

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 a questionnaire and a hand-held GPS receiver was employed to capture the coordinate the coordinates of the public secondary schools and other relevant data. Secondary data included administrative maps, population figures of students and teachers, names, and addresses of public secondary schools in the study area. The data obtained were analyzed using Geographic Information Techniques. From a survey carried out in the study area, a Total of seventeen public secondary schools with nineteen thousand and eleven students were identified. Nearest Neighbour Analysis was carried out based on each of the ten wards of the study area. The pattern of distribution of public secondary schools in the study area revealed dispersed pattern as in the of Bolari Eastward 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 sitting of public secondary schools by the Government in the study area should include accessibility factors in relation to the population size of the wards.

Keywords: Accessibility, Spatial distribution, neighbor analysis, Secondary school, GIS.

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,

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education, health, etc. (China standard GB/T.50280.9 cited by Lineberry (2000)). 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 (Geurs & Ritsema 2001). 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 (Lu, 2004).

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 the economy all over the world. World Bank points out that the GDP (Gross Domestic Product (GDP) of a country will increase by 3% every year with an increasing level of education (World Bank, 1996). The 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 (Ijaduola, 1998). 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, the 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 (Ogunyemi, 2014). The research was necessitated by the need to examine the distribution of facilities that support this important stage of human development in 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 was using for the analysis. Analysis based on the concept of the spatial distribution of schools in the study area using GIS techniques.

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

- i. To examine the spatial location of public secondary schools in the Gombe Local Government Area.
- ii. To examine the spatial pattern of secondary schools in the Gombe local government.

Material and Method:

Following primary and secondary data were used for this work:

- i. Questionnaire
- ii. Hand-held GPS receiver
- iii. Administrative map of Gombe Local Government Area wards
- iv. High resolution Google Earth image, 2017
- v. Nigeria shape file

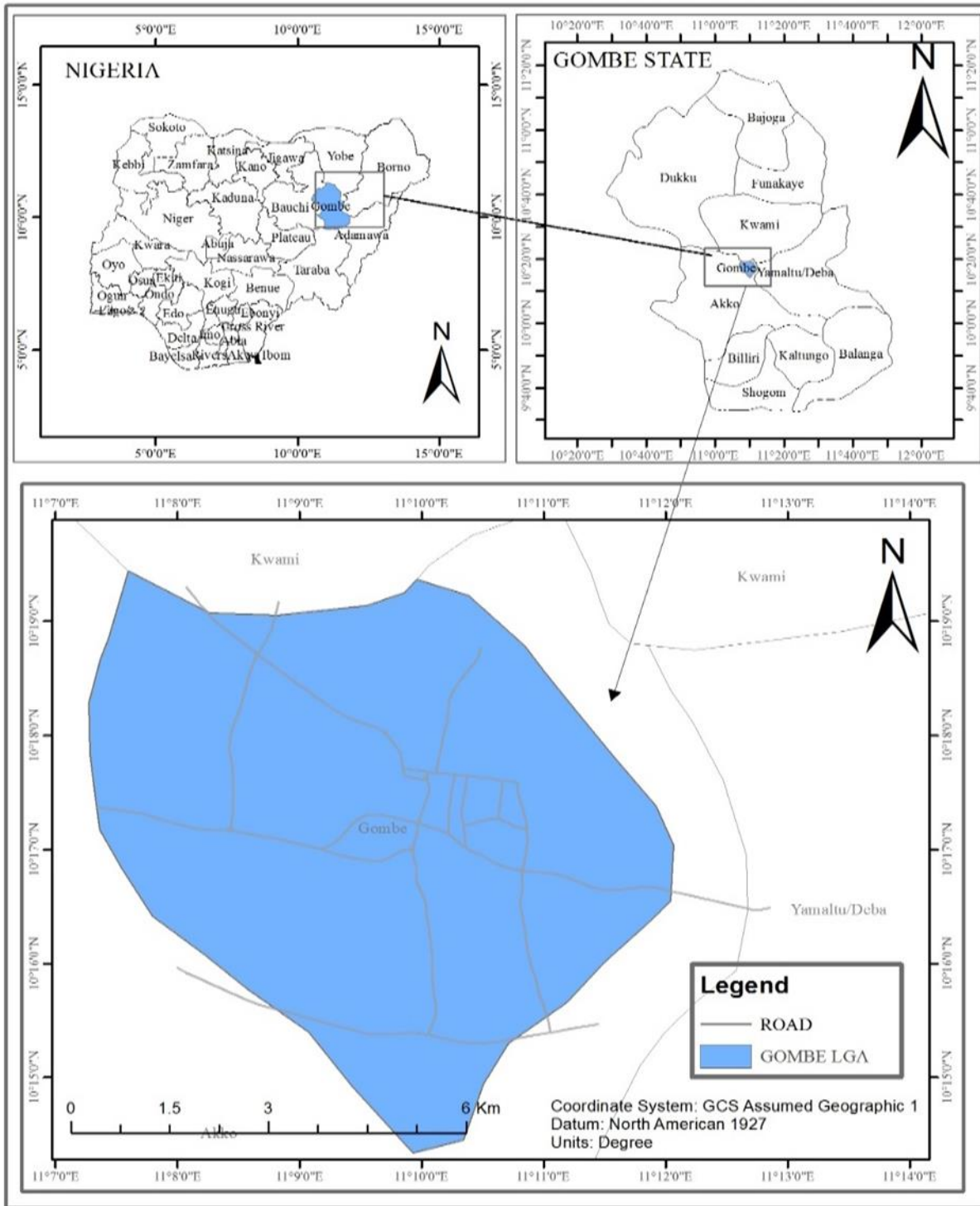
The GPS receiver was used to capture the geographic coordinate points of schools and other relevant data. Secondary data include administrative maps, population figures of both students and teachers, names, and addresses of the secondary schools in the study area.

