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Geo-Spatial Analysis on the Distribution Pattern of Public Primary Schools in Daura Local Government Area, Katsina State, Nigeria

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ABSTRACT

Education is like human in nature which required continual support so as to maintain its effectiveness and efficiency. It is a system which demands various category of resources called facilities which demand a high cost of maintenance to remain healthy, safe and possibly alive. Development of education among any community depend on its structure from the grassroot that is primary education. This study therefore examines the spatial distribution of public primary schools in Daura Local Government Area of Katsina State, Nigeria. Data for the location of the primary schools were collected using handheld GPS. The obtained data was analyses using point pattern analysis, buffering and Nearest Neighbor Analysis (NNA) in ArcGIS 10.8 environment. Results was presented using figures and tables. Results showed that Madobi B is having the highest number of primary schools with 17.65% while Sarkin yara B recorded the lowest number with only 3.92%. Results on the spatial distribution pattern of the schools using NNA revealed NN values of 0.778752 and the Z-Score index of -3.022707 which indicated a clustering pattern. The results further showed that, about 41.98% of the study area do not have access to public primary schools while about 36.06% were overserve. Therefore, it was recommended that government, non-governmental organizations and individuals should collaborates in the provision of appropriate facilities that will enhance the development of primary education in Daura LGA.

Keywords: Spatial, Distribution, Accessibility, Pattern, Schools.

INTRODUCTION

Education is like human in nature because it survives with continual support so as to maintain its effectiveness and efficiency. Jumare (2020) define education as a systematic process through which the young and the old gain skills and knowledge which make them live and assist in the development of the individual and the society for the rest of their lives. The foundation of formal education started with the primary studies where pupil at child age is enrolled. For anybody to qualify for higher levels of education one must first pass through primary schools, hence, primary serve as institution upon which all other levels of education and educational achievements are built. The system prepares the mind and trains the child for higher and tougher academic pursuits. It provides young learners with the fundamentals of reading, writing, skill acquisition, information and attitudes necessary for proper adjustment into the society (Asodike and Ikpitibo, 2014). In fact, primary education is very vital component of education system that deserves handling with great care and caution. According to Clement and Mowette (2017) education is a tool for national development which begins from the primary school education therefore, any error in the provision, distribution and utilization of resources at this level may reverberate on other levels and thus seriously jeopardizing the growth of other arms that feed from it.

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Hence, since primary education sets the foundation for achieving academic development of a community, a child's educational career depends on the first six years of primary education. The strength and quality of the child education depends on how strong the foundation of his primary study in such a way that if the primary education is weak, his entire future study will be affected. Our believe as teachers has been, students who have trouble in those first years of primary school will experience hard time with educational tasks at other levels. Availability of learning facilities is the backbone of primary educational development, in other word, distributions of educational facilities become the major factor that influence the development of primary education. Facilities required at this level other than those included in educational services are furnished classrooms, science laboratories, workshops, sports equipment and even play ground. Shortage in the supply of these facilities is an impediment to the success of implementation of policy on primary education matters. Oyesola (2000) in Asiyai (2012) sees school facilities to include permanent and semi-permanent structures such as buildings, machinery, laboratory equipment, the blackboard, teacher's tools and other equipment as well as consumables.

Even though, availability of learning facilities is an important determinant of educational development. Yet, accessibility to the facilities is also an important factor. Accessibility according to Asiyai, (2012) is concerns with the pattern of activities and the links between the activities. It has to do with the spatial distribution of destination in relation to the origin of those who are willing to reach a specific location. This include how community are able to make use of public facilities such as schools, hospitals, post office, market and so on. Accessibility according to Lu (2004) is the distance travelled by users to receive the service, or from which a service is provided to the whole community. Asiyai, (2012) classify accessibility into three as; physical in term of geographical location, economic which include ability to pay for a particular service and organizational, which is associated with the internal structure and availability of the resources. Based on these, the current study concern with the geographical location of public primary schools in the study area. The main concern as per accessibility is either community are served, underserved or overserved with primary schools in the research area.

In an attempt to foster the development of education in Nigeria, the 1999 constitution of the country under section 18(1) and (3) enjoined the government to provide free and compulsory basic education with a view to ensuring that there are equal and adequate educational opportunities in all levels. Despite these attempts and the important of primary education to the development of education sector and humanity at large the system experience many challenges, this is more especially the availability of the public primary schools' facilities. In Nigeria, public school enrolment has continued to increase without a corresponding increase in facilities for effective teaching and learning (Asiyai, 2012). Furthermore, in order to increase the development of education globally many programs were developed. As indicated in the United Nations Development Programme (UNDP) (2020), United Nation in 2015 adopted 17 Sustainable Development Goals (SDGs) as a universal call to action by the year 2030. The goal number 4 was aimed at provision of free and qualitative education to girls and boys in the primary and secondary schools by 2030. This and rises in population draw the attention of some Nigerian government at various level to increase

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concern towards establishment of some programs that could lead to the improvement of education in their respective area.

