

Research Article

Evaluating the Influence of Teachers Qualification on the Academic Achievement of Students in Mathematics

Mansur Nuhu A.^{1*} , Suleiman K.² , M. Hassan³ , Nazir Isma'il I.⁴ 

¹Dept. of Mathematics, Federal College of Education (Technical), Bichi, Kano, Nigeria

^{2,3}Dept. of Mathematics, Yusuf Maitama Sule University, Kano, Nigeria

⁴Dept. of Basic Studies, School of General studies, Kano State Polytechnic, Kano, Nigeria

*Corresponding Author: mansur.nuhu.alhassan@gmail.com

Received: 27/Dec/2023; Accepted: 23/Jan/2024; Published: 29/Feb/2024

Abstract— This research aims to explore the influence of teachers' qualifications on students' academic performance in the field of mathematics, with a specific focus on the educational scenario in the Kumbotso Local Government Area of Kano State. Acknowledging the crucial role educators play in shaping students' academic outcomes, this study intends to uncover the relationship between teacher qualifications and the mathematical achievements of students. Employing a case study methodology, the research utilizes data gathered from schools within the Kumbotso Local Government Area. It involves a thorough examination of factors such as teachers' educational background, certifications, and teaching experience, correlating these elements with the academic success of their students. Through this analysis, the study aims to provide insights into the impact of teachers' qualifications on the quality of mathematics education in the region. The anticipated findings of this study are expected to offer valuable information for educational policymakers, administrators, and educators, assisting them in making informed decisions regarding teacher qualifications and professional development to enhance overall academic performance in mathematics within the Local Government Area.

Keywords— Academic, Achievement, Quality Education, Teachers' qualification, Teaching experience.

1. Introduction

Education at the secondary level serves as a foundational cornerstone for the acquisition of advanced knowledge in tertiary institutions. It functions not only as an investment but also as a potent instrument capable of catalysing rapid economic, social, political, technological, scientific, and cultural development within a nation. The National Policy on Education underscores the pivotal role of secondary education, positioning it as a driver for national development that propels individual growth and societal progress, ensuring equal educational opportunities for all Nigerian children [1]. The secondary education system plays a crucial role in laying the groundwork for subsequent educational stages, and a well-established foundation at this level can mitigate challenges in the future [2].

In Nigeria, Mathematics is among the subjects mandated for study at the secondary school level, as outlined in the National Curriculum by the Federal Ministry of Education. The objectives of teaching Mathematics encompass fostering conceptual and manipulative skills, bridging the gap between elementary and higher mathematics, and catering to the needs

of potential professionals such as mathematicians, engineers, scientists, businessmen, administrators, and architects [3].

Despite its inclusion in the curriculum, Mathematics is often perceived as a challenging subject by many students, who tend to view higher mathematics as reserved for the most adept individuals. Despite its compulsory nature, students' overall performance in Mathematics remains less than satisfactory. This discrepancy is concerning, especially considering the high expectations associated with the mandatory nature of the subject [4]. Previous studies on students' performance in Mathematics reveal a discouraging scenario, with poor academic performance prevalent among secondary school students, particularly in mathematics.

Recognizing the pivotal role of in-service training programs in enhancing teachers' classroom interaction patterns, the effectiveness of the Associate Certification in Education (ACE Sandwich) training programs at the Institute of Education, University of Benin, cannot be overstated.

The hypotheses crafted for this research aim to guide the investigation:

Null Hypothesis (H_0): There is no significant difference in academic achievement between students instructed by qualified and less qualified mathematics teachers in Kumbotso Local Government Area.

Alternative Hypothesis (H_1): There is a significant difference in academic achievement between students instructed by qualified and less qualified mathematics teachers in Kumbotso Local Government Area.

2. Related Work

In this section, the review of related literature and key concepts used in the research is presented.

