

## **Spatial Distribution and Analysis of Secondary Schools in Damaturu Metropolis**

Alhaji Mustapha Isah<sup>1</sup> Ishaku Iliyasu<sup>2</sup> and Umar Barde<sup>3</sup>

<sup>1</sup> Department of Survey and Geoinformatics, Mai Idris Aloomo Polytechnic Geidam

<sup>2,3</sup> Department of Surveying and Geoinformatics

The Federal Polytechnic Damaturu

**Email address:** [ishaqjanga@gmail.com](mailto:ishaqjanga@gmail.com)

**Phones:** +2348036826494

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### **ABSTRACT**

This work identifies and Mapped all secondary schools in Damaturu Metropolis through the acquisition and processing of both Spatial and attribute data. The Geographic Information System (GIS) data base for all secondary schools in the study area was created and analyzed, where the results revealed that there are total of thirty (30) secondary schools in the Metropolis which comprises of 19 Private, 9 Government and only 2 Community Secondary school as at the time of compiling this research. The used of ArcGIS 10.5 software system revealed in the analysis that the secondary Schools were clusterly sited where private secondary schools dominated the area with 63.33% where 30.00% and 6.70% were left out for government and Community secondary schools respectively. These schools were sited at 18 within and 12 outside the ring road which is 60% and 40% respectively. The Research therefore recommends that the Government should establish more secondary schools at uniform locations. So that the members of the community too can benefit.

**Keywords:** *Spatial, Distribution and Analysis*

**Introduction**

Damaturu the state capital of Yobe is situated on A3 highway and has an estimated population of about 44,268 according to 2010 Census. Since the creation of the state in August 1991, the city has experienced the creation/establishment of secondary schools and their positioning particularly the private ones were just decided by the proprietors without considering the population or the number of settlements. So many secondary schools were established and distributed in Damaturu without professionalisms. The schools seem to be

Clustery distributed. The school locations were observed to be politically biased to the extent that some of the schools are over utilized while others are underutilized in an area if not properly sited. The school’s location should be based on factors such as population, proximity and economy efficiency for sustainable development. There is no any specific or unique digital map that shows the way secondary schools are been distributed in the town that can be use in further schools’ development so that it can serve as a guide for proper planning and decision making by policy makers.