Daura Local Government Area (LGA) of Katsina State like other LGAs in Nigeria experience population growth. The population of the LGA according to National Population Commission (2006) stood at 210, 721. This figure has increased over the years, for instance in 2022 the population of the local government has been projected to 401,900 (National Bureau of Statistics, 2022). This must have increased more pressure on the available social amenities especially primary schools, hence the children enrolment into primary schools must also increase. These couple with the insufficient source of income for educational development in area affected sitting of more schools in the appropriate location. Therefore, the available primary school facilities cannot longer accommodate the teaming population of the primary school age children effectively in the Study area. Asiyai, (2012) states that, there has been expansion in the Katsina state school system and pupil population grows without corresponding growth in the number of essential facilities to match the change. In addition, various studies such as that of Shuaibu (2016); Yusuf (2017) and Dalhat et al. (2020) revealed that, the available primary school facilities in Katsina State are not adequately distributed causing disparities in the pupil's accessibility. It was in line to these; the present study applies Geographic Information System (GIS) to examine the pattern of public primary schools in Daura LGA. The specific objectives are to determine the distribution pattern of the schools and examine the student's accessibility to the available public primary schools in the area.

MATERIALS AND METHODS

Study Area

Daura Local Government lies between Latitude 12°52'0.47''N and 13°5'21.91''N and between Longitude 8°8'59.02''E and 8°21'27.40''E. The area is having a total landmass of about 339km^2 (KSUPDA, 2009). It is bounded to the north by Mai'adua Local Government, to the south by Sandamu Local Government, to the west by Dutsinma Local Government area and East by Zango Local Government area. (Mshelia, 2010) (Figure 1). The climate of Katsina State and Daura LGA in particular is tropical continental, having an annual rainfall of 198.3mm and a seasonal average temperature of about 28°C. The teeming population of the rural people are mainly farmers while those in the local government head quarter engage in trading and farming activities. The population of students in the public schools of Katsina State as reported by Education Data, Research and Evaluation in Nigeria (EDOREN) (2013) has been, early child care development centres with 523, primary schools with 2,209, while junior and senior secondary schools with 237 and 230 respectively. Furthermore, Mezger (2014) reported that in general educational outcomes in Katsina State and Daura LGA in particular are very poor with primary net attendance ratios below 50% in 2011.

Data Collection

According to the record of Daura Local Government Authority, there are 51 public primary schools with 51 headmasters in the area. The researcher therefore, used a census sampling method by involving all the schools since the number of the schools is small. The sample size for the study was therefore 51 schools. Administrative map of Daura LGA was obtained from the State Ministry of Land and Survey and used to create base map for GIS analysis. Geographic coordinates of the

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51 public primary schools in the area was obtained using hand held GPS.