The administrative map was scanned and georeferenced to WGS 1984 UTM Zone 32N. Personal geodatabase, feature dataset, and feature classes for existing settlements, roads, and wards were created in a 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 an excel spreadsheet and saved as CSV format for easy import into the GIS environment. The coordinates of secondary schools typed in Microsoft excel were imported into the GIS environment for conversion into point map.

The data analysis was carried out using an average Nearest Neighbor Analysis in the 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 $11^{\circ}14'07''\text{E}$ and $11^{\circ}4'42''\text{E}$, and Latitudes $10^{\circ}16'48''\text{N}$ and $10^{\circ}17'24''\text{N}$. 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 the language. With ten wards (Ajiya, Bajoga, Bolari, Bolari east, Dawaki, Herwa Gana, Jekada Fari, Nasarawo, Pantami, and Shamaki). And seventeen public secondary schools with a total number of nineteen thousand and eleven (19,011) students. It has a total land area of 120 square kilometers, with a population of 268,000 (NPC, 2006) and 2016 projected population 367,000 inhabitants.



² 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.

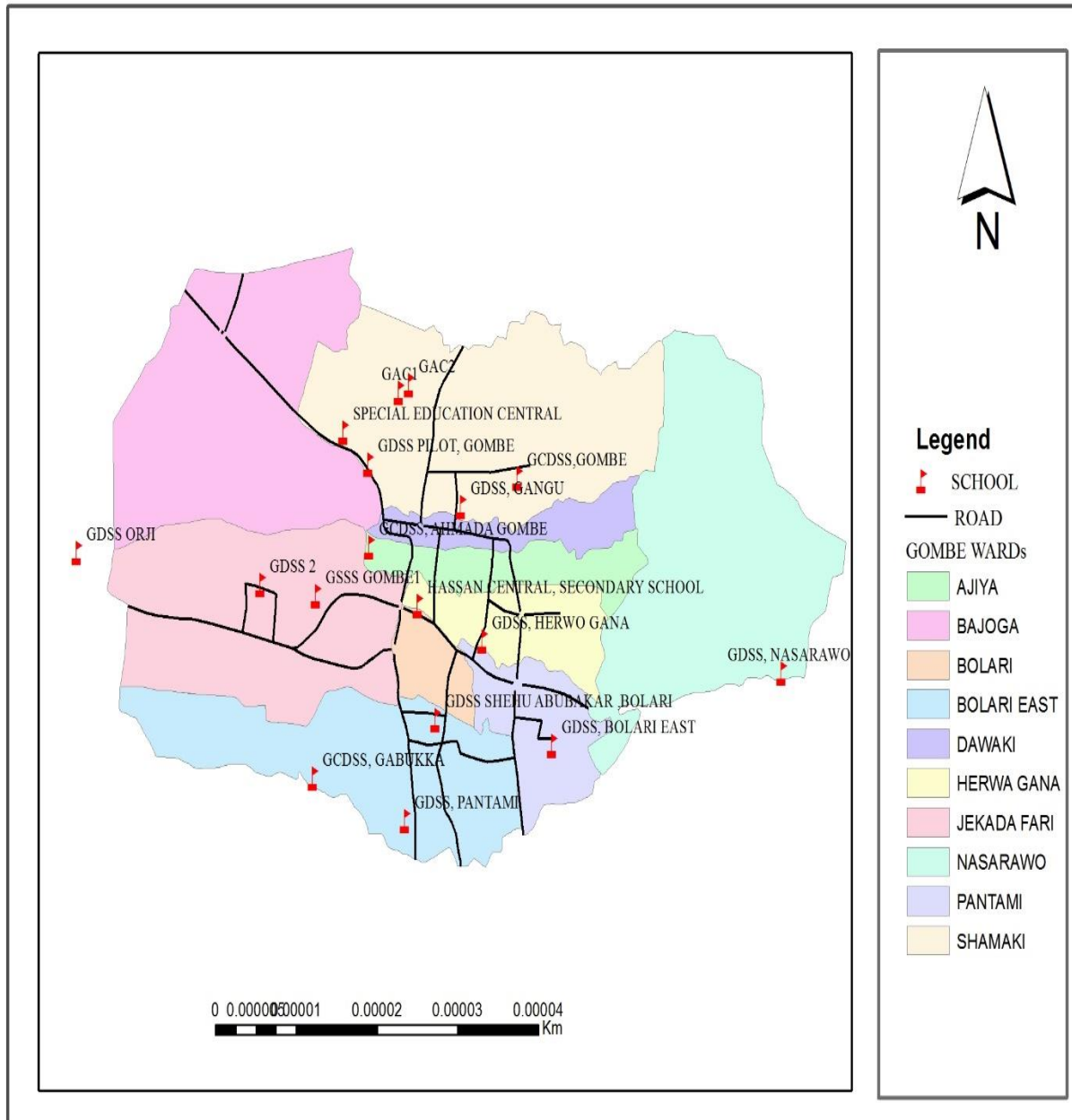


Figure 2 The location of public secondary school in study area³

³ Source: Authors' Analysis (2019)

