



Analysis of the Relationship between Public Schools Distribution and Population in Kaduna State, Nigeria

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ABSTRACT

The paper was aimed at examining the relationship between the distribution of public primary and secondary schools and the population in Kaduna State. The study used GPS Map 78 to ascertain the location of the schools through field observation. The student population was obtained from the headteacher while the population was obtained from the projected 2006 census figure. A multistage sampling method was adopted to select nine LGAs within the three senatorial zones of the state. Descriptive statistics using Statistical Package for the Social Sciences (v25), Spearman Rank Correlation, and Pearson Correlation was used for data analysis. The 1907 public schools (1634 public primary and 273 secondary schools) were found. The result revealed that the overall Location Quotient (LQ) value for all public schools (primary, junior, and secondary schools) is 1.14 which represents a moderate concentration of public schools. The result showed that Kaduna South LGA has the least LQ (0.23) and is closely followed by Zaria LGA (0.56), while Kajuru LGA has the most concentration of schools with an LQ of 2.2. The result also revealed that LQ for Junior Secondary Schools (JSS) value varies from (1.9) in Kagarko LGA, having the highest concentration of JSS and to 0.5 in Jemaá LGA. The Spearman Rank Correlation with the coefficient of 0.188 revealed a weak positive relationship between the provision of public schools and students' population while Pearson Correlation established a negative relationship between the distribution of public schools and general population with the coefficient of -0.19. The study concluded that there is no relationship between the population and distribution of public schools in Kaduna State.

Keywords: Education, School, Concentration, Distribution, Population, Density, Nigeria.

1. INTRODUCTION

Education occupies a major part of everybody's life. Parents are universal concerned about education of their wards, not merely in the same way as they might about other social services, but because it affects the quality of their children's lives not only while they are at school but also in later life (Kiker 1998; McMahon 1987; Varcoe, Peterson, Garrett, Martin, Rene and Costello, 2001). What unites geographers is a belief that geography matters all aspect of life and human interaction. This is nowhere more clearly seen than in the provision of public schools and educational facilities (Alzeer, 2005). The fact that geography matters in relation to educational provision applies in a number of different ways. For example, it is unequally distributed across space. Whether one examines such provision on a cross-national, regional, or local level, it quickly

becomes apparent that the nature of educational provision is inherently uneven (Butler and Hamnett, 2007).

In developed nations, the location of public schools is considered but in Nigeria only urban areas have such planning. However, it is not yet possible in rural area and villages but is a major factor to ensure that all children get education. This is either because schools do not exist in many of the rural communities, or because there has been a slower uptake of the available places than in the towns. Nevertheless, as the number of schools has grown, yet there are still many children not in school (Butler and Hamnett, 2007). Above 10.5 million children are out of school in Nigerian (UNESCO, 2017a). Only 61% of 6 to 11-year-olds regularly attend primary school. Some states in the north east and north west of the country have more than half of the girls not enrolled in schools as marginalisation ensures that girls are deprived of basic education (Amorighoye, 2020). The circumstances equally offer an answer to why people are easily manipulated by ethnic and religious bigots for selfish agenda. It describes why people unconsciously get into the enlistment net of criminal associations like Boko Haram, armed robbers and kidnapers. Lack of education is an outstanding problem in Nigeria like any other developing nations (UNESCO, 2017b). However, the focus is on the way in which geography relates to public school provision in relation to host communities. Indeed, this issue has not been the focus of much enquiry. Until now, the study of the geography of education has focused upon different issues such as spatial distribution, mapping, using of GIS and inequity of schools (Butler and Hamnett, 2007). The place of geography of education still relatively under-developed area of research. However, the issue of the relationship between public school and the population clearly important.

A number of geographers have researched on education or geography education. Such as Inobeme and Ayanwole (2009) studied the assessment of the spatial distribution of government secondary school in Zaria Area, Kaduna State. Olamiju and Olujimi (2011) studied the regional analysis of location of public educational facilities in Nigeria. Bhunia et al. (2012) studied the assessment of school infrastructure at primary and upper primary level. Abbas (2012) studied the database management and mapping secondary education infrastructure in Sabon-Gari and Zaria LGA, Kaduna State. Musa and Mohammed (2013) on analysis of spatial distribution of primary and secondary schools in Bida Town, Nigeria. Izobo-Martins et al. (2014) studied the assessment of infrastructural condition in public secondary schools in Ogun State Nigeria. Fabiyi and

Ogunyemi (2015) studied the spatial distribution and accessibility to post primary educational institution in Ogun State and Nyam-Jim (2016) studied the location analysis and creation of geo-database for public secondary schools in Kaduna Educational Zone, Kaduna State, Nigeria. Adebayo et al. (2020) studied health implementation in urban private and public primary schools and discovered it was very poor nevertheless, private schools had a better quality of implementation. Ezeamaka et al. (2020) understudied the conditions of educational facilities in selected Local Government Areas in Kaduna State and found the conditions were in disarray. However, the study of population in relate to distribution of public schools are under studied in geography.