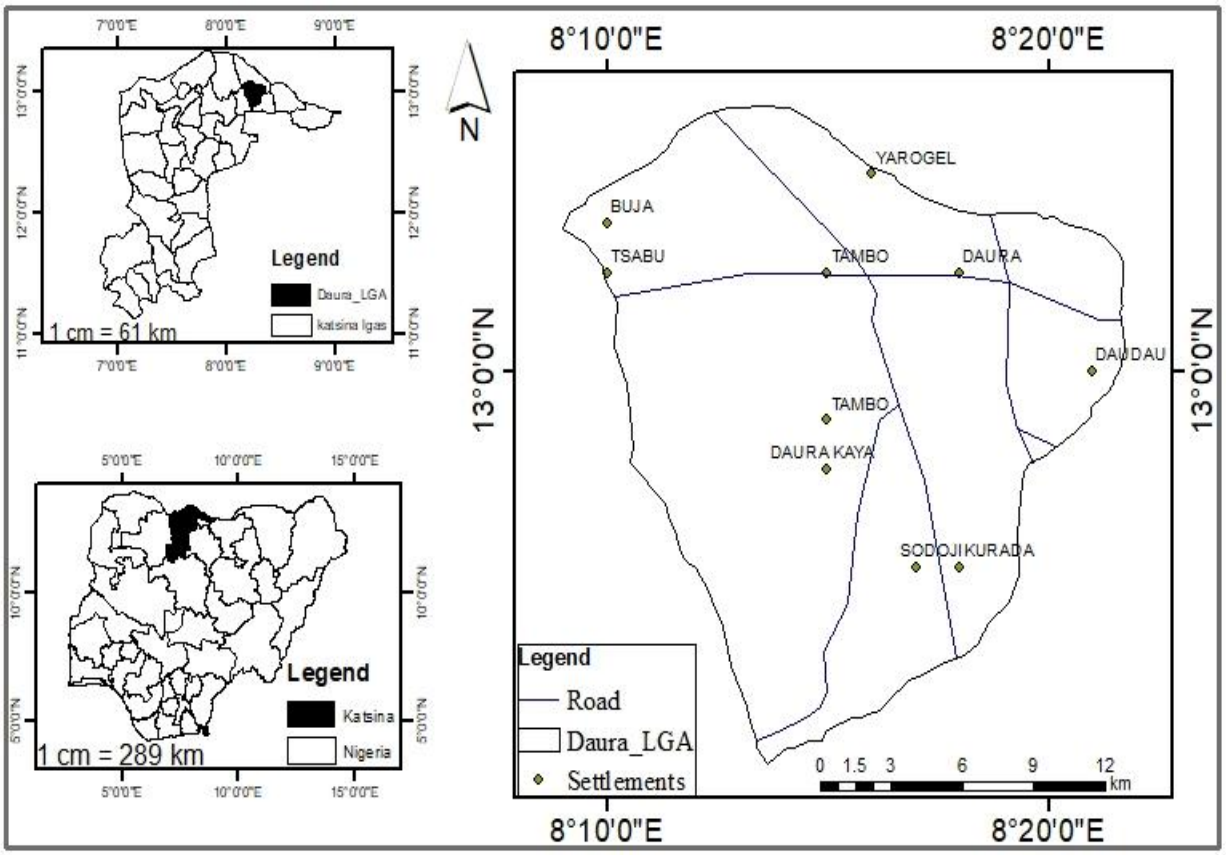

Figure 1: Map of the Study Area

Source: Adapted from the Administrative Map of Katsina State

Data Processing

The researchers utilized ArcGIS 10.8 environment for data processing and analysis. In this case, all the categories of data were transformed into shapefiles format. Administrative map of Daura LGA was scanned, georeferenced and assign to projected coordinate system (UTM Zone 32 N) before digitization. The digitizing of the georeferenced image was done using the editor toolbar. The geographical location of primary schools acquired using GPS was transformed into a plain text file format in Microsoft Excel and save as .CSV format for integration in ArcGIS environment. This after all was imported into the ArcGIS environment and display as XY data which appear as a point layer on the map showing the attribute table of the primary schools and later converted into Esri shapefile for further analysis.

Data Analysis

The pattern of the distribution of public primary schools in Daura LGA was determined using point distance and Nearest Neighbor Ratio (NNR) statistical tool of ArcGIS 10.8. The tool measured the distance between each feature and its nearest neighbor's location. Mitchell (2005) stated that, the

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average nearest neighbor ratio is calculated as the observed mean distance all over the expected mean distance as presented in the formular below:

$$\frac{\text{Observed Mean Distance}}{\text{Expected Mean Distance}}$$

The final results were discussed in such a way that, when the values of NNR happens to be less than 1 it implies clustering in the pattern, when equals to 1 there is random pattern however, when it is greater than 1 the results indicate irregular pattern. To examine the accessibility of schools based on their distribution pattern in the area, the researchers utilize the following analytical tools; the