Students' achievement in mathematics: Analysing the influence of gender and school nature

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Abstract

This study examined students' achievement in senior secondary school mathematics qualifying examination in Kano State, the influence of sex and schools nature on their achievement in mathematics has been assessed. Ex-post facto research design was adopted for the study. A pro forma was used to collect data from a sample of 300 students, selected using stratified random sampling procedure from the science secondary schools in Kano state Nigeria. The data collected were the students' performances in mathematics achievement test. The data were analysed using descriptive statistics and independent sample t-test to test the hypotheses at 0.05, level of significance. Overall results showed that students performed below average and a significant gender difference exists in mathematics performance. Similarly, a significant difference was also observed with respect to schools nature (boarding and day schools); day school students performed above better than boarding school students. The implication of this finding is that despite government continuous efforts, the academic achievement of students in mathematics through above hypothetical pass mark fell below the required average mark for admission into Nigerian universities. It was recommended among others that teachers should regularly motivate students to develop a good study habit and test them on the various mathematics concepts and feedback provided should be used to prepare them for credible achievement in mathematics at both internal and external examinations.

Keywords: Gender; mathematics; school nature; students' performance

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1. Introduction

The importance of mathematics knowledge to an individual and society is acknowledged worldwide. It is an essential tool in our society (Baroody, 1987). Bishop (1996) emphasises that mathematics knowledge can be used in our daily life to overcome the difficulties faced. Mathematics is considered as one of the most important core subjects in the school curriculum. More mathematics lessons and concepts are likely to be taught in schools and colleges throughout the world than any other subject (Orton, Orton, & Frobisher, 2004). However, standard tests and evaluations reveal that students do not perform to the expected level.

The importance of mathematics in all realms of life and the recent debate on the falling standards of students' achievement in mathematics has triggered the growing attention for science educators, researchers, parents and education authorities in their quest for the way forward over the past two decades (Blum, 2002). The inter-relationship between mathematics, development and advancement of humans shows the importance of mathematics in life due to its numeral and symbolic nature. Mathematics is more related to the scientific and technological facets of man's world than to any other aspect as it occurs and re-occurs in the physical and natural sciences. The basic skills underlying all scientific and technological skills are the control of the tools of mathematics (Maliki et al., 2009). Mathematics is considered as the language used to describe the problems arising in most branches of science and technology. The students underachievement in mathematics are not just a concern for particular countries but have become a global concern over the years (Pisa, 2003). The students' performances in mathematics at senior secondary schools in Nigeria have been very low and unimpressive.

Bichi and Abdullahi (2015) opined that academic achievement is used as an index of students' future in this highly competitive society. It has been one of the most important goals of the educational process. Academic achievement is considered as a key criterion to judge an individual's total potentiality and capability. Similarly, academic achievement occupies a very important place in the educational system. In the words of Crow and Crow (1969), academic achievement is the 'extent to which a learner is profiting from instructions in a given area of learning i.e., achievement is reflected by the extent to which skill or knowledge has been imparted to him.' Academic achievement also denotes the knowledge attained and skill developed in the school subject, usually designated by test scores (Karthigeyan and Nirmala, 2012). Mbugua et al. (2012) revealed among others, understaffing, inadequate teaching/learning materials, lack of motivation and poor attitudes by both teachers and students, retrogressive practices as factors contributing to poor performance in mathematics in Baringo County secondary schools in Kenya. Maliki et al. (2009) are of the opinion that students' academic achievement mathematics depends on their interest in the subject. Achievement processes reflect the characteristics of students and their environments, utilisation of teaching-learning models, instructional materials as well as the structural ability of the students.

