A Study on Quantity and Quality of Mathematics Teachers in Central Plateau State, Nigeria: Implications for National Development in Nigeria

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Abstract
This study examined and provided insight into the quality and quantity of mathematics teachers in secondary schools in central Plateau state, Nigeria, using descriptive survey research design.The sample consisted of 83 mathematics teachers and 19,323 students from 58 secondary schools located in three geographical areas of Mangu, Pankshin and Kanam. The sample was selected using simple random and purposive sampling techniques. For this reason, all the mathematics teachers and students from the 58 secondary schools in the three areas were selected. The instrument for data collection was a questionnaire tagged QQMT. This was developed based on the quantity of mathematics teachers, qualifications, teaching experience, gender and enrollment of students in secondary schools in the three areas. The QQMT was validated by experts. Observer agreement method was used to find the reliability. The inter-rater reliability coefficient was 85%. The data collected was analyzed using descriptive statistics. The findings from the study revealed that mathematics teachers from the study areas possess different qualifications ranging from NCE, B.Ed., B.Sc.(Ed.), B.Sc. to M.Ed. degrees. Some schools have no mathematics teachers, many have one each and a few have between 2-4 teachers. Majority of the teachers have NCE certificates while only one has M.Ed. degree in mathematics. Also, out of the 83 teachers, 24 have less than 5 years teaching experience, 27 have between 5-10 years and 32 have more than 10 years teaching experience. The average teacher/student ratio was 1:233. The implications of the study for national development in Nigeria were discussed. Among other things, it was recommended that the government should employ more qualified mathematics teachers and those serving but are not qualified should go for further studies to acquire higher teaching qualifications.
Keywords: Mathematics Education, Performance, Secondary School, Teachers, Quality, Quantity

1. Introduction
One of the causes of poor performance of students in mathematics in the secondary school in Nigeria and elsewhere in the world is poor quality and quantity of teachers (Ingersoll & Perda, 2009). Quality has to do with category of teachers that have been trained formally for the task of teaching mathematics. In Nigeria, trained teachers for the secondary school level are supposed to have a minimum of the Bachelor of Science Education (B.Sc. (Ed.)) or Bachelor of Education (B.Ed.) degrees before they are qualified to teach any subject including mathematics. Usually, the training of the prospective teachers take place in recognized tertiary institutions like the Colleges of Education (COE), Universities and Institutes of Education (IOE) in Nigerian universities. Quantity represents the total number of qualified teachers who are employed to teach mathematics in the secondary school in Nigeria.

The quality and quantity of mathematics teachers in the secondary school determines to a large extent how successful students learn, understand and perform in mathematics. This is because mathematics teachers that are qualified and employed in the right quantity are supposed to teach effectively leading to successful learning and improved performance for students. But in a situation where the teachers are not qualified, they cannot teach effectively since they will find the teaching difficult, therefore, this will affect the understanding and performance of their students in mathematics negatively. Unfortunately, the problem of lack of effective teaching is affecting Nigerian students because the education system as a whole is said to be faced with many challenges like acute shortage of qualified teachers, large class-size, archaic facilities and infrastructures and so on (Ukeje, 1999). The shortage of qualified teachers in Nigeria for example, can be seen from the following analysis. In 2006, it was reported that Nigeria had a total of 222,238 teachers. From this number, only 97,213(43.7%) were graduates with teaching qualifications, 45,172(20.3%) were graduates without teaching qualifications, 63,518(28.6%) were holders of Nigeria Certificate in Education (NCE), 10,620(4.8%) were diploma certificate holders and about 27% of the total teaching force were grade II, SSCE and other certificate holders (FME, 2006). The report further revealed that Nigeria had a total of 14,942 secondary schools with 4,984,560 students. The Gross Intake Rates (GIR) for junior and senior secondary school students were 21% and 23% respectively. According to the FME report, out of the 14,942 secondary schools, 7,562(51%) were public

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schools, 3,624(24%) were private and 3,756(25%) were not public or private. From this information, it means that on the average there are in Nigeria approximately 334 students, 15 teachers, 6 graduate teachers with teaching qualifications and teacher/student ratio of 1:55 per secondary school. This means that the average number of qualified teachers in each secondary school is inadequate with a high teacher/student ratio and gross intake rates. Also, the number of teachers with NCE certificates still teaching in the secondary schools is high. This is not normal as it is contrary to the required minimum teaching qualification in Nigeria.