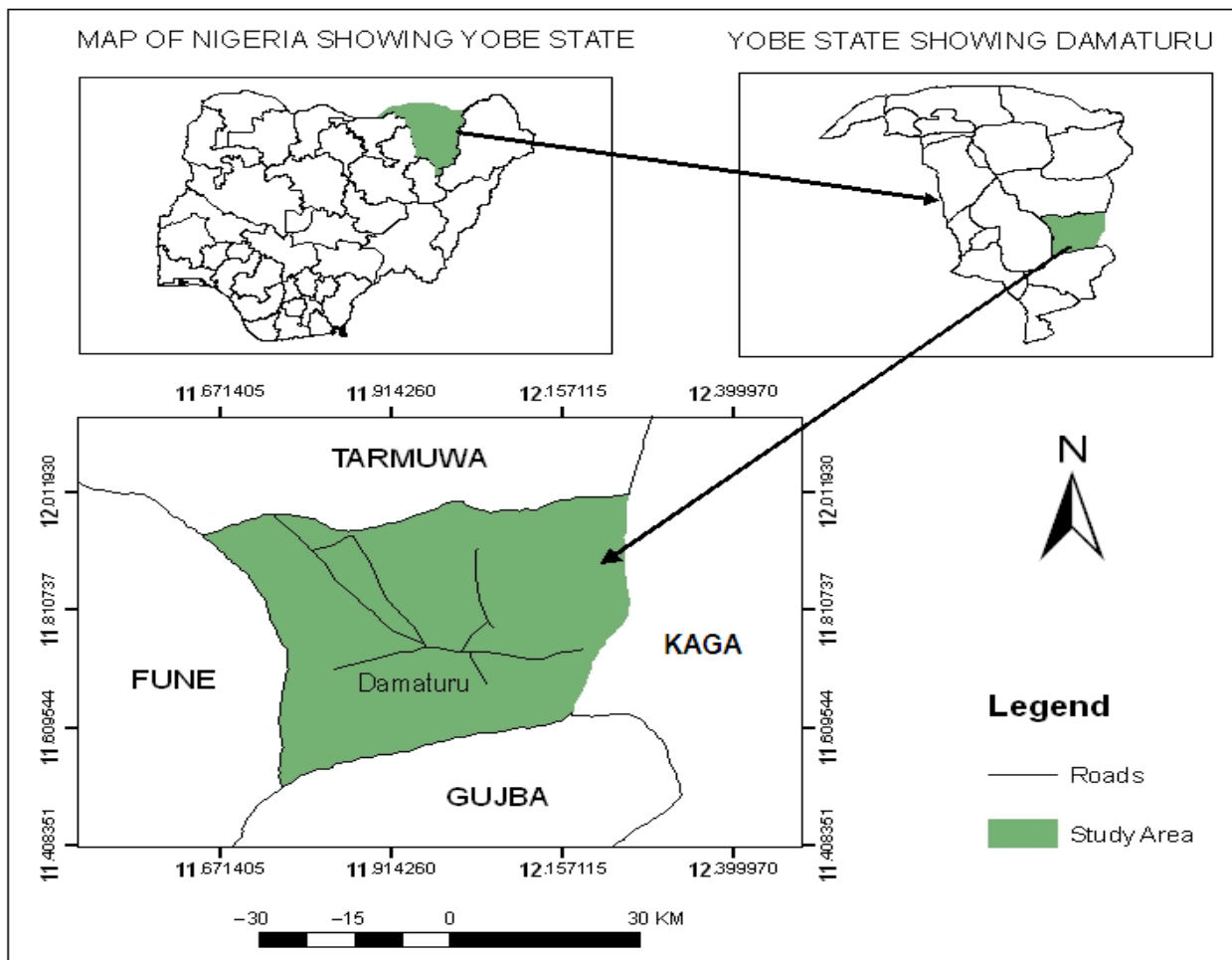


Figure 1.0 The Study area Maps

The Educational facilities were referred to by Adepoju and Fabiyi (2010), and Amnesty International (2012) as the basic structures necessary for learning such as; school buildings, furniture, laboratories, instructional materials,

computer facilities, libraries, sport facilities, etc. In many developing countries of Africa, social facilities are unevenly distributed (Emmanuel, 2000). One of the most outstanding educational problems in Nigeria, as in other parts of the

developing world, is the inadequate number of schools in various parts of the country especially in the northern part (UNICEF, 2005). The inadequacy and uneven distribution of facilities may be ascribed to poor forecast of facilities needs of schools due to poor planning strategies arising from inadequate and poor statistics (Edun, 2005).

Public service is defined as all activities delivered by the government to fulfill those needs that society requires to go through life (Anwaruddin, 2005). Public Service delivery has been one of the key functions of the public sector which uses civil service bureaucracies as the instrument for the delivery of services (World Development Report, 2004). The emphasis on educational services is based on the total dependence of development and policy actualization on the level of education in any society. If educational services are not adequately provided then good and usable information cannot be gotten. Service delivery however is seen to remain lower than what is targeted. People suffer from many hurdles when they need to access any government service either because of lack of information or due to bureaucratic procedures and attitudes; like types of services available, location of service facilities, processes or procedures to access these services (Tamrakar, 2010).

A Geographic Information System (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data. The GIS applications are tools that allow users to create interactive queries (user-created searches), analyze spatial information, edit data in maps, and present the results of all these operations. GIS (more commonly GIS science) sometimes refers to geographic information science (GIS science), the science underlying geographic concepts, applications, and systems. Since the mid-1980s, geographic information systems have become valuable tool used to support a variety of city and

regional planning functions (Abubakar A. M et al, 2012).