Wazzan (2017) used Location Quotient (LQ) to measure the degree of spatial in-equality in distribution of schools in Syria and discovered that existing of gaps in access to schools between wards with some wards experiencing glut and concentration while other suffering lack and have no adequate access to schools, LQ value varies from 0 to 2.6, and from 1.94 to 0.6 for S.S; Ratio population/schools varies from 1:2971.7 to 1:16776, and from 1:50329 to 1:5057. Borana and Yadav (2017) used location quotient in analysis in their study on spatial disparity analysis of public amenities in Jodhpur City. The study revealed 45% had absence of any health facility, while 24% were shortage of health facilities. Seven wards had maximum number of healthcare facility with a LQ value of 4.9. The study concluded that a lead-lag relationship among different wards in terms of the provision of urban amenities. In this study, location quotient was used to quantify the relative concentration of public schools and compared to the population of Kaduna State.

It has been observed that these studies such as Nyam-Jim (2016); Fabiyi and Ogunyemi (2015); Izobo-Martins et al. (2014); Musa and Mohammed (2013); Abbas (2012); Bhunia et al. (2012); Olamiju and Olujimi (2011); and Inobeme and Ayanwole (2009) did not provide information on the relationship between the distribution of public schools and population. Therefore, this paper is aimed at examining the relationship between the distribution of public primary and secondary schools and population in Kaduna State. It will provide the explanation to the understanding of this relationship, which forms bases for the research contribution to knowledge.

2. METHODOLOGY

A multistage sampling technique was used to obtain a representative sample of public schools in the selected LGAs across the state. The first stage involved the stratification of the state by senatorial zones. The second stage was the purposive selection of the three urban LGAs from each of the three senatorial zones. The third stage was the randomly selection 2 LGAs from each three senatorial zones considered semi-urban and rural areas. The study covered only public primary and secondary schools within Kaduna State, which involved the identification and location of all public primary and secondary schools. It covers nine (9) LGAs in Kaduna State that is three (3) LGAs from each of the three senatorial districts. Kaduna Central Senatorial Zone (Kaduna South, Chikun, Birnin Gwari LGAs) Kaduna North Senatorial Zone (KNSZ) (Zaria, Lere and Soba LGAs) and Kaduna South Senatorial Zone (KSSZ) (Jemaa, Kagarko and Kajuru LGAs). The choice of nine LGAs out of the 23 LGAs in the State was enable the study to assess of each school and covering 40% of the LGAs. The inventory of the existing public schools was obtained from Kaduna State Ministry of Education, Science and Technology (MOES&T) and administrative map from Kaduna Sate Geographic Information Services (KADGIS).

Hand-held Global Positioning System (GPS Map 78) was used to collect coordinates of the schools. The study used Statistical Package for the Social Sciences (SPSS, version 25) for data analysis. Location Quotient (LQ) was used is a way of quantifying how ‘concentrated’ of public schools in Kaduna State. Location quotient is a ratio that compares a region to a larger reference region according to some characteristic or asset (Nyam-Jim, 2016). Lorenz curve used to measure inequality and is a graphical representation of the distribution or equality of something. The straight line from (0,0) to (100,100) shows perfect equality, whereas the line from (0,0) to (0,100) shows perfect inequality. The line drawn between these two lines is the actual measurement. The graph shows the distribution of a variable through the whole region (Gini, 2012). The population density used was based on the projected population of 2018 from 2006 census figures from NPC (2009). Locational Quotient was used to assess the relationship that exists between spatial distribution of schools and population distribution in Kaduna State at selected LGAs. The data was further subjected to Spearman Rank Correlation and Pearson Correlation to establish the relationship between spatial distribution of public primary and secondary schools and population distribution. Lorenz curve was employed to show the proportion of overall variable assumed by