Furthermore, the quality and quantity of teachers affects the performance of students in mathematics if the teachers are not adequate in number and they are overloaded with too many lesson periods and other responsibilities in the school. Also, the issue of large class-size does not guarantee effective teaching and learning of mathematics because it affects the output of teachers in the class. On the contrary, when there is sufficient quantity of qualified teachers in the school system, the teaching of mathematics will be made more effective. This will lead to improvement in understanding and performance as well as the development and fostering of more positive attitudes towards mathematics among students.

Since qualified mathematics teachers in the right quantity are supposed to teach effectively by virtue of their training, it is important for the government at all levels and other education providers to employ and retain only the qualified teachers for the purpose of effective mathematics teaching in the secondary school. The retention is important because it is said to be the antidote to staffing problems (Ingersoll & Perda, 2009). Also, it will help in improving the performance of students in mathematics significantly. But if the qualified teachers are not retained and they keep coming in and going out of the teaching profession to greener areas, it will affect the performance of students in mathematics negatively due to what has been described as the problems of teaching (Ibraheem & Ogunnusi, 2001). According to the authors, the problems account for about 67% of the failure rates of students in mathematics while negative attitudes and difficulty of mathematics itself accounts for about 12% and 21% respectively. This means that if qualified teachers are not retained to ameliorate the effects of the teaching problems, students will continue to record poor performance in mathematics mainly due to lack of proper teaching.

Furthermore, since mathematics is important, it is important also to have it taught by sufficient number of qualified and interested or motivated teachers. The National Policy on Education (FGN, 2004) stated that no education can rise above the quality of its teachers. This means that if the quality of teachers is poor without having interest in teaching, the education system will be poor and if the education system is poor, it will result in poor quality products and this will affect the development of Nigeria. Similarly, the teaching of mathematics requires qualified teachers that are well experienced, if not, those that are not qualified may engage in practices that may short-change students like teaching with poorly prepared lessons, avoiding some topics that may appear difficult for them to teach but are very important for students to learn, making unnecessary computational mistakes that should be avoided and treating students without respect and so on. These can affect the performance and interest of students in mathematics. The report of the Chief Examiner (WAEC, 2009) clearly stated that students have shallow knowledge of mathematics, lack mathematical/manipulative skills and so on simply because they were exposed to poor teaching. As a result, their performance is low, interest is depressing and their rate of failure devastating (Obioma, 1990; Agwagah, 2004). Beyond this, students tend to be affected in their performance in other school subjects like physics and chemistry adversely with poor performance in mathematics. WAEC (2006) noted that the marks lost by each physics student from poor knowledge of mathematics account for 50%. Obomanu and Adaramola (2011) stated that the poor knowledge of mathematics is one of the major problems militating against the success of students in chemistry. These problems can be resolved if teachers who are interested, qualified, motivated and well experienced in the right quantity are employed to teach mathematics in the secondary school in Nigeria.

As discussed earlier, there is no doubt that the issue of qualified teachers who are employed in the right quantity among other things is a key element for effective teaching of mathematics. This is supported by many research findings. For example, it has been found that the depth of the knowledge of mathematics correlates strongly with the depth of teachers' mathematical knowledge (Bergeson, 2002), that qualified mathematics teachers help students to score high marks in mathematics (Bergeson, 2002) and that there exists a strong correlation between the ability, education and experience of teachers and achievement of students (Greenwald, Hedges & Lane, 1996). Also, it has been found out that a strong correlation exists between competence/quality of teachers and students' performance/achievement in mathematics with the result that teacher experience/competence is said to be the predictors of students' performance in many school subjects (Adeyemi, 2008; Fetler, 1999). This means that the more experienced teachers are the better they are able to teach mathematics effectively.