Table 1 Secondary schools in Gombe Local Government Area with their coordinates⁴

| S No | 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, GANGU | 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 |

⁴ Source: field work (2019)

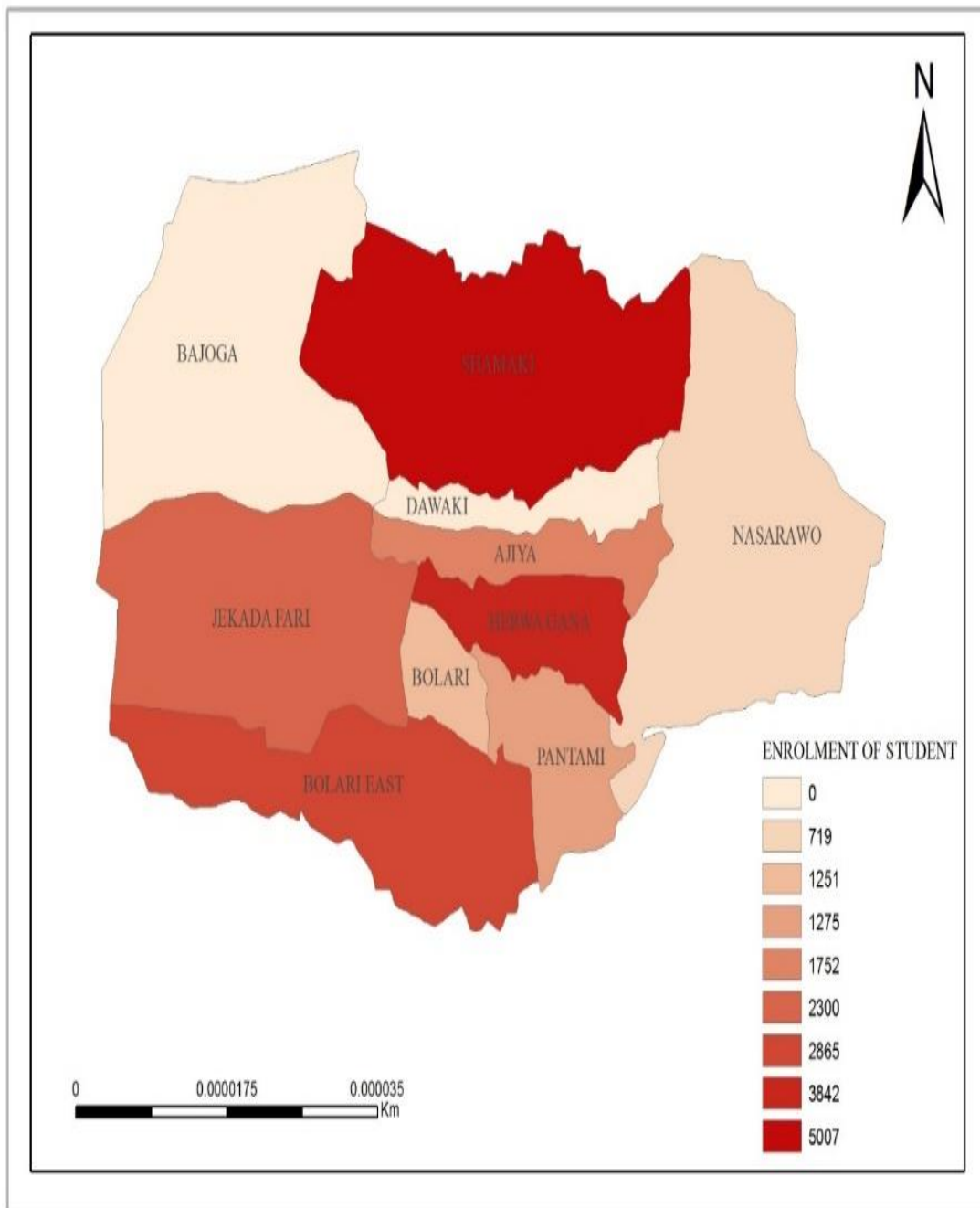


Figure 3 Enrolment of student in Gombe Local Government based on Ward Distribution⁵

⁵ Source: Authors' Analysis (2019)

Table 2 Addresses of Secondary Schools with total enrolment in Gombe L.G.A⁶

| 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. A 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.