The federal government of Nigeria to equip students to live effectively in the modern age science and technology lays emphasis on science education which is taught at all levels of education and made compulsory at both primary and secondary schools. At the tertiary level, mathematics is a compulsory subject and formed part of the requirement for admission especially in pure and social sciences programs and it is part of general studies for students in all fields of studies in Nigerian colleges, polytechnics and universities. Similarly Adegun and Adegun (2013) revealed that for admission purposes into the Nigerian institutions of higher learning; the ratio of sciences to liberal arts is 60–40% with functionality and integration of theory and practical as paramount aims. According to Adeyegbe (1994), it had been investigated and findings revealed that low level of students' achievement in mathematics at the senior school certificate examinations was due to lack of qualified teachers, low level of interest and commitment on the part of students, the abstract nature of some of the topics, teachers poor knowledge of the subject matter, non-availability of resource materials and over-loaded curriculum. They recommend improving on these factors and sensitisation of the local community to discard practices which prohibit student's effective participation in learning mathematics could improve performance in mathematics.

Mathematics is a core subject and one of the major science subjects taught at the senior secondary school level. The students need to pass the subject at the end of their secondary education at credit level to fulfil the requirements for admission to study natural/pure, physical and social sciences at the higher institutions of learning in Nigeria.

1.1 Statement of the problem and justification for the study

Over the years, the persistent senior secondary school students' low level of achievement in mathematics at the various public examinations in Nigeria has continued to attract the attention of major stakeholders in education. Performance of students in mathematics has consistently been poor and unimpressive. Despite all the considerable efforts made by policymakers at various levels, very little improvement in students' achievement has been recorded. Available data from the two public examination bodies i.e., (the West African Examination Council [WAEC] and National Examination Council [NECO]) Secondary School Certificate Examination (SSCE) indicate that students achievement in mathematics at the senior secondary school level continue to decline. Example, about 71% of the candidates who sat for the October/November 2014 West African SSCE private failed to obtain five credits with English Language and mathematics. A total of 241,161 candidates sat for the examination, but only 72,522 candidates representing 29.37% were successful in picking credits in five subjects that include in English Language and mathematics (WAEC, 2014).

In Kano State, Nigeria, the state government usually conducts qualifying examination for all senior secondary school (SSS II) students, to assess their suitability for sponsorship to write the final examinations being conducted by the two public examining bodies in Nigeria (i.e., WAEC and NECO). Although the Kano state qualifying examination is used as a criterion to sponsor students to write their final examination conducted by WAEC and NECO. However, there has been no evidence from the literature that any study was conducted to assess the magnitude of students' performances' in this subject.

Therefore, gaining an appreciation of their performance in mathematics may provide useful insight into their area of weakness and future performance as well as their suitability to be sponsored by the relevant agencies. The findings of the study might help the ministries of education and relevant stakeholders including the teachers in evaluating students' performances in their various capacities. Similarly, it is anticipated that the findings of this research will give curriculum developers new insights into emerging issues on performance and influence the authorities on policy formulation. It is also expected that students will benefit from the findings; because improved mathematics performance will give them opportunities to pursue sciences and other related courses in institutions of higher learning in the country.

1.2. Objectives

The main objective of this study is to assess the academic achievement of senior secondary schools students in Mathematics.

Specifically, this study intends to

i.   Assess the overall secondary school students' achievement in mathematics in Kano

ii.   Ascertain whether gender difference exists in the secondary school students' achievement in mathematics

iii.   Establish whether the nature of school influences students' achievement in mathematics in Kano

1.3. Research questions

The following research questions were raised to guide the study
i.   How well did the secondary school students perform in mathematics?
ii.   Is there any significant gender difference in secondary school students' achievement in mathematics?
iii.   Does schools' nature influence students' achievement in mathematics?

1.4. Research hypotheses

The following hypotheses were generated and tested at 0.05 level of significance.
Ho_1: There is no significant gender difference in students' achievement in mathematics.
Ho_2: There is no significant difference in students' achievement in mathematics with respect to schools' nature.

2. Material and Methodology

2.1. Research design

Ex-post facto research design was employed to assess students' performance in mathematics. The data used were collected from the monitoring and evaluation Unit of the Kano State Sciences and Technical Schools Board. The data contain all details of the students including their responses and scores.