buffer, identify, dissolve and intersect tools in ArcGIS environment. The standard distance used for the determination of location and accessibility of the schools during buffer analysis follow the UNESCO standard of 2km walking distance to school by any child travel to and from school (Federal Republic of Nigeria, 2014). In doing that, the percentage of localities served, underserved and overserved by the public primary schools were identify. Finally, results were presented in figure and table.

RESULTS AND DISCUSSION

Distribution Pattern of Public Primary Schools in the Study Area

Table 1 and Figure 2 present the results of the spatial distribution of public primary schools among eleven (11) political wards in Daura Local Government Area (LGA), which are Sabon-Gari, Mazoji B, Mazoji A, Madobi A, Madobi B, Tudun Wada, Ubandawaki B, Ubandawaki A, Sarkin Yara A, Sarkin Yara B and Kusugu. The result showed that, Madobi B is having the highest number of primary schools in the study area with 17.65%, this was followed by Sabon Gari ward with 15.69% while Sarkin yara B recorded the lowest number with only 3.92%. The appearance of more schools in Madobi B ward might be associated with its area coverage while that of Sabon Gari might be link with its location within Daura town which is the capital town of Daura LGA. Under normal circumstance urban area and community with vast land mass are expected to have more social amenities such as availability of schools, water supply, healthcare facility and so on, this therefore might be among the reasons why these communities recorded more schools than the others. This result is in line with that of Aroge (2023) who assess the spatial pattern of public primary schools in Moro LGA of Kwara State and reported Malete ward with the highest (10.3%,) percentage of public primary schools, followed by Megida with 9.6% while Ajanaku and Pakunma had the least, with 1.9% and 2.6% respectively.

