Geospatial Distribution of Public Secondary Schools in Gombe Local Government Area, Gombe State

by

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Abstract

The paper examined the spatial distribution and accessibility levels of the public secondary schools in Gombe metropolis, Gombe State. Primary and secondary data were used in the study. Primary data was collected using questionnaire and a hand-held GPS receiver was employed to capture the coordinates of the public secondary schools and other relevant data. Secondary data included administrative map, population figures of students and teachers, name and addresses of public secondary schools in the study area. The data obtained were analyzed using Geographic Information Techniques. From survey carried out in the study area a total of seventeen public secondary schools with nineteen thousand and eleven students were identified. Nearest Neighbor Analysis was carried out based on each of the ten words of the study area. The pattern of distribution of public secondary schools in the study area revealed dispersed pattern as in the of Bolari East ward with NNA of 3.385087, and Shamaki ward with NNA of 1.60014; while the clustered pattern occurred, for instance, in Pantami ward with NNA of 0.226863 and Herwa Gana ward with NNA of 0.185239. It is recommended that the siting of public secondary schools by the Government in the study area should include accessibility factors in relation to population size of the wards.

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Introduction:

Accessibility is defined as the distance to which people must travel to receive service, or from which a service is provided to the whole community of interest in administration, economy, education, health etc. (China standard GB/T.50280.9 cited by [1]). It is believed that accessibility is a concept that has taken on a variety of meaning, including the amount of effort required by a person to reach a destination or the number of activities which can be reached from a certain location [2]. The concept of accessibility is used in many contexts and in different ways, for example, as a goal in transportation policy, as a means in rural development policy, as an indicator of rural deprivation and as a variable in location analysis [3].

Education plays an important role in our society. United Nations Educational, Scientific, and cultural Organization indicate that the development of education is important to the development of economy all over the world. World Bank points out that the GDP (Gross Domestic Product (GDP) of a country will increase 3% every year with increasing level of education. [4] Education system is a complex organization of interactions between interdependent bodies, groups and individuals, all aimed at the achievement of educational goals. The stakeholders are usually the governments and religious groups, voluntary organizations, teachers’ associations, the teachers, the parents and the public [5]. Secondary education spreads over the ages of 10 years and 13 years for junior secondary schools, and then 14 years to 16 years for the senior secondary Schools. These are the years of adolescence. These are the years of transition; indeed, most crucial years of life. There are steady and fast changes in the body structure transforming to adult form and image of life. At this age, the bodily changes take final shape and stabilize. This is also the stage of emotional transformation and maturity that swings between joy and trauma [6]. The research was necessitated by the need to examine the distribution of facilities that support this important stage of human development the secondary schools, in the study area. Hitherto such a study has not been conducted in the area of study. The need for the use of high-resolution image, coordinate and questionnaire data of Gombe were using for the analysis. Analysis based on the concept spatial distribution of schools in study area using GIS techniques.

The aim of the research is to examine geospatial distribution of public secondary schools in Gombe Local Government Area, state through the following objectives:

i. To examine the spatial location of public secondary schools in Gombe Local Government Area.

ii. To examine the spatial pattern of secondary schools in Gombe local government.

Material and Method:

Primary and secondary data were used for this work; these includes:

- Questionnaire
- Hand-held GPS receiver
- Administrative map of Gombe Local Government Area wards
- High resolution Google Earth image, 2017
The GPS receiver was used to capture the geographic coordinate points of schools and other relevant data. Secondary data include administrative map, population figures of both students and teachers, names and addresses of the secondary schools in the study area.

The administrative map was scanned and geo referenced to WGS 1984 UTM Zone 32N. Personal geo database, feature dataset and feature classes for existing settlements, roads and wards were created in GIS environment. The existing roads, settlements and wards were therefore digitized from the georeferenced administrative map using the above stated feature classes. The data obtained from the administered questionnaire, School data and GPS point coordinates of secondary schools were typed into excel spreadsheet and saved as csv format for easy import into GIS environment. The coordinates of secondary schools typed in Microsoft excel were imported into GIS environment for conversion into point map.

The data analysis was carried out using average Nearest Neighbor Analysis in GIS environment. School location GPS coordinates, number of secondary schools in each ward and the total area were used to determine the pattern of distribution of secondary schools in the study area.