2.2. Participants

The population of this study comprises all the senior secondary school (SSII) students in Kano state who are ready to write their final examination. Similarly, 300 senior secondary school (SS II) students, age (16–18) from four secondary schools in Kano State were selected for the study based on stratified random sampling technique. The strata recognised the school nature; Boarding 170 (67.7%), Day 130 (43.3%) and gender 160 male (53.3%) 140 female (46.7%), as presented in Table 1;

Table 1. Distribution of the participants

Gender			Nature of School		
Male	160	53.3%	Day	130	43.3%
Female	140	46.7%	Boarding	170	67.7%
Total	300	100	Total	300	100

2.3. Research instruments

The mathematics achievement test (MAT) constructed for Kano state senior secondary school qualifying examination to assess students' suitability for government sponsorship to write the final examinations being conducted by the two public examining bodies in Nigeria (i.e., WAEC and NECO), was used for this study. The MAT comprises 40 multiple choice items with five answer choices/options (A-E) and essay questions. The test items covered the whole senior secondary school mathematics syllabus prepared for SSCE by WAEC and NECO as well as the mathematics curriculum prepared by the Federal Ministry of Education in Nigeria.

2.4. Data collection procedure

The 40 multiple-choice items MAT was administered on the sample after receiving specific instruction for the test by teachers under the supervision of monitoring and evaluation Unit of the Science and Technical Schools Board Kano State at the end of students' SS II in July 2014. The data used are the scores obtained from the test after marking by teachers following the designed marking scheme. The available records of the students' performance were collected by the researchers from the official students' records of Kano State Science and Technical Schools Board at the monitoring and evaluation Unit of the Board using a pro forma form designed and validated by the researchers with the assistant of expert in the field.

2.5. Data analysis

The data collected were analysed using SPSS 20v. The Mean, Standard Deviation and independent sample t-test statistics were used. The level of significance was set at 0.05 for all statistical tests.

3. Results and Discussion

The results of this study are presented in line with the research questions in the following order, thus:

Research Question 1: How well did the secondary school students perform in mathematics?

To answer this question, mean and standard deviation with the percentage of the students' performances were computed and presented in Table 2;

Table 2. Performance of students in mathematics achievement test

Variables	*n*	Mean	SD	% Performance
Mathematics achievement (Scores)	300	43.46	11.94	43.50%

Table 2 presents the mean students' academic achievement as measured by their performance in the MAT. The result revealed the mean performance to be 43.46 out of a total score of 100. This is barely about 43.50% and is a little <50%, which means the performance of the students in mathematics was below average. Comparing the hypothetical pass mark of 40.00 with the students' mean score of 43.46 this indicated that the students performed well. Looking at the requirements for admission into higher institutions of learning in Nigeria at the credit level (50%), the overall secondary student achievement in mathematics can be considered to below average.

Hypothesis 1: There is no significant gender difference in students' performance in mathematics

To test the above hypothesis, the mean mathematics performances of male and female students were used to conduct a test of differences. The coefficient of the differences was determined using two-tailed t-test at 0.05 level of significance as presented in Table 3.

Table 3. Independent sample t-test of students' performances with respect to gender

Gender	*n*	Mean	SD	t	df	Sig. (2-tailed)	H_{O1}
Male	160	46.84	13.12				
				5.51	298	0.00	Reject
Female	140	39.59	9.03				

The descriptive statistics and a test for differences using the independent sample t-test obtained, as shown in Table 3, indicate that male students on the average performed better (M = 46.84, SD = 13.116) than female students (M = 39.59, SD = 9.026), where t (298) = 5.505, p = 0.00, α = 0.05. The result of the analysis revealed that the mean of male students (M = 46.84, SD = 13.116) is statistically significantly higher (t = 5.505, df = 298, two-tailed probability < 0.05) than the mean of female students. The null hypothesis which says there is no statistically significant gender difference is therefore rejected since 0.00 < 0.05. This implies that there is significance difference in performance between males and females students in mathematics. The difference was in favor of males, meaning that they performed better than females in mathematics.

Hypothesis 2: There is no statistically significant difference in students' performance in mathematics with respect to schools nature

To test the above hypothesis, the mean mathematics performances of Day and Boarding students were used to conduct a test of differences. The coefficient of the differences was determined using two-tailed t-test at 0.05 level of significance as presented in Table 4.