One of the factors that affect the performance of students in mathematics also is large class-size which has been highlighted briefly. Class-size is the number of students per teacher in a classroom. It varies from one school to another and from one country to another (Adeyimi, 2008). In Nigeria, the FGN (2004) recommended that the teacher/student ratio should be 1:40 in the secondary school but this is not the case because of the

problem of acute shortage of qualified teachers and large students enrolment such that many schools register up to 50-100 students and above per class (Ijaiye, 1999). However, class-size needs to be small or normal because it helps in promoting effective teaching and learning of mathematics. Blatchford (2009) observed that small class-size makes it easy for teachers to spot problems and give feedback, identify specific needs and gear teaching to meet them but large classes do not. He found out that pupils in small reading and mathematics classes performed significantly better than those in regular classes. Yara (2010) found out that the performance of students in large classes is low (23%) compared to those in smaller classes (64%). This means that large classes have a negative effect on learning progress, thus it needs to be addressed in order to ensure effective teaching and learning of mathematics in the secondary school in Nigeria.

1.1 Statement of the Problem

The issue of quality and quantity of mathematics teachers is important because without quality teachers in the right quantity, there will be no effective teaching and without effective teaching, students will find it difficult to learn and succeed in mathematics. They will also find it difficult to develop interest, understand and pass their examinations with good grades. This is because it has been found that teacher experience, attitude and level of education significantly correlate with students' achievement in mathematics. It has also been found that sufficient number of qualified teachers exert considerable influence on students' learning and achievement in mathematics (Obodo, 2004). However, what is yet to be ascertained in the present circumstance is the quantity and quality of mathematics teachers as it affects public secondary schools that are in different geographical areas in Nigeria and how they are distributed in terms of their qualifications, teaching experience and gender within the areas. This study, therefore, set out to address this problem. This is significant because of the need to know the categories of teachers engaged in teaching mathematics in public secondary schools over the years in different locations. Also, it is significant because of the need for up-to-date information on teacher characteristics with respect to teaching and learning mathematics in the secondary school in Nigeria.

1.2 Objectives of the Study

The main objective of this study was to examine the quantity and quality of mathematics teachers in public secondary schools in Nigeria. The specific objectives of the study include finding out:
-        the quantity of mathematics teachers
-        the qualifications of the teachers
-        the pattern of their distribution in the secondary schools
-        their years of teaching experience
-        the teacher/student ratio

1.3 Research Questions

The following questions were raised to guide the study:
-        What is the quantity of qualified mathematics teachers in public secondary schools?
-        What are their teaching qualifications?
-        How many are qualified to teach mathematics based on gender?
-        What are their years of teaching experience in the secondary school?
-        What is the ratio of qualified mathematics teachers to students in the secondary school?

2. Method

The research design employed in the study was a descriptive survey method. The sample consisted of 83 mathematics teachers (71 males and 12 females), and 19,323 students from 58 public secondary schools in Mangu, Pankshin and Kanam in Central Plateau state, Nigeria. 38 of the teachers were from Mangu, 32 from Pankshin and 13 from Kanam while 6,615 of the students were from Mangu, 7,624 from Pankshin and 5,084 from Kanam. The three areas were selected using simple random sampling technique while the sample of teachers and students were selected using purposive sampling technique. For this reason, all the mathematics teachers and students from the 58 schools in the three areas were selected for the study.

Data collection was done using questionnaire tagged Quality and Quantity of Mathematics Teachers (QQMT). This was based on examining the quantity and quality of teachers, their teaching experiences, gender and students' enrolment from the schools selected for the study. The QQMT was subjected to experts' scrutiny for face and content validities. The corrections and suggestions of the experts were used to improve the QQMT. Observer agreement method was used to find the reliability of the QQMT. Thus two independent observers were asked to rate the QQMT. The ratings were compared by finding the percentage of agreement. The inter-rater reliability coefficient of the agreement was calculated. This yielded 85%. Thereafter, the QQMT was administered to the sample. This was done with the assistance of the Inspectors of Education from the Area Inspectorate Offices under which the selected schools were supervised or monitored. This took more than three

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weeks because the researchers had to go through the Zonal and Area Inspectorate Offices before collecting the information. Data analysis was done using descriptive statistics.