According to Hite, J. S. (2008), GIS can also be referring to a number of different technologies, processes, techniques and methods. It is attached to many operations and has many applications related to engineering, planning, management, transport/logistics, insurance, telecommunications, and business. For that reason, GIS and location intelligence applications can be the foundation for many location-enabled services that rely on analysis and visualization

GIS can relate unrelated information by using location as the key index variable. Locations or extents in the Earth space–time may be recorded as dates/times of occurrence, and x, y, and z coordinates representing, longitude, latitude, and elevation, respectively. All Earth-based spatial–temporal location and extent references should be relatable to one another and ultimately to a "real" physical location or extent. This key characteristic of GIS has begun to open new avenues of scientific inquiry (Haruna D.M 2010). Geographic Information System (GIS) is a computer system build to capture, store, manipulate, analyze, manage and display all kinds of spatial or geographical data (Burrough, P. A. 1998),

GIS can be used to solve the location-based question such as “What is located here” or Where to find particular features? GIS User can retrieve the value from the map, such as how much is the forest area on the land use map. This is done using the query builder tool. Next important features of the GIS are the capability to combine different layers to show new information. For example, you can combine elevation data, river data, land use data and many more to show information about the landscape of the area. From map you can tell where is high lands or where is the best place to build house, which has the river view. GIS helps to find new information (Lillesa & Kiefer, 1994).

The Spatial describes how objects fit together in space, either among the planets or down here on earth. There's a spatial relationship between Mars and Venus, as well as between the rose bushes in the backyard. The Spatial has to do with the distance between things, so mathematicians and computer scientists love using the word. "They measured the spatial relations of ping-pong balls in the gravity-free room." It can also refer to how people perceive the objects in front of them. If you're not wearing your glasses, your spatial perception might be off. If you're a space cadet, you might wander off into space. Not surprisingly, spatial is from the Latin word spatium for "space" (Onyeka, E.C 2002).

Distribution is the action of sharing something out among a number of recipients. the way in which something is shared out among a group or spread over an area. "changes undergone by the area have affected the distribution of its wildlife, Social amenities, Schools, Hospitals etc (Aliyu et al 2013)". He however explains that there are three types of distribution namely;

- 1- Uniform distribution
- 2- Clustered distribution
- 3- Random distribution

**Uniform distribution:** -This is a type of distribution in which the aspect or object is said to be distributed uniformly from each other and same distance same portion at a regular interval or based on region population.

**Clustered distribution:** - This is the type of distribution in which the aspect or objects are said to be distributed closed around each other at either regular or irregular interval.

**Random distribution:** - This is type of distribution in which the aspect or objects are said to be distributed randomly at irregular interval around region or area based on the infrastructural populations pattern of the region. A spatial distribution is the arrangement of a phenomenon across the Earth's surface and a graphical display of such an arrangement is an important tool in geographical and

environmental statistics. A graphical display of a spatial distribution may summarize raw data directly or may reflect the outcome of more sophisticated data analysis. Many different aspects of a phenomenon can be shown in a single graphical display by using a suitable choice of different colors to represent differences. One example of such a display could be observations made to describe the geographic patterns of features, both physical and human across the earth (Sinsecara S. et al, 2010).

Surveying or land surveying is the technique, profession, art and science of determining the terrestrial or three-dimensional positions of points and the distances and angles between them. A land surveying professional is called a land surveyor. These points are usually on the surface of the Earth, and they are often used to establish maps and boundaries for ownership, locations, such as building corners or the surface location of subsurface features, or other purposes required by government or civil law, such as property sales. Surveyors work with elements of geometry, trigonometry, regression analysis, physics, engineering, metrology, programming languages, and the law. They use equipment, such as total stations, robotic total stations, theodolites, GNSS receivers, retroreflectors, 3D scanners, radios, clinometer, handheld tablets, digital levels, subsurface locators, drones, GIS, and surveying software (Ndukwe,2001).

According to Burrough P.A 2005, A Geographic Information System (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data. He also defines it as a set of powerful tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes. It capable of acquiring spatially indexed data from a variety of sources, changing the data into useful formats, storing the data, retrieving and

manipulating the data for analysis, and then generating the output required (Fischer and Njikamp, 1993).