Table 4. Students' performances with respect to nature of school

Gender	n	Mean	SD	t	df	Sig. (2-tailed)	H_{O1}
Day	130	48.04	12.30				
				6.16	298	0.00	Reject
Boarding	170	39.95	10.40				

The descriptive statistics and a test for differences using the independent sample t-test obtained, as shown in Table 4, indicate that Day school students on the average performed better (M = 48.04, SD = 12.30) than Boarding school students (M = 39. 95, SD = 10.40), where t (298) = 6.16, p = 0.00, α = 0.05. The result of the analysis revealed that the mean of Day school students (M = 46.84, SD = 13.116) is statistically significantly higher (t = 5.505, df = 298, two-tailed probability < 0.05) than the mean of Boarding students. The null hypothesis which says there is no statistically significant difference in students' performance in mathematics with respect to schools nature is therefore rejected since 0.00 < 0.05. This implies that there is significance difference in performance between Day and Boarding school students in mathematics. The difference was in favour of Day, meaning that they performed better than Boarding school students in mathematics. This is evident in the fact that the mean scores recorded were 46.84 and 39.59 for Day and Boarding school students, respectively. The conclusion is that Day school students do well in MAT than and Boarding school students.

4. Discussion of Findings

This study assessed the students' academic achievement in mathematic qualifying examination in senior secondary schools in Kano state Nigeria. The findings, it is revealed that the performance of students in mathematics qualifying examination is little below average as measured by the mean scores of the students in their academic performance in mathematic qualifying examination. Even though the student's performances are higher than the hypothetical pass mark of 40%, it is still below the credit level (50%) required for admission into higher institutions of learning in Nigeria. This result is in agreement with that of Maliki et al. (2009) whose findings revealed that students perform higher than hypothetical pass mark at secondary school mathematic test.

The analysis based on gender difference revealed that the males had a higher mean score compared to females in their academic achievement in mathematic. This gives an indication that the males performed better than females in mathematics, thus, hypothesis 1 which stated that no significant gender difference in students' academic performance in mathematics is rejected. This finding is consistent with that of Maliki et al. (2009) Fennema and Sherman (1977), Grambs (1972), Comber and Keeves (1973), Tyler (1961), Finn et al. (1979) and Maccoby and Jacklin (1975) who all observed that in nearly all cases reported, male students obtained higher mean score than the females in mathematics tests. However, the result of this study is in contrast with that of Ayodele (2011), Fisher (2008), Oladunni (1995) and Daramola (1992) whose findings showed similarity in performance of males and females in mathematics.

On whether the nature of school influences performance in mathematics examination, the result showed that the mathematics performance of students from Day schools is higher than the performance of those from boarding schools. This result is possible since mathematics has been made compulsory requirement or pre-requisite for admission into higher institutions of learning in Nigeria; hence, the students have been monitored by their parents and guardians, highly motivated with extra lessons and exposed to good study habits. Perhaps parental guidance which boarding students may be lacking, help the day students to develop a favourable attitude toward mathematics which has manifested their high performance.

5. Conclusion

The main focus of this study was to assess secondary school students' performance in mathematics. The influence of gender and nature of schools on their performance were also evaluated. The findings of this study have brought a number of issues concerning mathematics achievement in Kano State qualifying examination.

First, despite government continuous efforts, the academic achievement of students in mathematics through above hypothetical pass mark fell below the required average mark for admission into Nigerian universities. Second, gender differences in mathematics achievement exist. Finally, despite all the advantages accorded to boarding schools, the result of this research has proved to be in favour of students from Day schools. It is generally considered that boarding schools students hardly violate rules and regulations such as involved in drug abuse, lateness, absenteeism or truancy as they are properly monitored and are secured in one place. They enjoyed such other advantages as good teachers, facilities and extra study periods. This brings a lot of concerns and the question arises here as is there any magic perform in day schools?

5.1. Recommendations

Based on the findings of this study and considering the important place of mathematics in our educational system it is recommended that;

1. Teachers and other stakeholders should pay special attention to encourage and motivate students to develop a good study habit to improve their academic achievement in mathematics.

2. Second, teachers may need to be more sensitive with the different needs of the male and female students. Hence, caution has to be placed when teaching both genders.