3. Results

Table 1. Quantity, Quality & Teaching Experience of the Mathematics Teachers from the three Areas: Mangu(1-Sch), Pankshin(2-Sch) and Kanam (3-Sch)

1-Sch.	No. of Trs.	Qual.	Yrs. of Exp.	2-Sch.	No. of Trs.	Qual.	Yrs. of Exp.	3-Sch.	No. of Trs.	Qual.	Yrs. of Exp.
1	2	NCE	18	1	2	BSc.(Ed)	25	1	1	NCE	5
		NCE	18			NCE	9	2	2	BSc.(Ed)	21
2	-	-	-	2	-	-	-			BSc.(Ed)	19
3	2	B.Ed	9	3	1	B.Sc	22	3	-	-	-
		B.Sc	5	4	1	B.Ed	19	4	-	-	-
4	1	B.Sc	19	5	4	NCE	24	5	1	NCE	21
5	-	-	-			NCE	14	6	2	NCE	10
6	3	NCE	14			NCE	11			NCE	6
		NCE	10	6	4	BSc.(Ed)	18	7	1	NCE	20
		NCE	9			BSc.(Ed)	16	8	1	NCE	2
7	-	-	-			BSc.(Ed)	6	9	1	NCE	3
8	3	NCE	21			NCE	6	10	1	NCE	6
		NCE	9	7	2	NCE	6	11	1	BSc.(Ed)	2
		NCE	9			NCE	2	12	1	NCE	7
9	1	NCE	9	8	2	B.Tech	4	13	1	NCE	15
10	1	BSc.(Ed)	21			NCE	3	14	-	-	-
11	2	NCE	26	9	-	-	-				
		NCE	5	10	1	NCE	2				
12	2	NCE	2	11	1	NCE	4				
		NCE	2	12	2	M.Ed	30				
13	1	NCE	2			B.Sc	4				
14	1	NCE	11	13	2	BSc.(Ed)	30				
15	2	BSc.(Ed)	27			NCE	1				
		NCE	16	14	1	NCE	2				
16	2	BSc.(Ed)	4	15	-	-	-				
		NCE	8	16	1	NCE	5				
17	2	NCE	10	17	2	B.Sc	16				
		NCE	5			NCE	2				
18	2	BSc.(Ed)	18	18	1	NCE	6				
		NCE	6								
19	4	NCE	23	19	-	-	-				
		NCE	18	20	-	-	-				
		NCE	2	21	-	-	-				
		NCE	2	22	5	NCE	29				
20	4	BSc.(Ed)	21			NCE	14				
		NCE	14			NCE	9				
		NCE	14			NCE	6				
		NCE	9			NCE	2				
21	3	BSc.(Ed)	4								
		NCE	10								
		NCE	2								
22	-	-	-								

Table 1 revealed that the mathematics teachers possess various qualifications. These are NCE, B.Ed., B.Sc. (Ed.) B.Sc. and M.Ed. Some schools have no mathematics teachers, majority have one mathematics teacher each, few have between 2-4 mathematics teachers and only one has 5 of them. Majority of the teachers are NCE holders while only one has M.Ed. degree.

Table 2. Quantity of Mathematics Teachers Based on their Years of Teaching Experience

Study Area	Number of Secondary Schools	Number of Teachers	Less than 5 years Exp.	5-10 years Exp.	More than 10 years Exp.
Mangu	22	38	9	14	15
Pankshin	22	32	12	8	12
Kanam	14	13	3	5	5
Total	58	83	24	27	32

Table 2 shows that from a total of 58 public secondary schools with a total of 83 mathematics teachers, 24 teachers have less than 5 years teaching experience, 27 have between 5-10 years experience while 32 have more than 10 years experience.

Table 3. Quantity of Mathematics Teachers Based on their Teaching Qualifications

Study Area	NCE	HND/B.Sc. Without Education	B.Sc.(Ed.)/ B.Ed.	M.Sc.(Ed.) M.Ed.
Mangu	29	2	7	-
Pankshin	21	4	6	1
Kanam	10	-	3	-
Total	60(72.3%)	6(7.2%)	16(19.3%)	1(1.2%)

Table 3 shows that 60(72.3%) of the teachers have NCE, 6(7.2%) have HND/B.Sc. without Education, 16(19.3%) have B.Sc.(Ed.)/B.Ed. and 1(1.2%) has M.Ed. certificate in mathematics.