⁶ Source: field work (2019)

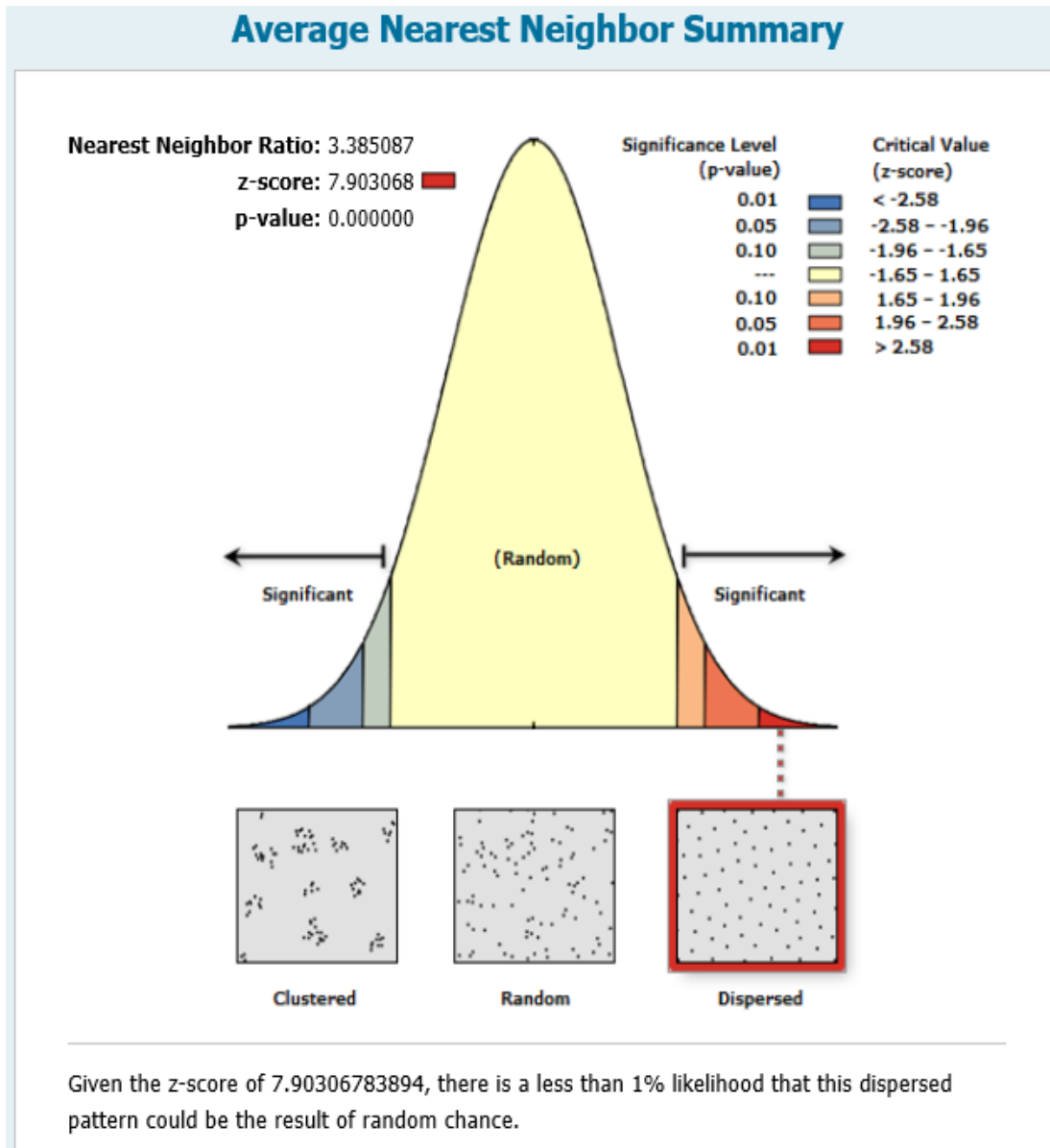


Figure 4 Analysis for Public Secondary Schools in Gombe Local Government Area⁷

The Nearest Neighbour Analysis of Gombe metropolis as an $R_n = 0.01$ and critical value of >2.58 , with $N = 17$, study area = 52km^2 , 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).

⁷ Source: Authors' analysis (2019)