the bottom x% of the population. It is used in this study to represent public schools' distribution where it shows for the bottom x% of population, what percentage y% of the total schools they have. The percentage of population is plotted on the x-axis, the percentage of schools on the y-axis. A perfectly equal public school distribution is where the bottom N% of population would always have N% of public schools. The Spearman and Pearson correlation analysis method were used to statistically determine if a relationship exists between population and number of existing public schools. The study used the SPSS software for analysis. The Spearman Rank Correlation is a non-parametric technique and uses the ranking of the variables instead of the actual values and is given as;

$$r_s = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)},$$

Where, d is the difference of each pair of x and y values, n is the number of the pairs of observation (x, y). The Spearman correlation coefficient, (r_s) has values +1 to -1. When r_s is close to +1, it means the ranks is near perfect association of ranks, while if r_s is zero (0) means no association among the ranks and when r_s near -1 it means perfect negative association. The association is when r_s is nearer to zero. While the Pearson correlation is given as;

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{[N\sum x^2 - (\sum x)^2][N\sum y^2 - (\sum y)^2]}}$$

Where,

N = the number of pairs of scores;

$\sum xy$ = the sum of the products of paired scores;

$\sum x$ = the sum of x scores;

$\sum y$ = the sum of y scores;

$\sum x^2$ = the sum of squared x scores; and

$\sum y^2$ = the sum of squared y scores.

2.1. Study Area

Kaduna State is located at mid-central portion of the Northern parts of Nigeria and serves as a major gate way to important traditional, political and commercial states of Kano, Katsina, and Sokoto (Hena, 2014; Bako, Maiwada, Abubakar and Akwo, 2016). The Kaduna State is located between Latitudes 9° 03' and 11° 32' North of the Equator and Longitudes 6° 05' and 8° 38' East of the Greenwich Meridian (Fig 1).



Figure 1. Kaduna State in Nigeria (Source: KADGIS, 2017).

Kaduna State has 23 LGAs and Kaduna is the capital. Kaduna State experiences a tropical continental climate with two distinct seasonal climates, dry and rainy seasons (Hena, 2014). The annual average rainfall in the state is about 1323mm. The average daily minimum and maximum temperatures are 15.1° and 35.18° degrees Celsius (Nwude, 2006; Akpu, 2012; Hena, 2014; Bako et al., 2016). Kaduna State extends from the tropical grassland known as the Guinea Savannah to Sudan Savannah (Nwude, 2006). Kaduna State is third most densely populated states in Nigeria. The population of the state according to 2006 National Census stands at 6,113,503 and has 3.18% growth rate (National Population Commission, 2009) and 2017 projected population stands at 8,147,161 (KDSG, 2017; NBS, 2017). The state’s population structure shows that majority of the

citizenry lives in urban and semi urban towns like Kaduna, Zaria, Kafanchan, Kagoro, Zonkwa, Birnin Gwari, Makarfi and Zangon Kataf. Twenty-two percent (22%) of the population are infants, aged between 0-5 years while 18% are children aged 6-11 years (KDSG, 2017).

3. RESULTS AND DISCUSSION

3.1. Location Quotient (LQ) of Schools in Selected LGAs

In this study the population was considered in two aspects the general population of the residents and the students. The 2018 projected population of the selected LGAs is 3, 566, 417 and having 1907 schools (1634 public primary and 273 secondary schools) (Table 1). The student population was obtained from the head teacher or most senior teacher available at the time of the survey. The population were used to examine the concentration of the schools, which enabled the study to determine if the schools were enough for the population (populace and school age children within the LGAs).

Table 1. Location Quotient of Public Educational Facilities in LGAs (Source: Fieldwork, 2018).

LGA	Popu- lation	Student	Primary	LQ^{pop}	LQ^{Std}	JSS	LQ^{pop}	LQ^{Std}	SSS	LQ^{pop}	LQ^{Std}	All Schools	LQ^{pop}	LQ^{Std}
Chikun	349127	111247	255	1.6	0.9	27	1.8	1	21	1.8	1	303	1.6	0.9
Birnin Gwari	502627	66415	165	0.7	1	12	0.6	0.7	10	0.6	0.8	187	0.7	0.9
Kaduna South	511189	34069	44	0.2	0.5	13	0.6	1.5	7	0.4	1.1	64	0.2	0.6
Lere	458700	108120	293	1.4	1	26	1.3	1	17	1.1	0.8	336	1.4	1
Soba	393135	95479	243	1.4	1	19	1.1	0.8	11	0.9	0.6	273	1.3	0.9
Zaria	504904	74610	120	0.5	0.6	16	0.7	0.9	14	0.8	1	150	0.6	0.7
Jema'a	375704	49594	163	1	1.3	8	0.5	0.7	8	2.6	0.9	179	0.9	1.2
Kagarko	322771	48689	198	1.3	1.6	22	1.9	1.8	19	1.8	2.1	239	1.4	1.6
Kajuru	148260	38115	153	2.3	1.5	10	1.6	1.1	11	2.2	1.5	174	2.2	1.5
Total	3566417	626338	1634	1.1	1	155	1.1	1.1	118	1.4	1.1	1907	1.1	1