The GIS provides numerous benefits for the educational process, including the development of students' geographic skills by helping them to think spatially and analyze spatial data, the promotion of students and teacher's motivation, and facilitation of project-based teaching and learning. The GIS is a discipline for capturing, storing, analyzing, managing and presenting data and associated attributes which are spatially referenced to earth. The use of GIS in education involves combining statistical inference to geographic information. Statistics in Education might be use with GIS to present a clear picture of educational facilities and activities such as ratio of Students to teacher, number of students in a class and student density in school and school distribution in district. Eray, (2012)

The GIS can relate unrelated information by using location as the key index variable. Locations or extents in the Earth space–time may be recorded as dates/times of occurrence, and x, y, and z coordinates representing, longitude, latitude, and elevation, respectively. All Earth-based spatial–temporal location and extent references should be relatable to one another and ultimately to a "real" physical location or extent (Sule J. O et al 2012).

lack of tentative digital distribution pattern map that shows how the schools were distributed in the study area necessitated the need to carry out this Research.

**Materials and Methods**

The concept, materials/equipment's used and the methodology followed to archive the aim of this research are stated below:

**Conceptual Design**

Methodology flow chart

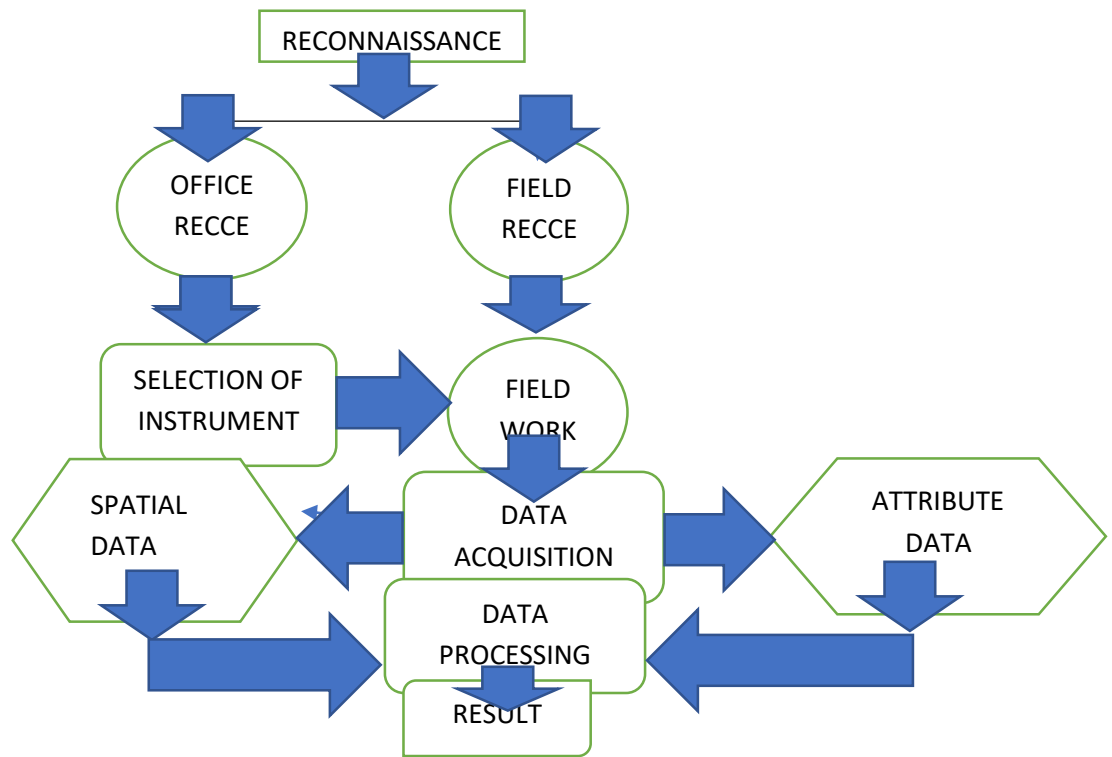


Figure 2.0 A flow chat methodology

The instruments/materials used were classified into hardware and Software.

### **Hardware Equipments**

1) Global Navigation Satellite System (GNSS) Receiver

2) Etrex Garmin, hand held Global Positioning System (GPS)

3) Computer system (HP Laptops).