Table 1: Public Primary Schools by Wards

Wards	No of Schools	Percentage (%)
Kugusu	3	5.88
Madobi A	6	11.76
Madobi B	9	17.65
Mazoji A	4	7.84
Mazoji B	4	7.84
Sabon Gari	8	15.69
Sarkin yara A	3	5.88
Sarkin yara B	2	3.92
Tudunwada	4	7.84
Ubandawaki A	4	7.84
Ubandawaki B	4	7.84
TOTAL	**51**	**100**

This result indicated that Sarkin Yara B is having the lowest number of primary schools despite its closeness to the Daura metropolis. This might be link to many factors such as political or poor concern by the people of the area to struggle for more school's construction in the area. This support Darma (2019) that, the major challenges that leads to non – performance of the students in Katsina State have been the relationship between students and their social environment which include emotional, social and motivational factors. This study further indicated that beside the

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factors identify by State education sector strategic plan inadequate schools in some areas affected the enrolment of students into primary school in some wards of Daura LGA.

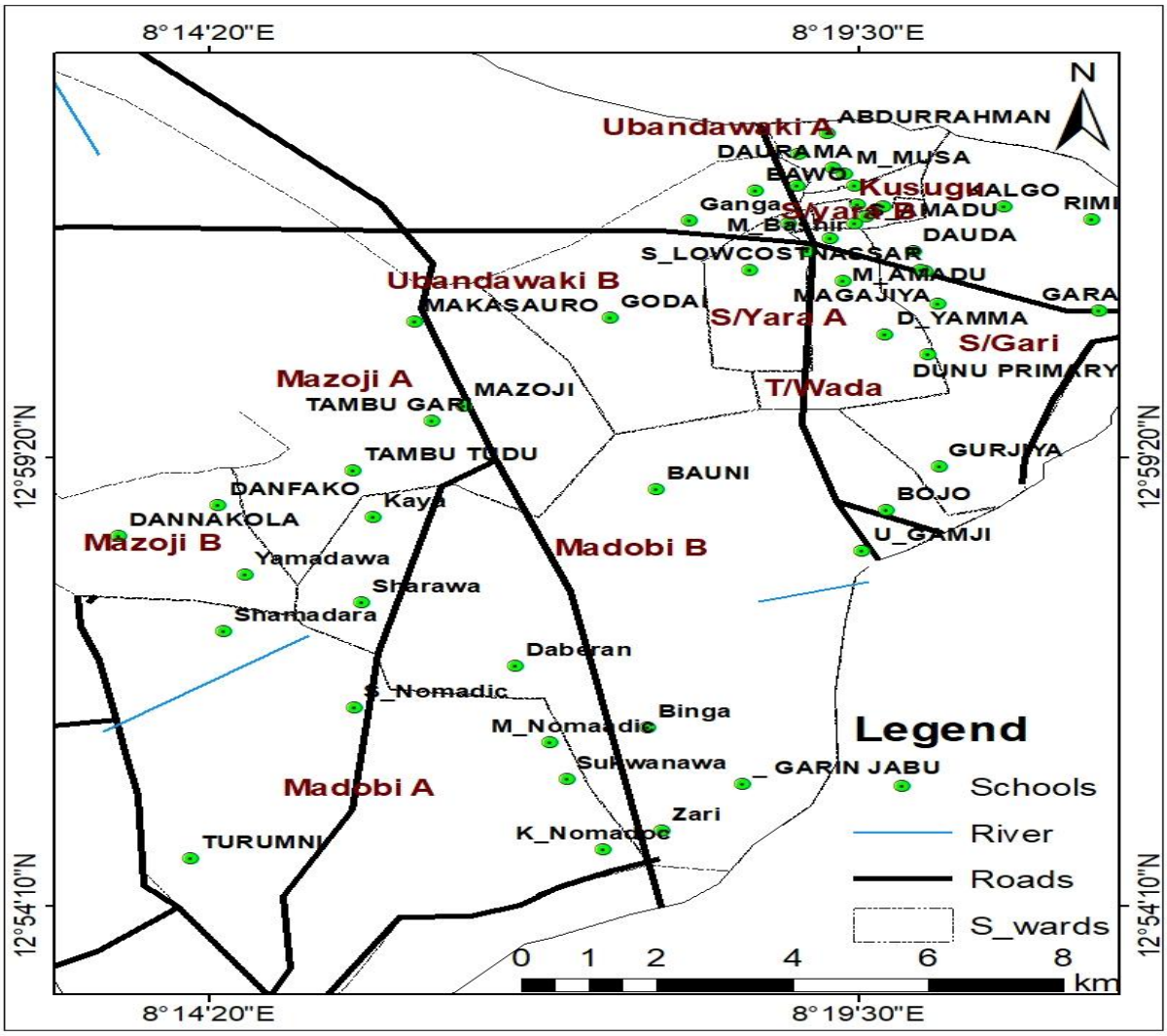

Figure 2: Spatial Distribution of the Public Primary Schools in the Study Area.

Furthermore, the results of the distribution pattern based on NNR as presented in Figure 3 has been 0.778752 which is less than 1 and the Z-Score index (-3.022707) outside the critical values (-1.65 to +1.65). These shows the pattern of distribution to have been clustered since the NNR is less than 1. The clustered pattern of the distribution as observed in the study area shows that there is uneven distribution of the schools as could be seen in Figure 2. The Figure 2 indicates that, most of the primary schools are located in the urban areas of the Local Government. This finding might be associated with the high population density of the area or been the capital seat of the LGA. However, the implication of the NNR value higher than the Z score is that the pattern is more dispersed than clustered. This could also be seen in Figure 3. which shows that there are many areas where people do not have access to primary schools.

These findings indicated that, there is an uneven spatial distribution of primary school

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in the study area, and hence could lead to poor educational development in the area. Findings from this study does not conform with that of Mahmud (2014) who found the spatial distribution pattern of public primary schools in Tarauni LGA, Kano State to has been disperse at 3.25. Variation between these two studies might be related with location of the study areas. While Tarauni is located within Kano metropolis that was occupied by many business man and political office holders who does not send their children to public schools. On the other hand, Daura LGA is a rural LGA occupied mainly by farmers and traders who send their children into public primary schools; hence they required more public schools than those resided at Tarauni LGA. This result also corresponds to that of Aroge (2023) who also observe a clustered pattern in the spatial distribution pattern of public primary schools in Moro LGA of Kwara State. The result indicated an NNA value of 0.86 and a Z-Score of -3.39 at 0.01% significance level.