The result reveals that at the overall mean LQ value for all public schools (primary, junior and secondary schools) is 1.14 which represents moderate concentration of public school. The result shows that Kaduna South LGA have the least LQ (0.23) and closely followed by Zaria LGA (0.56), while Kajuru LGA have most concentration of schools with LQ of 2.2. The result reveals

that for public primary schools the LQ value varies between (2.3) in Kajuru LGA, having the high concentration of primary schools, and 0.19 in Kaduna South LGA.

This result is supported by the average number of students per school which is over 500 in Kaduna South LGA, with population of over half a million and served by 44 public primary school is completely not adequate to serve the people. The result shows that four LGAs namely Jemaá, Zaria, Birnin Gwari and Kaduna South LGAs have low concentration in the distribution of primary schools based on the overall population while Chikun LGA (1.59), Lere LGA (1.39), Soba LGA (1.35), Kajuru LGA (2.25) and Kagarko LGA (1.34) have adequate concentration.

The result also reveals that LQ for Junior Secondary Schools (JSS) value varies from (1.9) in Kagarko LGA, having the highest concentration of JSS and to 0.5 in Jemaá LGA, which is completely inadequate for the population. The result shows that Chikun, Lere, Soba, and Kajuru LGAs are slight concentration in the distribution of JSSs while four LGAs (Zaria, Kaduna South, Jemaá and Birnin Gwari) having less than 1.0 implying low concentration.

The result further discloses that the LQ value varies from (2.6) in Jema'a LGA, having the most concentration of Senior Secondary Schools (SSS) to 0.4 in Kaduna South LGA have the least concentration of SSS. The analysis shows that Chikun, Lere, Jema'a, Kagarko and Kajuru LGAs are moderate concentration in the distribution of SSSs while Zaria, Kaduna South, Soba and Birnin Gwari LGAs have low concentration. Jemaá LGA have the lesser population than Kaduna South and Zaria among the urban LGAs where there is high population growth. The result also shows that at senatorial level, the LQ values varies between 4.48 in KSSZ, which is closely followed by KNSZ with LQ value of 3.23 and KCSZ with LQ of 2.55 (Table 2).

Table 2. Location Quotient at Senatorial Level (Source: Fieldwork, 2018).

<i>Senatorial Zone</i>	<i>Population</i>	<i>Student</i>	<i>Primary</i>	<i>LQ^p</i>	<i>LQ^s</i>	<i>JSS</i>	<i>LQ^p</i>	<i>LQ^s</i>	<i>SSS</i>	<i>LQ^p</i>	<i>LQ^s</i>	<i>Schools</i>	<i>LQ^p</i>	<i>LQ^s</i>
KCSZ	1362943	211731	464	0.7	0.8	52	0.9	1	38	0.8	1	554	0.8	0.9
KNSZ	1356739	278209	656	1.1	0.9	61	1	0.9	42	0.9	0.8	759	1	0.9
KSSZ	846735	136398	514	1.3	1.4	42	1.1	1.2	38	1.4	1.5	592	1.3	1.4
Total	3566417	626338	1634	1	1.1	155	1	1.1	118	1	1.1	1907	1	1.1

The Spearman Rank Correlation (r_s) analysis shows that there is negative relationship between public schools and population of the LGAs, given that the calculated r_s value (-0.1) (Table

3). Thus, the correlation is very negative but since the coefficient of determination is 0.01 only 1% of the variation of public schools is explained. This study concludes that there is no relationship between the population and distribution of public schools. Thus, the population of the people are not considered in siting and location of public schools. Population should be one of the conditions for siting public schools so that the near perfect location, which will enable the children to have equal access to public schools.

Table 3. Spearman Rank Correlation of School and Population (Source: Fieldwork, 2018).