4) A flash driver

### **Software (Package)**

1) ArcGIS 10.5 (Version)

2) Erdas Imagine V14

3) Microsoft Excel

4) Microsoft office which was used for the presentation of the research report.

The hardware instruments were used to acquire, process and present the data be its primary or secondary type. The **primary data** were the first-hand data such as the spatial locations, the attribute data that gives more details about the location. That attribute when integrated in the system it gives the analysis that was used to draw the conclusion. The **secondary data** which are sometimes called second-party data refers to the type of data that has already been collected through primary source and made readily available. In this work, the secondary data used include the existing map of the area for study guide, the satellite imagery downloaded which was processed and used to mapped the area and used for further analysis. Another secondary data used include the attributes such as year of establishment of the schools, number of staff and students, school categories, school owners etc which were all collected through the respective school records.

Haven collected the data, it was inputted into the system (software) and processed

to give the result that was used to draw the conclusion. The software used are ArcGIS 10.5 for processing and analysis, Microsoft excel and office for result presentation and analysis.

### **Results and Discussion**

**The processed data lead to result through query in the ArcGis 10.5 by making use of standard query language (SQL). The queries were made both on spatial and attribute data as follows:**

#### **The queries carried out include:**

##### **Query modeled:**

- ✓ Show all the schools with greater than 21 teachers.  
"No\_of\_Tea" >= 21
- ✓ Show all schools with less than 21 teachers  
"No\_of\_Tea" <= 21
- ✓ Show all the schools within the ring road.  
"Schools\_Wi" = 'Within'
- ✓ Show all the schools outside the ring road. "Schools\_Wi" = 'Outside'
- ✓ Show all the schools with greater than 120 students.  
"No\_of\_Stud" >= 120
- ✓ Show all schools with less than 120 students "No\_of\_Stud" <=120
- ✓ Show all schools owned by Government.  
"School\_Car" = 'Government'
- ✓ Show all schools owned by Private sole proprietors.  
"School\_Car" = 'Private'
- ✓ Show all schools owned by community.  
"School\_Car" = 'Community'

The queries were presented below as figures:

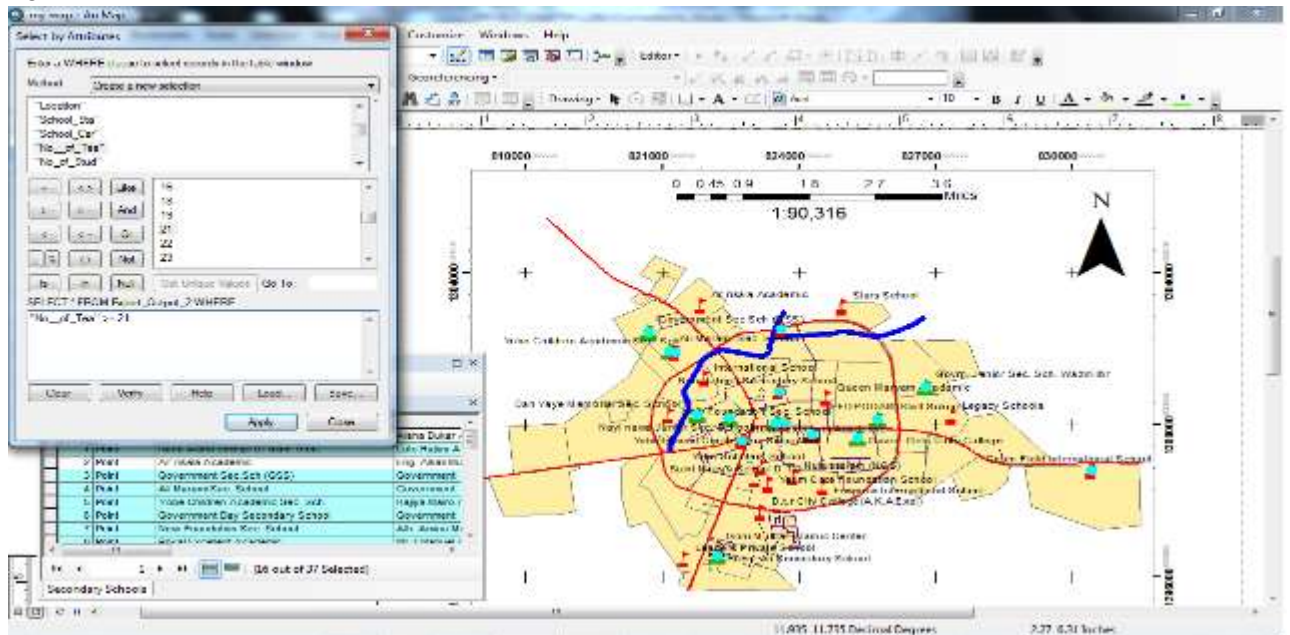


Figure 3.0 shows the secondary schools with Greater than 21Teachers

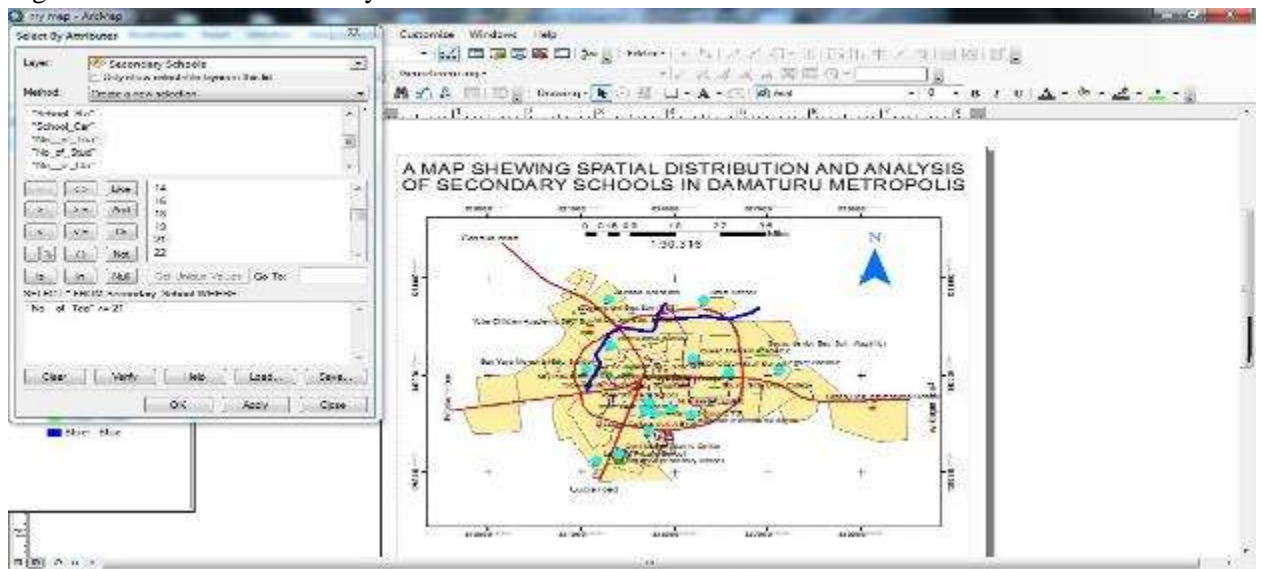


Figure 4.0 shows the secondary schools with less than 21Teachers

Figure 3.0 and 4.0 shows that out of 30 secondary schools, 14 are having more than 21 teachers and the remaining 16 has less than 21 teachers as seen in fig. 3 and 4 respectively.