2.1 Impact of Teacher Qualification on Students' Academic Achievement

According to a study in Sky Journal of Education, teacher qualification can be measured in three ways: the level of education, years of experience in subject matter preparation and pedagogy, and certification in their expertise area along with on-going professional development [5]. Well-managed classrooms led by trained teachers employing child-centered teaching approaches and skilful assessment contribute to effective learning and reduce disparities among students [6]. In the United States, a report by the National Commission on Teaching and America's Future highlighted concerns about the qualifications of newly hired teachers, revealing that a significant portion lacks college training in their primary classroom subject. The report raised questions about nationwide teacher recruiting and hiring practices [7]. Teacher qualification may impact student achievement in urban secondary schools, as demonstrated in a South African study examining teacher qualifications and student achievement in urban elementary schools. The study revealed substantial differences in teacher quality across school districts, indicating that teacher license test scores were not directly linked to classroom success, and student achievement showed a weak correlation with teachers' advanced degrees [8]. In Nigeria, a study found that students taught by teachers with higher qualifications performed better in physics, emphasizing the positive impact of teacher status on student performance. The study recommended that experienced teachers should handle students in the year of examination [9].

2.2 Impact of Qualified and Less Qualified Teachers on Students' Academic Achievement

A study on "Measuring and Targeting Internal Conditions for Schools Effectiveness in the Free State of South Africa" emphasized the crucial role of teachers in driving internal school conditions for effectiveness, development, and change, [10]. Another study in Kwara State, Nigeria, identified the quality of teachers as the most significant determinant of students' academic performance in secondary schools [11]. The literature suggests that teachers play a vital role in students' achievement of educational goals, forming the basis for this study to investigate the relationship between the quantity and quality of teachers and students' academic performance in public secondary schools.

2.3 Teacher Quality

Research on teacher effectiveness has evolved through three stages, initially relying on cross-sectional data aggregated at the school or district level. These studies indicated that explicit measures of teacher qualifications had minimal impact on student achievement, while implicit measures (average performance of individual teachers) differed significantly [12]. Later studies focused on year-to-year improvements in student achievement, providing better controls for student background and preparation [13]. They suggested that differences in teacher qualifications could influence student achievement gains. Some studies examining pedagogical knowledge tests found a positive relationship between higher teacher scores and improved student test performance [14].

3. Materials and Method

3.1 Research Design

This study will adopt a survey research design, as its primary objective is to investigate the impact of the independent variable (Teacher's Qualification) on the dependent variable (Mathematics achievement of students) without manipulating variables. Data collection will involve the administration of a Teacher Self-Assessment Test (Questionnaire), supplemented by structured interviews conducted with Mathematics teachers in the chosen Secondary Schools in Kumbotso Local Government Area. Interviews are considered valuable for acquiring in-depth information about personal feelings, perceptions, and opinions.

3.2 Target Population

The study encompasses all teachers and students in Secondary Schools within Kumbotso Local Government Area of Kano State. The population comprises 116 Secondary Schools, with a total of 450 mathematics teachers and 85,587 students.

3.3 Sample Size and Sampling Procedure Sampling

Sampling involves the process of selecting specific subjects from a target population. Stratified random sampling was employed in school selection for this study. The formula for determining the sample size will be applied to establish the representative sample for the research.

$$\text{Limited population: } n = \frac{n}{1 + \frac{z^2 \times \hat{p}(1-\hat{p})}{e^2 N}}$$

Where;

z is the z score

e is the margin of error

N is the population size

\hat{p} is the population proportion

Sample size is 383. This means 383 or more measurements/surveys are needed to have a confidence level of 95% that the real value is within $\pm 5\%$ of the measured/surveyed value.

Hence, Out of 116 schools, 33 were selected from which 2 mathematics teachers and 10 students were picked from each

school making it 66 teachers and 330 students, with a total of 396 respondents.

3.4 Method of Data Analysis

The mode of analysing the data collected is based on averages which include percentages to analyse the questionnaire. The t-test of independent samples was used to further test the hypothesis of the study.

4. Results and Discussion

This section deals with analysis of data. The research findings are also presented.