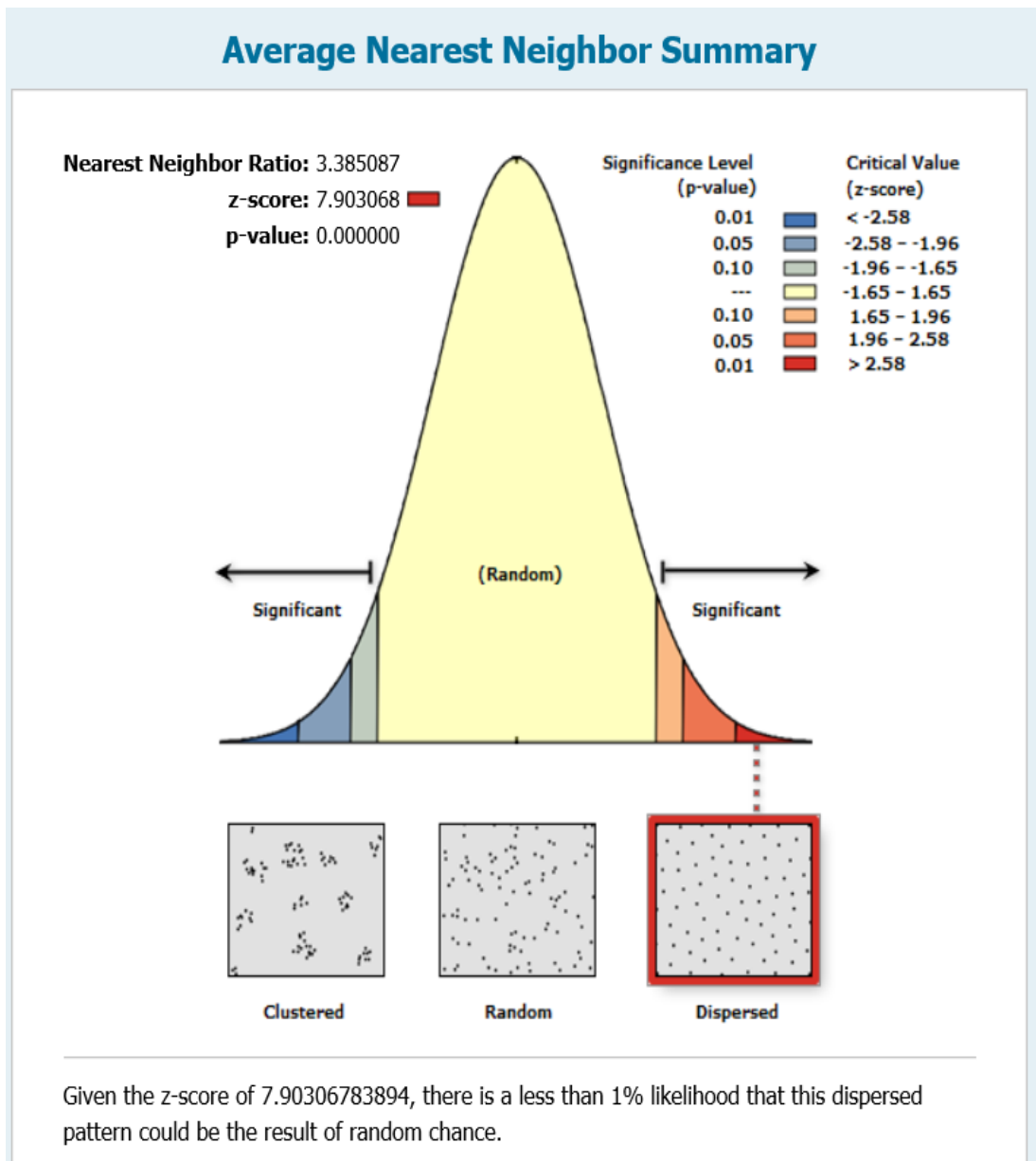


Figure 5 Analysis for Public Secondary Schools in Bolari East⁸

The Nearest Neighbour Analysis of Bolari east, (figure 5) here revealed that $R_n = 0.01$ and critical value of >2.58 , with $N=3$, ward area = 13.7 km^2 , 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.

⁸ Source: Authors' analysis (2019)