Table 4. Teacher/Student Ratio and Quantity of Mathematics Teachers Based on their Gender

Study Area	Mathematics Teachers	Number of Students	Teacher/ Student ratio	Number of Males (%)	Number of Females (%)	Difference Between Male & Female (%)
Mangu	38	6,615	1:174	32(84.2)	6(15.8)	26(68.4)
Pankshin	32	7,624	1:238	28(87.5)	4(12.5)	24(75.0)
Kanam	13	5,084	1:391	11(84.6)	2(15.4)	9(69.2)
Total	83	19,323	1:233	71(85.5)	12(14.5)	59(71.0)

Table 4 shows that there are 83 teachers with a student population of 19,323. Overall, the teacher/student ratio is 1:233. This varies from one area to another with Mangu having the least ratio 1:174. Also, there are 71(85.5%) male and 12(14.5%) female teachers from the three areas showing that the males outnumber the female teachers by far (71.0%).

Table 5. Quality of Mathematics Teachers Based on Gender from the Study Areas

Gender	NCE	HND/B.Sc.	B.Sc.(Ed.)/B.Ed./M.Ed.	Total
Male	51	6	15	72
Female	09	-	02	11
Total	60	6	17	83

Table 5 shows that, out of a total of 72 male teachers, 51 are NCE holders, 6 are graduates without teaching qualifications and 15 are qualified with B.Sc.(Ed.)/(B.Ed.)/M.Ed. degrees. Also, out of a total of 11 female teachers, 9 are NCE holders and only 2 are qualified with B.Sc.(Ed.)/(B.Ed.) degrees.

Table 6. Qualifications of the Mathematics Teachers Based on their Years of Teaching Experience

Yrs of Teaching	NCE	HND/B.Sc.	B.Ed./B.Sc.(Ed)	M.Ed./M.Sc.(Ed.)	Total
Less than 5yrs	19	2	3	-	24
5-10yrs	24	1	2	-	27
More than 10yrs	17	3	11	1	32
Total	60	6	16	1	83

Table 6 shows that 19 teachers with NCE have less than five years teaching experience, 24 have 5-10 years experience and 17 have over 10 years experience. Also, 3 teachers with B.Sc.(Ed.)/B.Ed. have less than five years teaching experience, 2 have 5-10 years experience and 11 have more than 10 years experience. This shows that teachers with NCE have more years of teaching experience than others.

3.1 Discussion

This study was designed to examine and provide insight into the quantity and quality of mathematics teachers in the secondary school and the implications for national development in Nigeria. The findings from the study revealed that the quality and quantity of teachers from the three selected areas in Nigeria (Mangu, Pankshin, Kanam) are not enough for effective mathematics instruction in the secondary school. This is because over 72% of them are NCE holders and NCE is not the minimum qualification required for teaching in the secondary school in Nigeria. Consequently, the proper preparation of students especially for external mathematics examinations will be difficult due to the low level training and qualifications of the teachers. Probably, this is one of the main reasons why many secondary school students perform poorly in mathematics in Nigeria.

On the extent of availability of mathematics teachers, the findings from the study revealed that only 83 teachers are in the 58 secondary schools in the areas of the study with various qualifications. This means that, on the average, there are less than two teachers per school with nothing less than six classes to teach on daily basis. This is highly inadequate, thus this is partly responsible for the poor performance of students in mathematics. This concurred with Lassa (2012) who said that the shortage of mathematics teachers is one of the challenges facing the teaching and learning of mathematics in the secondary school in Nigeria.

On qualifications, it was found out that 72.3% of the teachers are NCE, 19.3% are B.Sc. (Ed.)/B.Ed. and 1.2% posses M.Ed. Those with HND/B.Sc. without education constitute 7.2% indicating that majority of the teachers are NCE holders. The NCE is the minimum qualification for teaching in the primary school and not secondary school in Nigeria. This means that secondary schools in Nigeria do not have the right quality of mathematics teachers. To address this problem, there is need to recruit only degree holders with education background in large quantity. Also, the NCE holders should be encouraged and sponsored to go for further training to acquire higher teaching qualifications.