4.1 Demographic Profile of Teachers

Table 1

Variables	Frequency	
Gender	Male	Female
	64(96.9%)	2(3.1%)
Age	25-35	18(27.2%)
	36-40	34(51.5%)
	41-50	8(12.1%)
	above 50	6(9.2%)
Marital Status	Married 59(89.4%)	Single 7(10.6%)
Educational Background of Respondents	NCE/Diploma	41(62.1%)
	Bachelor Degree	23(34.8%)
	Master Degree	2(3.1%)
	Experience of the Respondents	
1 year	5(7.5%)	
2 years	11(16.7%)	
3 years	20(30.3%)	
Above 3 years	30(45.5%)	

From the table above, according to the gender respondents, 96.9% were male while 3.1% were female. 27.2% of the respondent's age was between 25 and 35 years old, 51.5% were between 36 and 40 years, 12.1% were between 41 and 50 years, while 9.2% were above 50 years. In terms of marital status of the respondents, 89.4% were married while 10.6% were single. In terms of educational background, 62.1% of the respondents had NCE/Diploma certificate, 34.8% of the respondents were bachelor degree holders, and 3.1% were master degree holders. In terms of experience, 7.5% of the respondents had 1 year experience, 16.7% of the respondents had 2 years' experience, and 30.3% of the respondents had 3 years' experience, while 45.5% of the respondents had more than 3 years' experience.

4.2 Interpretation of Questionnaire for Teachers:

Table 2

Variables	Frequency (%) Agree	Disagree
On whether mathematics is appreciated by their students.	55(83.3%)	11(16.7%)
On whether there are relevant text books for the teaching of mathematics in their school.	53(80.3%)	13(19.7%)
On whether there are provisions for computer assisted instruction of mathematics in their school.	20(30.3%)	46(69.7%)
On if there are subjects that mathematics	27(40.9%)	39(59.1%)

understanding affected greatly.		
On if their students have sufficient learning materials.	15(22.7%)	51(77.3%)

From the table above, according to whether mathematics is appreciated by their students, 83.3% agree while 16.7% disagreed. 80.3% of the respondent's agreed that there are relevant text books for the teaching of mathematics in their school while 19.7% disagreed. 30.3% agreed with the opinion that there are provisions for computer assisted instruction of mathematics in their school, while 69.7% disagreed. In terms of if there are subjects that mathematics understanding affected greatly, 40.9% agreed while 59.1% disagreed. On if their students have sufficient learning materials, 22.7% of the respondents agreed, while 77.3% of the respondents disagreed

4.3 Interpretation of Questionnaire for Students

Table 3

Variables	Frequency (%) Agree	Disagree
On whether they like mathematics as a subject or not	70(21.2%)	260(78.8%)
On whether they have mathematics text books.	135(40.9%)	195(59.1%)
On whether their teachers uses computer to teach mathematics in their school.	90(27.2%)	240(72.8%)
On if their understanding of mathematics helps them in other subjects.	200(60.6%)	130(39.4%)
On if they have sufficient learning materials (workbooks).	75(22.7%)	255(77.3%)

From the table above, according to whether they like mathematics as a subject or not, 21.2% agree while 78.8% disagreed. 40.9% of the respondent's agreed that they have mathematics text books while 59.1% disagreed. 27.2% agreed with the opinion that their teachers uses computer to teach mathematics in their school, while 72.8% disagreed. In terms of if their understanding of mathematics helps them in other subjects, 60.6% agreed while 39.4% disagreed. On if they have sufficient learning materials (workbooks), 22.7% of the respondents agreed, while 77.3% of the respondents disagreed.

4.4 Testing the Research Hypothesis

The schools are codified based on the academic achievement of Students taught by less qualified (X) and qualified (Y) teachers.

Thus, from our t-test calculation, we obtained following table;

Table 4

Group	N = 396	Mean	S D	Df	t-value	p-value
X	198	45.37	287.67	395	4.324	2.623
Y	198	67.54	397.56			

$$\text{From t-statistic} = \frac{\bar{X}_1 - \bar{Y}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}, \text{ with } \bar{X}=45.37, Y= 67.54 \text{ and } S_1^2 = 287.67, S_2^2 = 397.56$$

The degree of freedom = N+N-1 (395) and alpha level = 0.05

Decision: In light of the calculated t-value standing at 4.324, surpassing the critical p-value (table) of 2.623, we make the decisive choice to reject the null hypothesis. This affirmative action aligns with embracing the alternative hypothesis, indicating a substantial variance in academic accomplishments between students under the tutelage of highly qualified and less qualified mathematics instructors within the Kumbotso Local Government Area. Hence, we draw the inference that students benefiting from the expertise of qualified educators showcase a discernible proficiency advantage in mathematics within the confines of the Kumbotso Local Government Area.