<i>LGA</i>	<i>Population</i>	<i>Total Schools</i>	<i>R₁</i>	<i>R₂</i>	<i>d</i>	<i>d²</i>
Chikun	349,127	303	7	2	5	25
Birnin Gwari	502,627	187	3	5	-2	4
Kaduna South	511,189	64	1	9	-8	64
Lere	458,700	336	4	1	3	9
Soba	504,904	273	2	3	-1	1
Zaria	393,135	150	5	8	-3	9
Jema'a	375,704	179	6	6	0	0
Kagarko	322,771	241	8	4	4	16
Kajuru	148,260	174	9	7	2	4
Total	3,566,417	1907			0	132

Table 4. Spearman Rank Correlation of School and Student's Population (Fieldwork, 2018).

<i>LGA</i>	<i>Student's Population</i>	<i>Total Schools</i>	<i>R₁</i>	<i>R₂</i>	<i>D</i>	<i>d²</i>
Chikun	111247	303	9	8	1	1
Birnin Gwari	66415	187	5	5	0	0
Kaduna South	34069	64	1	1	0	0
Lere	108120	336	8	9	-1	1
Soba	95479	273	7	7	0	0
Zaria	74610	150	6	2	4	16
Jema'a	49594	179	3	4	-1	1
Kagarko	48689	241	4	6	-2	4
Kajuru	38115	174	2	3	-1	1
Total	626338	1907				24

The Spearman Rank Correlation (r_s) analysis indicates that there is weak positive relationship between provision of public schools and students' population of the LGAs, given that

the calculated r_s -value of 0.188 at significance level of 0.05 (Table 4). The coefficient of determination is 0.035, only 3.5% of the variation of the distribution of public schools is explained by the population of students.

The result further displays that there is perfect linear relationship in Soba LGA while Chikun and Jema'a LGAs have nearly perfect linear relationship exist between population of students and the distribution of public schools (Fig 2).

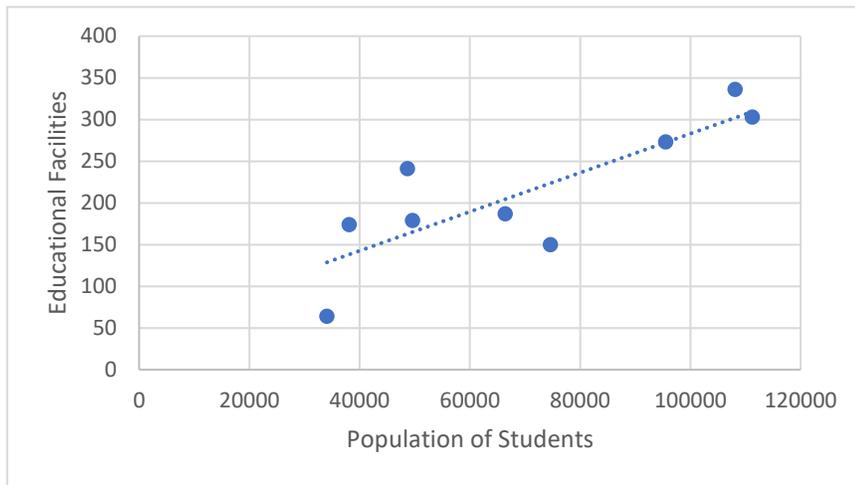


Figure 2. Students' Population and Public Schools in Kaduna State.

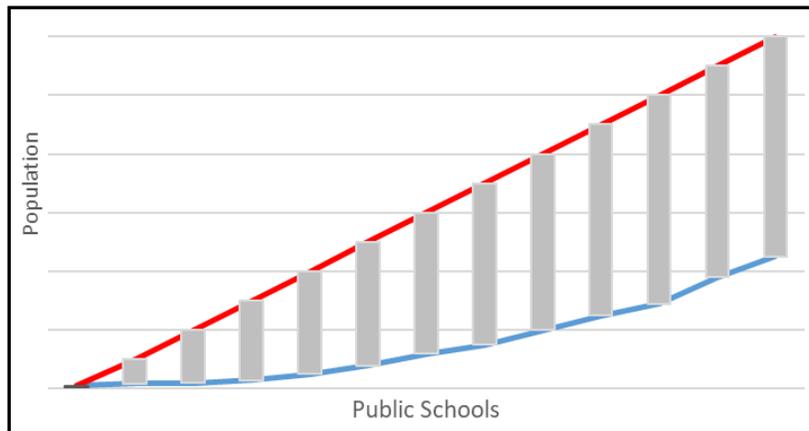


Figure 3. Lorenz Curve of Population and Public Schools.