**Study Area:**

Gombe LGA is located in Gombe State lies between Longitudes 11°14′07″E and 11°4′42″E, and Latitudes 10°16′48″N and 10°17′24″N. The area is bounded on the east by Yamatul Deba local Government and on the west by Akko Local Government and north by Kwami. The study area is inhabited predominantly by the Hausa Fulani speaking language. With ten (10) wards (Ajiya, Bajoga, Bolari, Bolari east, Dawaki, Herwa Gana, Jekada Fari, Nasarwo, Pantami and Shamaki). And seventeen (17) public secondary school with total number of nineteen thousand and eleven (19,011) student. It has a total land area of 120 square kilometers, with population of 268,000 (NPC, 2006) and 2016 projected population 367,000 inhabitants (NPC, 2016).
Fig: 1 Study Area

Source: Authors’ Analysis (2019)
Result and Discussion:

Mapping of the public secondary schools and their coordinate location in Gombe LGA

The field survey and data collected reveal that there are 17 public secondary schools in Gombe Local Government Area.

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Fig: 2 The location of public secondary school in study area

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3 Source: Authors’ Analysis (2019)
Table 1: Secondary schools in Gombe Local Government Area with their coordinates

| S/N | NAME OF SECONDARY SCHLS | EASTING  | NORTHING  |
|-----|-------------------------|----------|-----------|
| 1.  | GAC2                    | 11.16743056 | 10.30722222 |
| 2.  | GAC1                    | 11.16618833 | 10.30654167 |
| 3.  | GDCSS, AHMADA GOMBE     | 11.16253889 | 10.29253056 |
| 4.  | GCDSS, GOMBE            | 11.18085278 | 10.29877778 |
| 5.  | GDSS, BOLARI EAST       | 11.185175  | 10.2745556  |
| 6.  | GDSS, GANJU             | 11.17384444 | 10.29618972 |
| 7.  | GDSS, HERWA GANA        | 11.17651111 | 10.28405556 |
| 8.  | GDSS, NASARAWO          | 11.21359444 | 10.28111111 |
| 9.  | GDSS ORJI               | 11.12625833 | 10.29206667 |
| 10. | GDSS, PANTAMI           | 11.16692778 | 10.26777222 |
| 11. | GDSS PILOT, GOMBE       | 11.16240278 | 10.30004167 |
| 12. | GDSS SHEHU ABUBAKAR, BOLARI | 11.17077389 | 10.27690833 |
| 13. | GCDSS, GABUKKA          | 11.15555556 | 10.27161667 |
| 14. | GSSS, GOMBE 1           | 11.155925  | 10.28811111 |
| 15. | GDSS 2                  | 11.14903056 | 10.28914444 |
| 16. | HASSAN CENTRAL, GOMBE   | 11.16851944 | 10.2872250  |
| 17. | SPECIAL EDUCATION CENTRAL | 11.15933667 | 10.30295833 |

\[\text{Source: field work (2019)}\]
Fig: 3 Enrolment of student in Gombe Local Government based on Ward Distribution
Table 2: Addresses of Secondary Schools with total enrolment in Gombe L.G.A

| S/N | NAME OF SECONDARY SCHLS | TOTAL ENROLMENT |
|-----|-------------------------|-----------------|
| 1.  | GAC2                    | 488             |
| 2.  | GAC1                    | 1,121           |
| 3.  | GDCSS, AMADA GOMBE      | 782             |
| 4.  | GCDSS, GOMBE            | 1,752           |
| 5.  | GDSS, BOLARI EAST       | 1,275           |
| 6.  | GDSS, GANGU             | 2,289           |
| 7.  | GDSS, HERWA GANA        | 1,633           |
| 8.  | GDSS, NASARAWO          | 719             |
| 9.  | GDSS ORJI               | 647             |
| 10. | GDSS, PANTAMI           | 2,095           |
| 11. | GDSS PILOT, GOMBE       | 1,032           |
| 12. | GDSS SHEHU ABUBAKAR, BOLARI | 1,251   |
| 13. | GCDSS, GABUKKA          | 770             |
| 14. | GSSS, GOMBE1            | 871             |
| 15. | GDSS 2                  | 1,588           |
| 16. | HASSAN CENTRAL, GOMBE   | 621             |
| 17. | SPECIAL EDUCATION CENTRAL | 117         |

Total number of the student 19,011

Nearest Neighbor Analysis of the schools in the study area:

Spatial Accessibility Index:

Nearest Neighbor Analysis (NNA) was used to determine the pattern of secondary schools in each ward. Total number of each school in the ward (which represent n), the size of the area (which represent a) and Manhattan distance was used to determine the pattern of secondary schools in each ward and Rn value, Z score, Observed mean distance/ Expected mean Distance and p-value were generated.