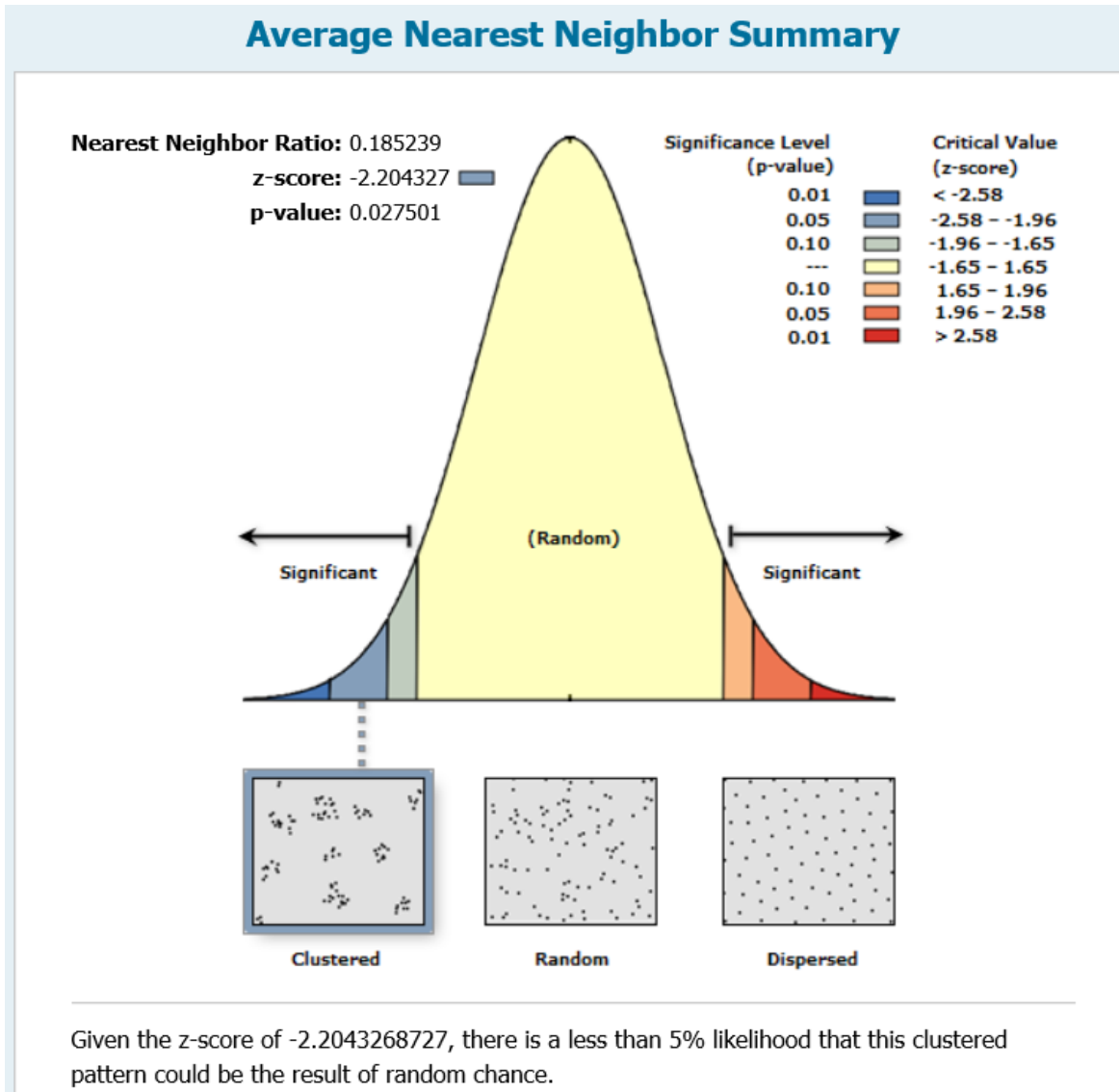


Figure 6 Analysis for Public Secondary Schools in Herwa Ghana⁹

The Nearest Neighbour Analysis of Public Secondary Schools in Herwa Ghana 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 6).

⁹ Source: Authors' analysis (2019)

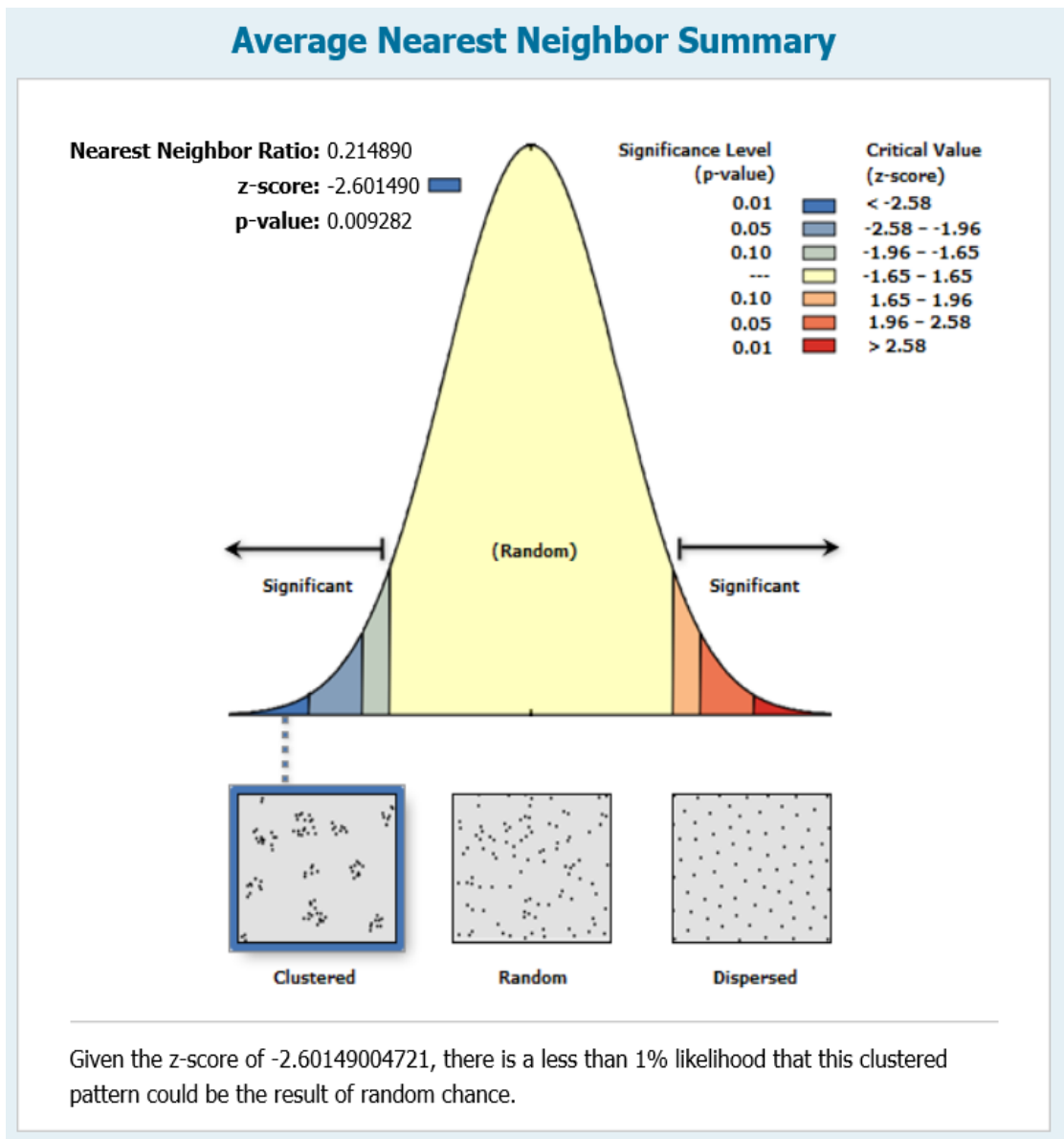


Figure 7 Analysis for Public Secondary Schools in Jekada Fari Ward¹⁰

The Nearest Neighbour Analysis of Public Secondary Schools in Jekada Fari ward revealed an $R_n = 0.01$ and critical value of < -2.58 , with $N=2$, ward area = 11.5 km^2 , 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).