The number of public schools does not meet the population, as the red line indicates that the existing public schools cannot take the number of children in the state. If public schools had

been provided in the same proportion as the population, a perfect line (the diagonal) would have resulted in figure 3, therefore there is inequality in the relationship between public schools and population in Kaduna State. The deviation between the two sets of value is represented by the space between the plotted line and the diagonal.

Table 5. Schools and Population Distribution in the Selected LGAs (Fieldwork, 2018).

<i>LGA</i>	<i>Populatio n</i>	<i>Students' Populatio n</i>	<i>Number of Schools</i>	<i>% of Populatio n</i>	<i>% of Schools</i>	<i>% of Students' Populatio n</i>
Chikun	349,127	111247	303	9.79	15.89	17.76
Birnin Gwari	502,627	66415	187	14.09	9.81	10.60
Kaduna South	511,189	34069	64	14.33	3.36	5.44
Lere	458,700	108120	336	12.86	17.62	17.26
Soba	504,904	95479	273	14.16	14.32	15.24
Zaria	393,135	74610	150	11.02	7.87	11.91
Jema'a	375,704	49594	179	10.53	9.39	7.92
Kagarko	322,771	48689	241	9.05	12.64	7.77
Kajuru	148,260	38115	174	4.16	9.12	6.09
Total	3,566,417	626,338	1907			

The result also reveals that about 79.38% of the public schools are in rural LGAs while Zaria, Kaduna South and Jema'a LGAs have just over 20% of the schools. While, the rural LGAs have about 65% of the population while the urban LGAs have 35% (Table 5). This might be the outcome of development of more private primary and secondary schools in urban centers like Kaduna and Zaria. This is in agreement with the findings of KSBS (2018). This implies that some areas within Soba, Lere Kajuru have deficient in public schools and quite a number of the inhabitant have no adequate access to public schools. The result has further established that population density in various LGAs was not considered in the distribution of public primary and secondary schools in Kaduna State. In terms of population, Kaduna South LGA have the highest population while Kajuru LGA have the least. However, Kajuru LGA have more public school than Kaduna South LGA. The analysis shows that Lere LGA have the highest percentage (17.62%) of overall public schools and Kaduna South LGA have the lowest percentage (3.36%). The result

reveals that population density and public school distribution are in fair inequality level, indicates relatively some degree of inequality (Gini Coefficient value is 0.57).

The implication is that the spatial concentration shows that a large percentage of the population is disadvantaged or totally lack access to public secondary schools especially senior secondary schools to all residents of Kaduna State. The study shows that urban LGAs have high concentration of population such as in Kaduna South, Zaria and Jema'a LGAs than rural and semi urban LGAs. The result of Pearson Correlation reveals a weak negative relationship between the distribution of public schools and population (Table 6). Thus, population is not considered in the siting of public schools in Kaduna State.

Table 6. Pearson Correlation of Population and Public Schools

	<i>2018 Population</i>	<i>Distribution of Schools</i>
<i>2018 Population</i>	1	-0.19
<i>Distribution of Schools</i>	-0.19	1

correction is significant at 0.01 level

4. CONCLUSION

This study investigated the relationship between population and public schools in nine selected Local Government Areas of Kaduna State, Nigeria. This study could help state actors especially the Kaduna State Ministry of Education, Science and Technology, and other stakeholders in education section to understand the relationship between population and public schools' location and guide them in siting new public schools to favour the areas that are deficient. This study has looked closely at the distribution of public primary and secondary schools in the selected LGAs in Kaduna State is not in relation to population of the people and students. It has conclusively shown that; there is lop-sidedness in the distribution of public primary and secondary schools in all the nine Local Government Areas; most of the educational facilities are concentrated in the urban areas at the expense of the rural suburbs. The study also showed that population of the general residents is not the best justification for siting of public schools in the state. Rather, the population of the school age children and location of public schools does not matter so much.

This study recommends concerted efforts from the state government to provide of additional public school to make up the shortfalls. Farming settlements should be serviced with public schools at both primary and secondary. Kaduna State should brace up to the challenges by committing substantial part of its annual budget into improving the educational sector and most importantly educational facilities in the state. The study has established that the number of available public schools (primary and secondary school) are inadequate, and population is not considered in the siting of public schools in Kaduna State.

5. ACKNOWLEDGEMENTS

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