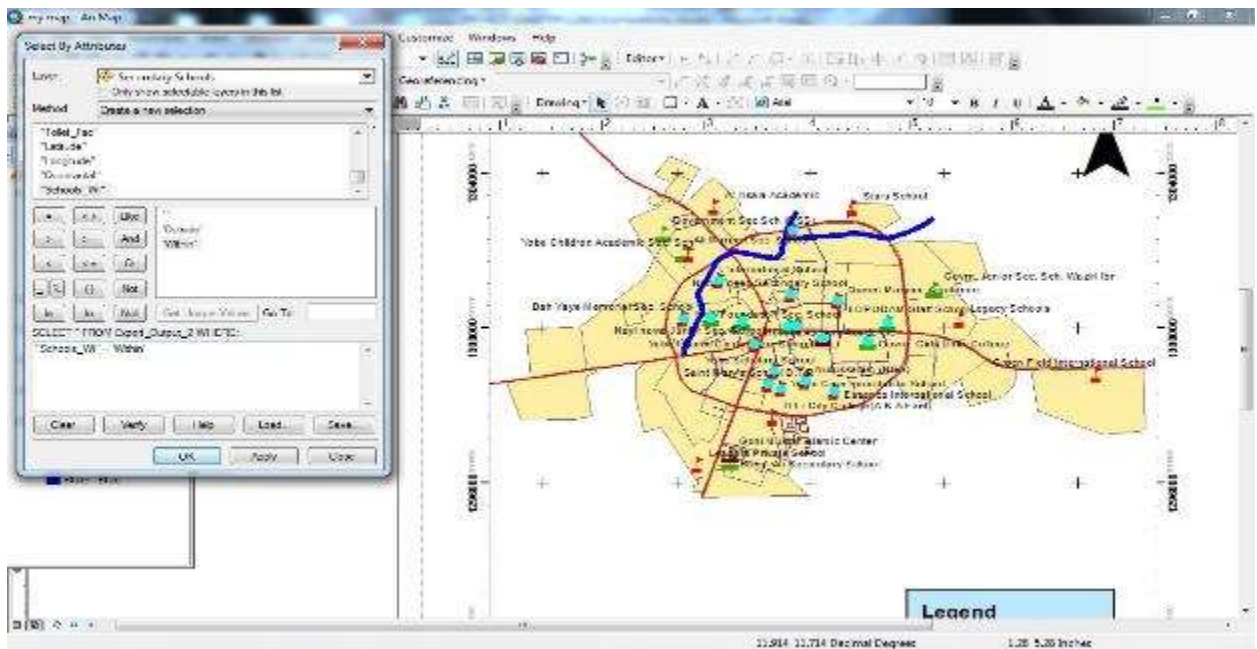


Figure 5.0 shows the secondary schools Within ring road

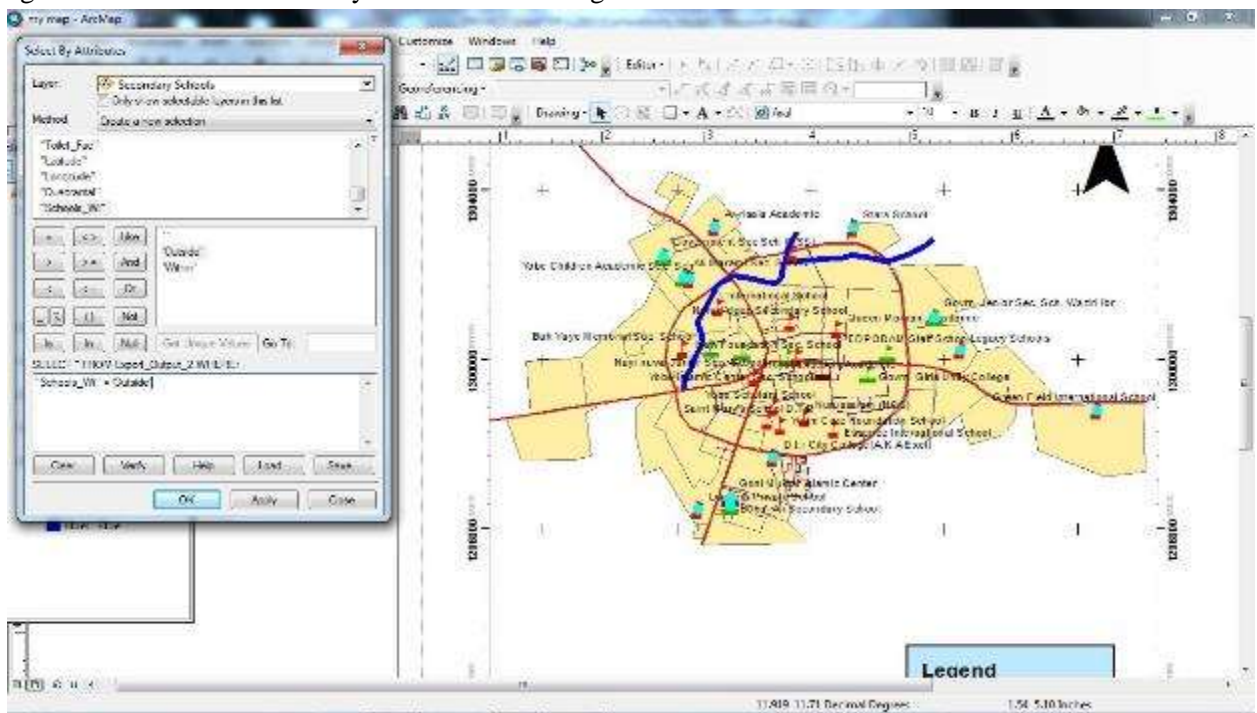


Figure 6.0 shows the secondary schools Outside ring road