¹⁰ Source: Authors' analysis (2019)

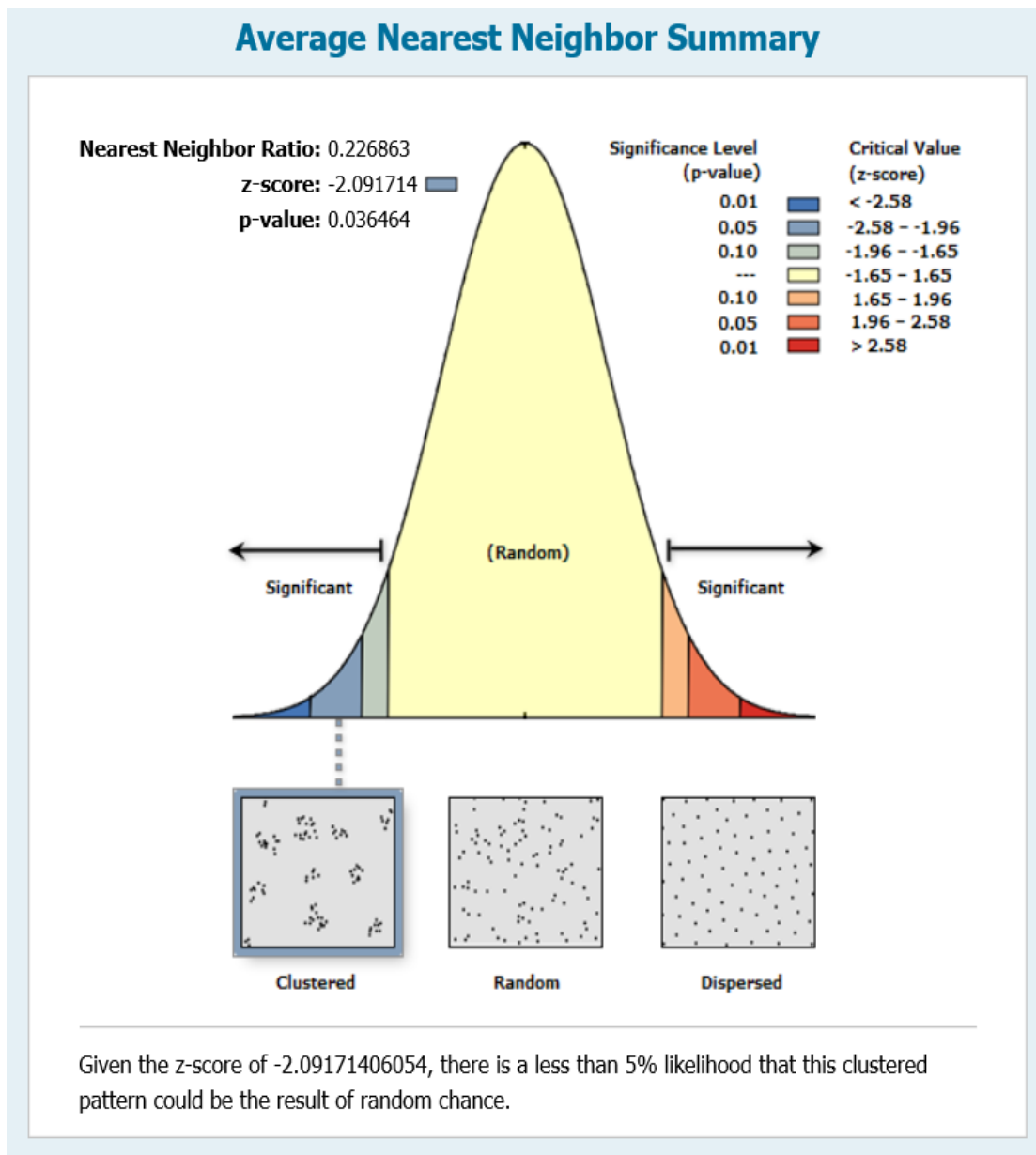


Figure 8 Analysis for Public Secondary Schools in Pantami Ward¹¹

The Nearest Neighbour Analysis of Public secondary schools in Pantami ward revealed an R_n 0.01 and critical value of < -2.58 , with $N=2$, ward area = 7.6 km^2 , 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).