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5 Source: field work (2019)
The Nearest Neighbour Analysis of Gombe metropolis as an Rn = 0.01 and critical value of >2.58, with N = 17, study area = 52km², Nearest Neighbour Ratio: 3.385087, observed mean distance=0.0106, Expected mean Distance =0.0031, and the test significance: p – value 0.000000 z = 7.903068. The result of the analysis showed that all the schools are dispersed and there is no even distribution of schools in the area (figure 4).

Figure 4: Analysis for Public Secondary Schools in Gombe Local Government Area

Source: Authors’ analysis (2019)
The Nearest Neighbour Analysis of Bolari east, (figure 5) here revealed that Rn =0.01 and critical value of >2.58, with N=3, ward area =13.7 km², Nearest Neighbour Ratio: 3.385087, observed mean distance= 0.0106, Expected mean Distance = 0.0031, and the test significance: p– value 0.000000 z- score = 7.903068. The result of the analysis showed that all the schools Bolari East are dispersed and there is no even accessibility to secondary schools in the area.

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Source: Authors’ analysis (2019)
Given the z-score of -2.2043268727, there is a less than 5% likelihood that this clustered pattern could be the result of random chance.

Figure 6: Analysis for Public Secondary Schools in Herwa Gana

The Nearest Neighbour Analysis of Public Secondary Schools in Herwa Gana ward, (figure 6) portrayed an $R_n = 0.01$ and critical value of $<-2.58$, with $N=1$, ward area $= 7.4 \text{ km}^2$, Nearest Neighbour Ratio: 0.185239, observed mean distance $= 0.0086$, Expected mean Distance $= 0.0464$, and the test significance: $p$-value $0.027501$ z-score $= -2.204327$. The result of the analysis showed that all the schools are clustered and the accessibility to secondary schools in the area is relatively even. This can be explained from the fact that the ward is relatively urban (figure 7).

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8 Source: Authors’ analysis (2019)
The Nearest Neighbour Analysis of Public Secondary Schools in Jekada Fari ward revealed an Rn =0.01 and critical value of <-2.58, with N=2, ward area =11.5 km², Nearest Neighbour Ratio: 0.214890, observed mean distance= 0.0073, Expected mean Distance = 0.0340, and the test significance: p – value 0.009282, z- score = -2.601490. The result of the analysis showed that all the schools in Jekada fari are clustered and there is no equal access to secondary schools in the area (figure 7).

Figure 7: Analysis for Public Secondary Schools in Jekada Fari Ward

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9 Source: Authors’ analysis (2019)
The Nearest Neighbour Analysis of Public secondary schools in Pantami ward revealed an Rn 0.01 and critical value of <-2.58, with N=2, ward area =7.6 km², Nearest Neighbour Ratio: 0.226863, observed mean distance= 0.0129, Expected mean Distance = 0.0567, and the test significance: p – value 0.036464, z- score = -2.091714. The result of the analysis showed that all the schools in Pantami are clustered and there is no equal access to secondary schools in the area (figure 8).

10 Source: Authors’ analysis (2019)
Figure 9: Analysis for Public Secondary Schools in Shamaki ward

The Nearest Neighbour Analysis of public secondary schools in Shamaki revealed an Rn = 0.01 and critical value of >2.58, with N=6, ward area =13.7 km², Nearest Neighbour Ratio: 1.600148, observed mean distance= 0.0044, Expected mean Distance = 0.0027, and the test significance: p – value 0.004919 z= 2.812321. The result of the analysis showed that the schools in Shamaki ward are dispersed and there is no even distribution of schools in the area.

Conclusion:

The Nearest Neighbour analysis (NNA) for the spatial distribution of secondary schools indicated two categories of patterns of distribution which is dispersed and clustered pattern. The nearest neighbor index shows clustered pattern for all the wards in the local government area except Bolari East that has dispersed pattern of distribution. The implication of these two patterns

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11 Source: Authors’ analysis (2019)
means that accessibility is poor in the study area. Students travel more distance than normal to overcome the function of distance.

**Recommendations:**

This study investigated the spatial distribution of public secondary schools in Gombe Local Government, Gombe State. The result of the mapping and nearest neighbour analysis (NNA) showed that the distribution of public secondary schools are unevenly in the wards. Therefore, there is need for Gombe State Government to consider the population size of students in locating educational infrastructure in the various wards of the study area.

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