5. Conclusion

The following conclusions were made from the study; there is a wide gap in mathematics performance between students taught by qualified teacher and those taught by less qualified in Kumbotso Local Government area. The study noted that most mathematics teachers were well experienced in the teaching profession but lack proper knowledge of the subject matter resulting in misinformation. Those teachers who had the proper qualification tended to teach in the senior classes, resulting in a fractured or weak background of mathematics on the part of the Junior Secondary Students in Kumbotso Local Government area.

Finally, the study found that students taught by qualified teachers performed better than those taught by less qualified teachers.

The figure below shows students response

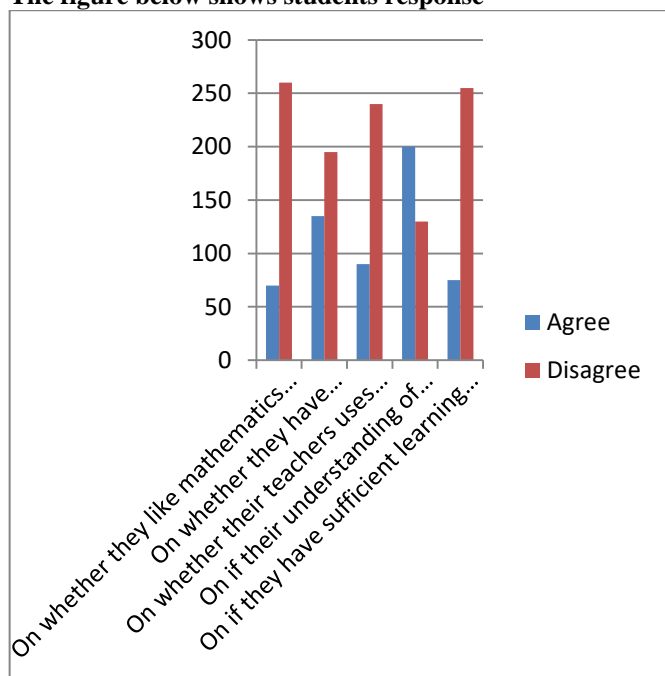


Fig. 1

5.1 Recommendations

The following recommendations were made from the study:
 1. The government / school proprietors should provide more incentives to encourage more teachers to pursue further

education as this has potential to be beneficial to students. This can be done by providing very competitive salary packages.

2. The study recommends that students at all levels should be taught by the qualified mathematics teachers.

3. Government should organize refresher courses for mathematics teachers regularly from which teachers can be equipped with various effective instructional strategies.

Data Availability

The data used in this research, titled "Evaluating the Influence of Teachers Qualification on the Academic Achievement of Students in Mathematics", has been sourced from various repositories, databases, schools in the local government area under study and literature.

Conflict of interest: All authors declare no conflict of interest.

Funding Sources: The research required no funding as all data needed were provided by the Local Government Authority through the schools in the locality, which are resident in the same state as the Authors.

Author’s contribution: Special appreciation to, Suleiman K., M. Hassan and Nazir Ismail for their valuable insights and assistance in verification of the computations as well as making adjustments where necessary.

Acknowledgement: The authors would like to express their gratitude to Ibrahim Yusuf of Bayero University; Kano for taking time to proof read the work. Special thanks to Mansur Hassan for valuable discussions and Yusuf Maitama Sule University, Kano for providing access to their Mathematics Laboratory where the needed software for the research was provided free of charge. We are also thankful to Farouk Tijjani Sa’ad, Dean Faculty of Science, Yusuf Maitama Sule University, Kano for his guidance throughout the research process.