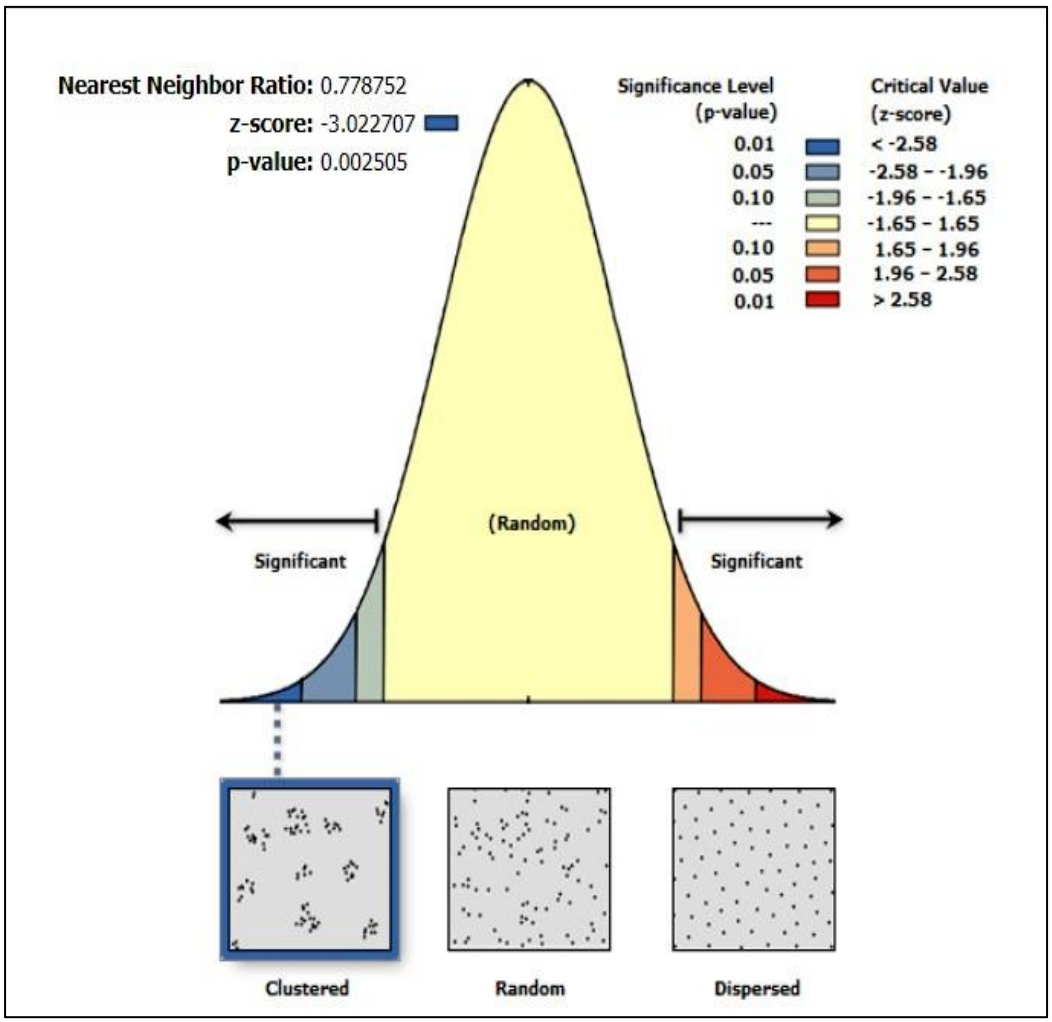

Figure 3: Spatial Pattern of Public Primary Schools in the Study Area.

Personal observation by the researchers shows that higher number of primary schools were densely concentrated within Daura town while those in rural areas were sparsely distributed in some few areas. The main factors that influence this spatial distribution according to

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some of the head teachers and researchers' knowledge include politic, location and population. Observation also revealed that, the primary schools within Daura town have greater number of classes with more teaching and learning facilities. In some cases, within Daura town you can find two schools one facing each other as in the case of Muhammad Bashar and Daura School for the Deaf which were also very close to Sardauna Amadu and also in the case of Magaji Saidu and Nassarawa. While those located in the rural areas were sparsely located with single blocks without enough teaching and learning facilities. Findings generally indicated low development of public primary schools' construction in the area and will therefore results to poor educational development in the area.

Accessibility of the public primary schools

The results in Table 2 and Figure 4 showed findings on the community accessibility to the public primary schools in the study area.

Table 2: Accessibility of the Public Primary Schools.

Categories	Area (Sq km)	Percentage
Underserve	142.40	41.98
Serve	74.48	21.96
Overserve	122.30	36.06
Total	**339.18**	**100**

The result reveals that, major (41.98%) part of the study area do not have access to public primary education while about 36.06% were overserve with the public primary schools. This means that many people must travel long distance even greater than 2KM to attend public primary school. The study therefore, indicated that, the areas that do not have access to public primary school are very much, and they include Buja, Yarogel, Tsabu and Tambo communities. The implication of this findings is that, these community are expected to experience problems associated with teaching and learning process. Many children might not attend schools which will lead to so much social issues such as fighting, drinking, and stealing. On the other hand, areas that are overserved with the public primary schools such as Sodoji, Daura town and Kurada will acquire more sound education and are likely to have wiser community.

The results which indicated some areas to have been underserved with the public primary schools in the study area is similar to that of Wali and Musa (2016) in Zaria city of Kaduna State which shows that many areas are underserved by primary schools. The findings also correspond with that of Aroge, (2023) in Ado LGA which revealed that, primary school in the area were not evenly distributed with the areas underserved recorded the largest (53.85%), while those well served and marginally served recorded 23.08% was 23.09% respectively. In fact, this result generally revealed that many children might not have the ability to attend public primary school due to their distance from their respective houses. Researchers' observation and discussion with the head teachers during data collection indicated that, many students in the rural primary schools do not attend schools. Which might be link with their distance to school, poor awareness or inadequate motivation by the surrounding communities. This result also supports Kassahun (2011) who disclosed that school's distance and quality of transportation network are important factors of pupils' enrollment and completion probability in the school. The findings also support Gitter and Barham (2007) who also disclosed negatively significant effect of school distance on child educational attainment, particularly in rural areas The result is also in line with that of Christian (2015) who disclosed distance from school, school location, and school environment as the factors that affect students' attendance to school.

