the subject; increasing the number of tests and quizzes; providing sufficient teaching and learning resources; inspiring students; ensuring that the curriculum is completed on time; hiring teachers with the necessary training in mathematics; utilizing a range of instructional strategies; and having school administrators monitor student progress. According to Karue and Amukowa (2013), establishing a positive relationship with parents through the availability of educational resources, a library, a laboratory, and other physical facilities, Embu District in Kenya can improve math performance by having head teachers build a strong relationship with parents and by bringing the student-teacher ratio down to a manageable level.

In a similar spirit, Ojimba (2012) proposed the following four tactics to raise pupils' arithmetic proficiency: groupings based on students' abilities when teaching mathematics in the classroom; constructivism should be ingrained in the curriculum, meaning that in order for students to learn and retain what they have learned, they must be in charge of it. Additionally, he mentioned that employing computer-aided education and instructional games are two ways that can be employed to help kids do better in mathematics. Chief Kieth Richards, Managing Director of Promasidor Nigeria Limited, was cited by Edukugho (2010) to clarify that the mathematics competition As part of its Corporate Social Responsibility (CSR), it is sponsoring a national campaign to address the following issues:

- Reversing Nigerian kids' belief that mathematics is an extremely challenging subject.
- Reversing the unfavorable WAEC data that indicates a high failure rate on math tests.
- Enhancing the understanding that mathematics is the bedrock of technological inventions and growth..
- Ensuring pupils pass maths in order to make it easier for them to get into more advanced courses in academic subjects that use numbers.
- Instilling in students a deliberate interest in mathematics from an early age.
- Establishing a reliable channel for recognizing, promoting, and honoring excellence.

Thus, it is evident that there are numerous approaches that can be taken to enhance secondary school students' performance in mathematics. These include the provision of sufficient physical and instructional resources, the hiring of qualified math teachers, the development of a positive attitude in students toward the subject, parental involvement in their children's education, the use of appropriate teaching strategies, the hosting of interschool competitions and quizzes, and so on.

The aim of this research is to study first order differential equations and use it to solve problems that arises in population growth and decay problems that requires the use of Malthusian population model.

II. CLASSIFICATION OF DIFFERENTIAL EQUATION

Differential equation is classified according to three properties which include;

- Classification by type
- Classification by order and degree

- Classification as linear or non-linear differential equation.

III. SOLUTION OF DIFFERENTIAL EQUATION

The first order differential equation has a variety of methods in finding its solution which includes the following,

- Variable Separable
- Equations Reducible To Variable Separable
- Homogeneous Equations
- First Order Exact Differential Equation
- Linear Equations

IV. METHODOLOGY

The method to be employed in this chapter is Malthusian population model which describes the rate in which population growth and using an increasing/decreasing factor (r) which can be used to determine the percentage of students pass and failure in a particular year and also can be used to forecast the future performances of the students in the future. A Malthusian growth model, sometimes called a simple exponential growth based on the idea of the function being proportional to the speed to which the function grows, The Malthusian population model, named after 18th-century economist Thomas Malthus, is a theoretical framework that explores the relationship between population and growth, this model presents a pessimistic view of population growth.

In this work, the Malthusian model will be used to determine the level of students passes in Mathematics.

The Malthusian model looks like this:

$$P(t) = P_o e^{rt}$$

Where

$P_o = P(0)$ is the beginning population size,

r = the population growth rate, which Ronald fisher called Malthusian parameter of population growth.

t = time

Another way to express the concept is as a differential equation, such as

$$\frac{dP}{dt} = rP$$

With initial condition: $P(0) = P_o$

This research uses time series analysis of the five years' worth of data from a few private and secondary schools in Birnin Kebbi local government of Kebbi State, Nigeria, in order to predict the future percentage of students in the WASSCE using the Malthusian population model.

Table 1 The information below was obtained from a few government and private schools in the city of Birnin Kebbi.

s/n	Items	Total	Pass	Fail	% of pass	% of fail
1	Total registered from 2017-2022 of the surveyed schools	8341	6764	1577	81.90661	18.90661

Source: field work.

Table 2 From the Table above, a Sub Table was been Retrieved.

s/n	Year	Number of Students in the register	Passed	Failed	% pass	% fail
1	2017	1586	1203	388	75.8512	24.1488
2	2021	1546	1266	280	81.8887	18.1113

Source: Sample from Table 1

Using Malthusian population model, we can see that, the initial population of passes is in the year 2017 where the total number of students registered in the surveyed schools were 1,586 of which 1,203 successfully passed with a credit and above while 388 scored below credit, also in the year 2021 the total number of students registered in the surveyed schools were 1,546 of which 1,266 successfully passed with a credit and above while 280 scored below credit, from the above data we now apply the Malthusian model to find the recurrence relation that will be used to forecast the future performance of the students based on this analysis of the results gotten.

$$P(t) = P_o e^{rt}$$

$$at\ 2017, t = 0, \qquad P_o = 75.8512$$

$$at\ 2021, t = 5, \qquad P(t = 5) = 81.8887$$

$$P(t) = P_o e^{rt}$$

$$81.8887 = 75.8512 e^{5t}$$

$$e^{5r} = \frac{81.8887}{75.8512}$$

$$e^{5r} = 1.0796$$

$$r = 0.02$$

$$P(t) = 75.8512 e^{0.02t}$$

This research aimed at forecasting the performance of students in the future (next 10 years) and this implies that, when t=10,

$$P(t = 10, year\ 2031) = 75.8512 e^{0.02 \times (t=10)}$$

$$P(t = 10, year\ 2031) = 75.8512 e^{0.2}$$

$$P(t = 10, year\ 2031) = 77.3845$$

$$P(year\ 2031) = 77.$$

This is to conclude that, after 10 years the percentage of passes will be 77% and this shows that there is progress in their performance but the Malthusian factor (r=0.02) is very low.

V. CONCLUSION

In conclusion, the study highlights a concerning low pass rate in mathematics among students in Birnin Kebbi local government. It suggests that the Newtonian factor, which signifies the overall interest and performance in math, is also subpar. To address this issue, it is imperative for the government to prioritize the recruitment of qualified and experienced mathematics teachers, as this could significantly boost students' interest and proficiency in the subject.

RECOMMENDATION

Using computer-aided programs for future performance prediction in education is a promising area for further research. This could improve the accuracy and efficiency of estimating students' future performance and aid government decision-making for educational policy. It's important to explore the development and implementation of such programs and assess their effectiveness in real-world scenarios.

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