References

- [1] T.O. Abe, "Effect of Teachers' Qualifications on Students' Performance in Mathematics," Sky Journal of Education, Vol 2, No. 1, pp213-212, 2019.
- [2] A.M. Abraham, K. I. Keith, "State teaching policies and student achievement," Teaching quality policy briefs, education week. Vol. 1, 2018.
- [3] S.A. Adesemowo, "The relationship between supervisory climate and teacher-student performance in secondary in Oyo State, Nigeria," Unpublished Ph.D. thesis, educational management department, University of Ibadan, 2021.
- [4] P. Aremu, L. Sokan, "Systematic study of planned variations: the essential focus of teacher education reform," Journal of teacher education, Vol. 2, No. 8, pp.8-22, 2019.
- [5] A. Balogun, "Events that shape education," The Nation newspaper, p.2, 2020.
- [6] R. Buddin, G. Z. May, "Teacher Qualifications and Student Achievement in Urban Elementary Schools of South Africa," Journal of teacher education, Vol. 8 No.17, 2009.
- [7] D.G. Dan, J. B. Dominic, "Evaluating the Effect of Teacher Degree Level Teachers and Students' Academic Performance," Florida

Journal of Educational Administration & Policy, Vol. 3, Issue 2, 2010.

- [8] Federal Republic of Nigeria, "National Policy in Education, Lagos Federal Government Press," 2007.
- [9] E.A. Hanusheik, "Teachers, schools and academic achievement," National bureau of economic research Massachusetts, Cambridge, 2000.
- [10] A.M. Igwebuike, "Alternatives to retention and social promotion," Delta Educational Foundation, Delta State, 2005.
- [11] A. Ijaiya, "Teacher quality, in hand book of the economics of education," Kwara, Revised, 2019.
- [12] B. Oshodi, "A survey on students' mathematics achievement," publication B.13, Lagos State University, Revised, 2021.
- [13] A. L. Owolabi, "Antecedents of current procedures of evaluating learning outcomes in the Nigerian educational system," Nigerian journal of educational foundations, Vol. 23, No. 4, pp. 231-323, 2012.
- [14] P.D. Rasheed, "The school teacher student relations and values," UNICEF, APH Publishing Corporation, Vol. 2 No.34, pp. 12-34, 2000.

AUTHORS PROFILE

Mansur Nuhu Alhassan earned his NCE (Mathematics/Computer), Bsc (Ed) Mathematics, and Currently pursuing Msc in Mathematics from Yusuf Maitama Sule University, Kano in 2011, 2021, and 2024, respectively. He is currently working as a Lecturer in Department of Mathematics from FCE (T) Bichi, Kano State, since 2021. He is a member of TRCN since 2011, He has 14 years of teaching experience in Secondary Schools and Tertiary institutions combined and 2 years of research experience.

Kabiru Suleiman earned his Bsc., M. Sc., and Ph.D. in Mathematics from UDUS Sokoto in 1995, 2003, and 2010, respectively. He is currently working as an Associate Professor in Department of Mathematics, YUMUK, Kano since 2020. He has published more than 16 research papers in reputed international journals including International Journal of Operations Research and conferences and it's also available online. His main research work focuses on Operations Research. He has 15 years of teaching experience and 10 years of research experience.

Mansur Hassan earned his Bsc., from BUK Kano, M. Sc., from Jordan University of Science and Technology and Ph.D from University Sains Malasia. in Mathematics from in 2007, 2011, and 2017, respectively. He is currently working as a Senior Lecturer in Department of Mathematics from YUMSUK, Kano since 2013. He has published more than 10 research papers in reputed international journals and conferences including IEEE and it's also available online. His main research work focuses on Operations Research. He has 11 years of teaching experience and 8 years of research experience.

Nazir Isma'il Ibrahim earned his BSc., and currently studying M. Sc., in Mathematics from YUMSUK Kano in 2014, and 2024, respectively. He is currently working as a Lecturer in Department of Basic Science and Remedial studies from Kano State polytechnic, Kano since 2015. His main research work focuses on Operations Research. He has 10years of teaching experience and 2 years of research experience.