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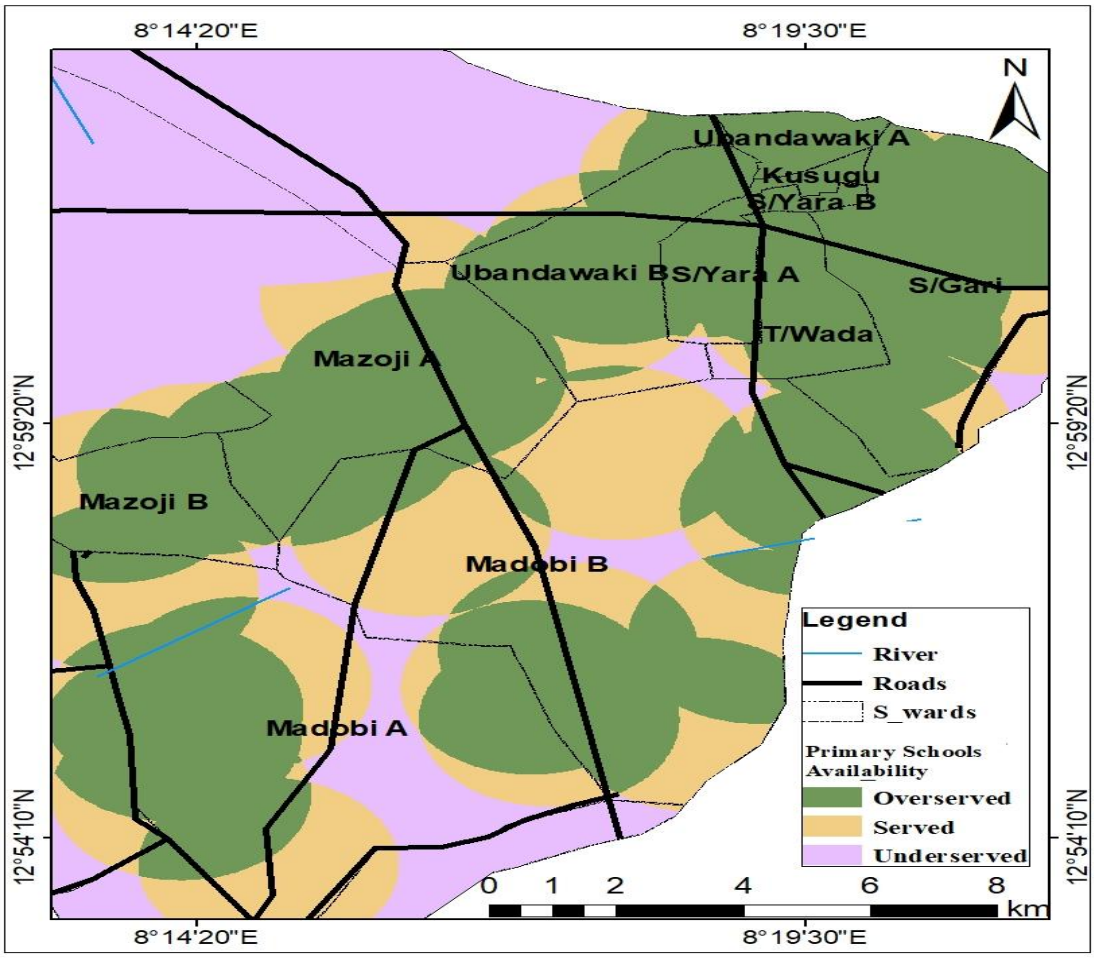

Figure 4: Accessibility of the Public Primary Schools in the Study Area.

CONCLUSION

The study has proven the ability and capability of Geographic Information System in mapping the spatial pattern of educational facilities and determination of areas that needs the establishment of school facility. In conclusion the study concluded that Madobi B is having the highest number of primary schools in the study area than all other ten wards of the study area. The study also concluded the spatial pattern of the public primary schools in the study area to have been clustered in the urban centers leaving major part amounted to 41.98%, mostly in the rural areas without schools. The communities that do not have access to public primary school as identify by the study include Buja, Yarogel, Tsabu and Tambo communities. Based on these, the study recommended construction of more public primary schools in Daura LGA this is more especially within the rural and remote communities of the area.

REFERENCES

Aroge, Y. (2023). Geospatial Distribution Pattern of Primary Schools in Ado Local Government Area of Ekiti State. *International Journal of Advances in Engineering and Management (IJAEM)*, 5(1), 1110-1127 www.ijaem.net

Asiyai, K. I. (2012). Database Management and Mapping of Secondary Education

DOI: 10.56892/bima.v8i4B.1199

Infrastructure in Kumasi, *Journal of Science and Technology, 2*(3),1-8.