On the quantity and gender of the teachers in various schools within the study areas, the findings from the study showed that some of the schools have four to five mathematics teachers while some have none. It was also found out that 85.5% of the teachers are males while 14.5% are females. This means that men dominate the teaching of mathematics in the secondary schools. To bridge this gap, female students should be encouraged and motivated to study mathematics education in the universities and colleges of education and subsequently be employed to teach mathematics.

Furthermore, the findings from the study revealed that 71.1% of the teachers have at least five years teaching experience. This is good but it is inadequate considering that there is a strong correlation between teaching experience and performance of students in mathematics. The findings from the study in relation to teacher/student ratio showed that on the average, the ratio is too high 1:233, that is, one teacher to about two hundred and thirty-three students. This contradicts the National Policy on Education (FGN, 2004) in Nigeria which stipulated a teacher/student ratio of 1:40. To reduce this ratio, therefore, a large number of qualified mathematics teachers should be employed.

3.2 Implications

The concept of national development simply refers to the ability of a nation to improve the welfare of its citizens by developing infrastructures, goods and services like roads, hospitals, air and sea ports, schools, health, sports and so on. In the absence of mathematics, meaningful development cannot take place since it is the bedrock and language of science and technology and it is useful for social, political, economic and cultural transformation. Thus mathematics need to given due consideration.

Teaching mathematics effectively requires enough time to be able to plan and deliver good lessons involving giving class work and assignments to be marked after every lesson, and good evaluation practice. However, the findings from this study showed that it will be difficult for mathematics as a subject to be taught effectively with only few qualified teachers and a high teacher/student ratio of 1:233 on the average. For this reason, the performance of students will continue to be affected whereas they are supposed to excel in mathematics in order to contribute their own quota in national development in Nigeria.

The findings from the study show that about 72.3% of the mathematics teachers are NCE holders but the FGN (2004) expects teachers especially those at the senior secondary school level to be degree holders in education. Thus the NCE teachers are not qualified to teach mathematics at this level. This explains why Odili (2006) stated that most mathematics teachers are not adequately qualified. This problem needs to be addressed in the interest of national development in Nigeria. Also, it has been pointed out that teacher's years of teaching experience is a measure of the quality of teaching and performance of students in mathematics because there is a correlation between the two variables. Although this study found out that majority of the mathematics teachers have at least five years teaching experience, a large quantity of experienced mathematics teachers need to be employed and retained on the job by the state or federal government to argument the shortfall. This should be done immediately in the interest of national development. To encourage mathematics teachers to be effective in teaching, the student/teacher ratio should be reduced drastically. To this end, apart from employing teachers, the

students should be split into smaller teaching and learning units and taught by well qualified and experienced teachers to make the learning easy and productive.

Also, it was found out in the study that males dominate the teaching of mathematics in the secondary school. In the interest of national development, female students should be encouraged to study mathematics education in the universities. They should be employed to teach mathematics immediately after their graduation. This will help in motivating female students in the secondary school to develop interest in the subject and learn it well towards better performance.

3.3 Recommendations
Based on the findings from the study, the following recommendations are made:
- The states and the federal governments should employ qualified mathematics teachers to teach mathematics in the secondary schools in Nigeria.
- Teachers who are not qualified to teach mathematics in the secondary school should be encouraged to go for further studies in tertiary institutions to acquire higher teaching qualifications.
- The high teacher/student ratio in the secondary school should be reduced drastically to the normal ratio by employing more qualified teachers and creating more classrooms for the students.
- Female students who desire to study mathematics education at any level of tertiary education in Nigeria should be encouraged and motivated to do so at no cost by the state and federal governments. Immediately after their graduation, they should be given employment to teach mathematics in the secondary schools that are grossly short-staffed. This will help in reducing the gender disparity in the recruitment of mathematics teachers in the secondary school in Nigeria.

3.4 Conclusion
This study, among other things, has shown that there is inadequate number of qualified mathematics teachers in public secondary schools in Nigeria. For this reason, a large number of qualified teachers should be employed in the interest of national development in Nigeria.

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