3. Authors of mathematics textbooks and curriculum developers should shift emphasis from teachers' activities to students' activities that will promote learning by doing.

4. Item analysis should be conducted on the Kano State qualifying examinations items to

ensure standardisation for better performance in external examination

5. Finally, further studies should be conducted to find out the perceived causes of students poor performances in boarding schools and if there are relationships between perceived causes and students' achievements in other subjects.

References

Anderson, R. C. (1942). How to conduct achievement test to assess comprehension. *Review of Educational Research*, *42*, 145-170.

Ayodele, O. J. (2011). Gender difference and performance of secondary school students in mathematics. *European Journal of Educational Studies, 3*(1), http://ir-library.ku.ac.ke/handle/123456789/14968

Baroody, A. J. (1987). *Children mathematical thinking: Developmental framework for preschool, primary, and special education teachers.* New York: Teachers College Press.

Bichi, A. A., & Abdullahi, S. (2015). Gender issue in students' academic achievement in English language. *Kano Journal of Educational Studies*, *4*(2), 31-38.

Bishop, A. J. (1996). *International handbook of mathematics education*. Dordrecht: Springer.

Comber, L. C., & Keeves, J. P. (1973). *Science education in nineteen centuries*. New York: John Wiley and Sons.

Daramola, C. A. (1992). *A study of the comparability of external examination in different subjects. Research in education, 16.* Manchester: University Press.

Eguridu, C. (2014). *71 percent candidate fail WAEC private exams*. Daily Trust Newspaper Online.

Fennema, E., & Sherman, J. (1977). Sex-related differences in mathematics achievement, spatial visualization and affective factors. *American Educational Research Journal*, *14*(1), 51-71. https://doi.org/10.3102/00028312014001051

Finn, J., Dulberg, L., & Reis, J. (1979). Sex differences in educational attainment: A cross-national perspective. *Harvard Educational Review, 49*(4), 477-503. https://doi.org/10.17763/haer.49.4.q23057265jq25704

Fisher, M. (2008). *No gender difference in mathematics performance*. The Uw-Madison and University of California, Berkeley Researchers' Report July Issue of Science.

Frasher, R., & Walker, A. (1972). Sex roles in early reading textbooks. *Reading Teacher*, *25*(8), 741-749.

Grambs, L. D. (1972). Sex stereotypes in instructional materials in literature and language. A survey of research. *Women Study Abstract*, *1*, 1-4.

Joseph, M. U., & Ansa, I. F. (2010). Developing causal model of some psycho-academic and school variables for mathematics achievement in junior secondary schools in Akwa-Ibom state Nigeria. *Journal of Research in Education and Society*, *2*(1), 159-167.

Maccoby, E. E., & Jacklin, C. (1975). *The psychology of sex differences*. Standford: Standford University Press.

Maliki, A. E., Ngban, A. N., & Ibu, J. E. (2009). Analysis of students' performance in junior secondary school mathematics examination in Bayelsa state of Nigeria. *Study Home Community Science*, *3*(2), 131-134. https://doi.org/10.1080/09737189.2009.11885288

Mutai, J.K. (2014). *Attitudes towards learning and performance in mathematics among students in selected secondary schools in Bureti district, Kenya.* M.Ed Thesis. Retrieved Dec 9, 2014 from http://www.ku.ac.ke/schools/graduate/images/stories/docs/abstracts/2010/june/attitudes_towards_earning_and_performance_in_mathematics.pdf

Oladunni, M. O. (1995). Effect of mathematics language and problem-solving strategies on achievement of students in mathematics. *Journal of Educational Research and Evaluation*, *1*(1), 153-163. DOI: 10.5539/ass.v6n2p67

Orton, A., Orton, D., & Frobisher, L. J. (2004). *Insights into teaching mathematics*. United Kingdom: Continuum International Publishing Group.

PISA. (2003). OECD Programme for International Student Assessment (PISA). Retrieved Jun 29, 2011 from http://www.pisa.oecd.org

Tyler, L. E. (1961). *The psychology of human differences*. New York: Appleton-Century.