¹¹ Source: Authors' analysis (2019)

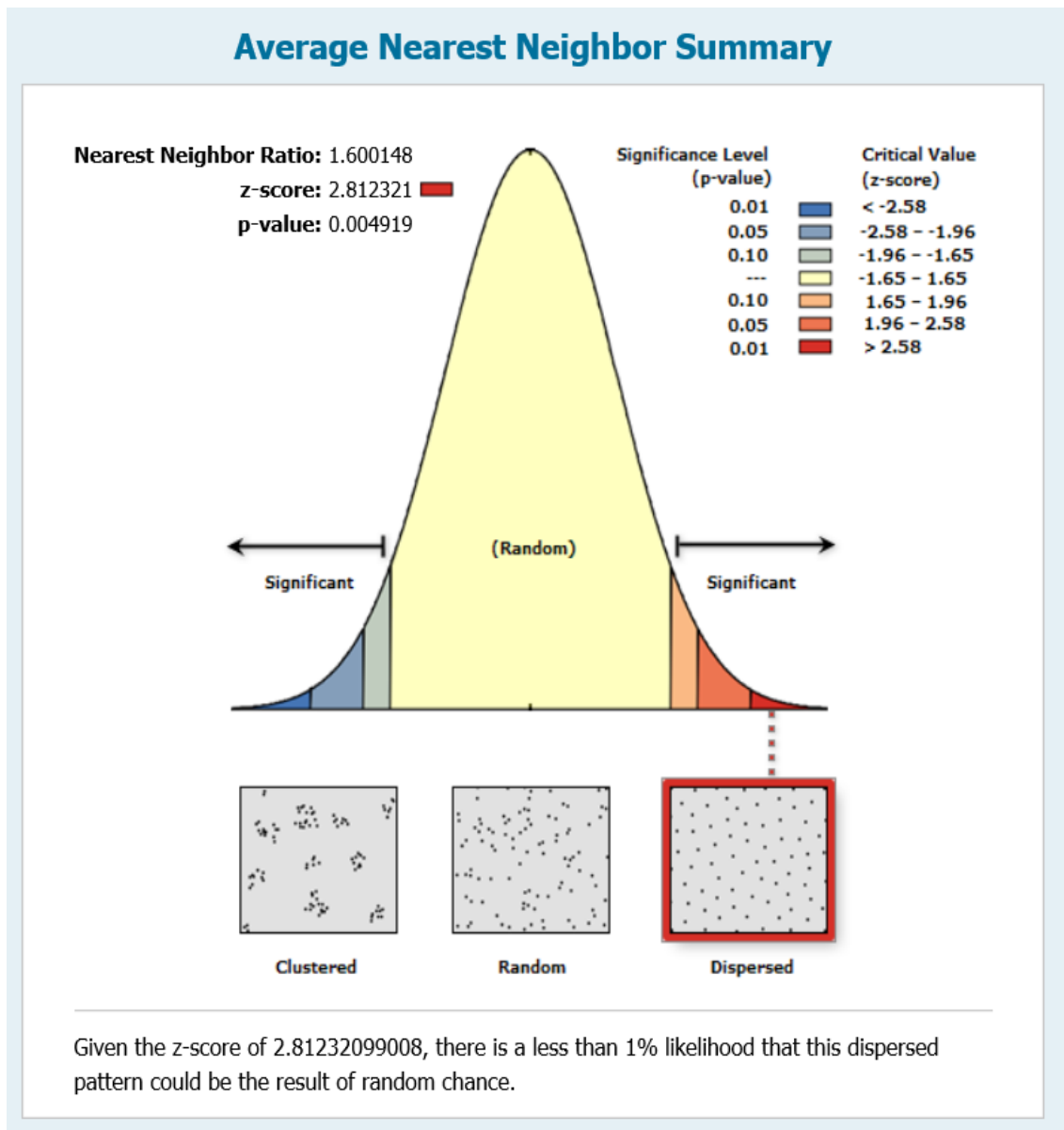


Figure 9 Analysis for Public Secondary Schools in Shamaki ward¹²

The Nearest Neighbour Analysis of public secondary schools in Shamaki revealed an $R_n = 0.01$ and critical value of >2.58 , with $N=6$, ward area = 13.7 km^2 , 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.

¹² Source: Authors' analysis (2019)

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 a clustered pattern for all the wards in the local government area except Bolari East that has a dispersed pattern of distribution. The implication of these two patterns 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 is unevenly in the wards. Therefore, there is a need for the Gombe State Government to consider the population size of students in locating educational infrastructure in the various wards of the study area.

References

- Geurs K. T. and Ritsema J.R. (2001). Accessibility measures, review and applications. Bilthoven, Rijksinstituut voor Volksgezondheid milieu (RIVM).
- Ijaduola, K. A. (1998). Education in Nigeria: An Historical Perspective. Ijebu-Ode: (Nig.) Enterprises, pp 68 – 90.
- Lineberry, (2000). Equality and Urban policy. The Distribution of Municipal public service. Lu, Y. (2004), Evaluation of Accessibility to primary schools, pp 26 – 31.
- Lu, Y. (2004). Evaluation of accessibility to primary schools, pp 26 – 31.
- Ogunyemi, S.A. (2014). A geospatial approach to evaluation of accessibility to secondary Educational institution in Ogun State, Nigeria.
- World Bank. (1996). Priorities and strategies for education report by World Bank in practice Washington D.C.