Asodike, J. D. and Ikpitibo, C.L. (2014). Basic Issues in Primary Education Delivery in Nigeria. *European Scientific Journal, 8*(1),150-163.

Christian, M. (2015). Analysis of secondary school dropout rates in Rivers State, Nigeria. *Journal of Educational Research and Studies*, 3(4), 66 – 73

Clement, I. and Mowette, M. (2017). The challenges of funding primary education in a depressed economy. *International Journal of Education and Evaluation, 3*(7):1-14. Retrieved from www.iiardpub.org

Dalhat, U., Zubairu, S. M., Ibrahim, Y. Z., and Erhabor, F. O. (2020). Geospatial Analysis of Primary Schools Distribution in Katsina Metropolis, Nigeria. *Sokoto Journal of Geography &Environmental Management, Dept of Geography, UDUS.*2(2):1 -15

Darma, M. R. (2019). Challenges facing Educational Sector in Katsina State III: Look t at some outcomes, *President Pleasant Research and Development Group (PREDG*), Umar Musa Yaradua Human Development Centre Katsina

Education Data, Research and Evaluation in Nigeria (EDOREN) (2013), 'Desk review of EMIS in GEP and ESSPIN states in Nigeria 2009-2012 – a comparison', EDOREN: Abuja

Federal Republic of Nigeria (FRN) (2014). *National Policy on Education.* Retrieved from https://educatetoleadfileswordpress.com

Gitter, S. R. and Barham, B. L. (2007). Credit, national disaster, coffee, and educational attainment in rural Honduras. *World development*, 35, 498 – 511

Jumare, A. M. (2020). *Simplified Approach to Education Management in Nigeria*. Nigeria: Concepts Designs and Prints.

Kassahun, A. A. (2011). Primary school enrollment and dropout in Ethiopia: Household and school factors. Retrieved from http://paa2011.princeton.edu/abstracts/111283

Katsina State Urban Planning Development Authority (KSUPDA) (2009). *Annual Report*, Katsina State Government House

Lu, Y. (2004). *Evaluation of Accessibility to Primary Schools*, Chan Printer, Pp. 26 – 31

Mahmud, T. A. (2014). Analysis of Spatial Distribution of Public Primary Schools in Tarauni Local Government Area, Kano State, Nigeria. Masters Project Submitted to the Department of Photogrammetry and Remote Sensing, Regional Centre for Training in Aerospace Surveys, Obafemi Awolowo University.

Mezger, C., (2014), 'Education data in Nigerian national household survey data: Review of survey reports and evidence from metadata', Education Data, Research and Evaluation in Nigeria. EDOREN: Abuja.

Mitchell, A. (2005) The ESRI Guide to GIS Analysis, Volume 2. ESRI Press, https://pro.arcgis .com/en/pro-app/latest/tool-reference/spatial-statistics/h-how-average-nearest-neighbor- distance-spatial-st.htm

Mshelia, K. (2010). Planning and Implementation of Primary School Education Policies in Nigeria Problems and Solutions. *Quest Journal of Research in Humanities and Social Science, 3*(7), 33-37. Retrieved from www.questjournals.org.

DOI: 10.56892/bima.v8i4B.1199

National Bureau of Statistics (NBS) (2022). *Annual Abstract of Statistics;* Federal Republic of Nigeria. Obtained on 14th March, 2023 from https://www.citypopulation.de/en/nigeria/admin/NG/A021_katsina/

National population Commission (2006). *Annual report year book:* NPC, Nigeria

Shuaibu, A. (2016). The Impact of Infrastructure on the Quality of Primary Education in Katsina Zone Katsina State, Nigeria. Approaches. *International Journal of Research Development,* 10(1,): 14 – 26. ISSN 2141-1409

United Nations Development Programme (UNDP) (2020). Quality Education, Sustainable Development Goals (SDGs)in Action, obtained from "https://www.undp.org/sustainable-development- goals/quality-education#:~:text=Skip% 20to%20 main, leading %20to% 20 relevant

Wali H. and Musa, A. (2016). GIS as a Tool for Education Decision Support System: A Demonstration with Public Primary Schools in Zaria City Kaduna State Nigeria. *European Researcher*.96:511-522. Doi.10.13187/er.2015.96.511.

Yusuf, A. (2017). Katsina SUBEB to construct 5 Schools in Daura. *Sundiata Post*. Retrieved from http://sundiatapost.com/2017/05/16/katsina-subeb-to-construct-5-schools-in-daura/