Figure 5.0 and 6.0 above revealed that there are 18 and 12 secondary schools within and outside the ring road respectively.

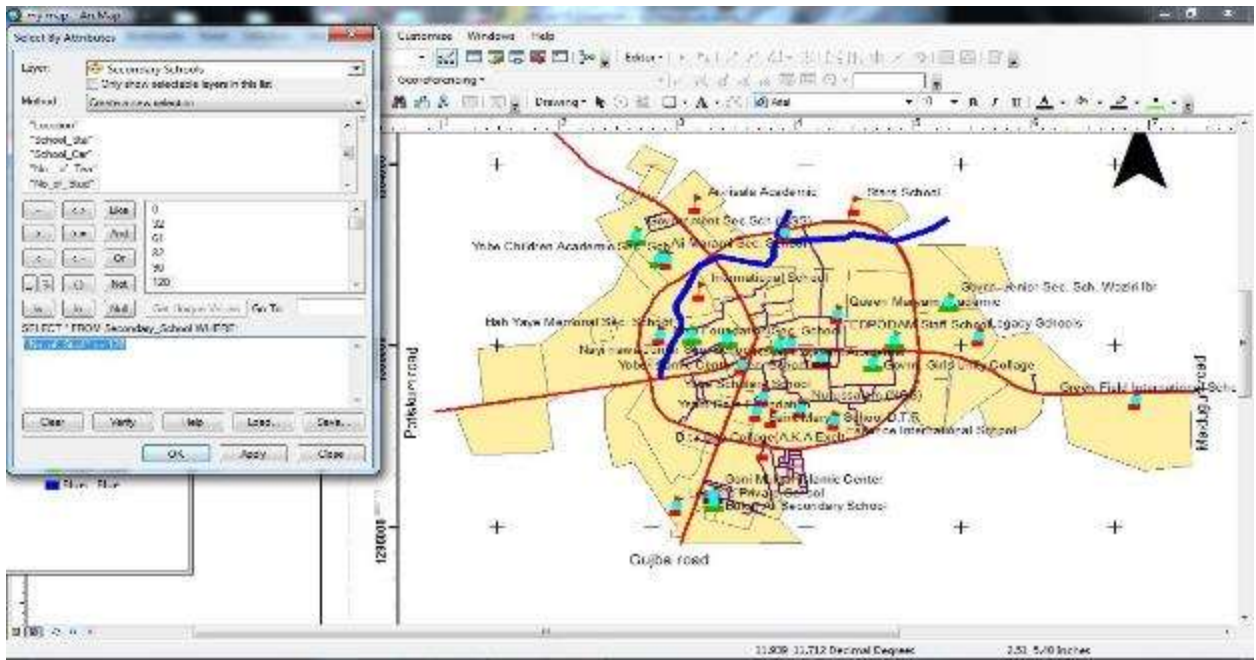


Figure 7.0 shows the secondary schools With Greater than 120 students

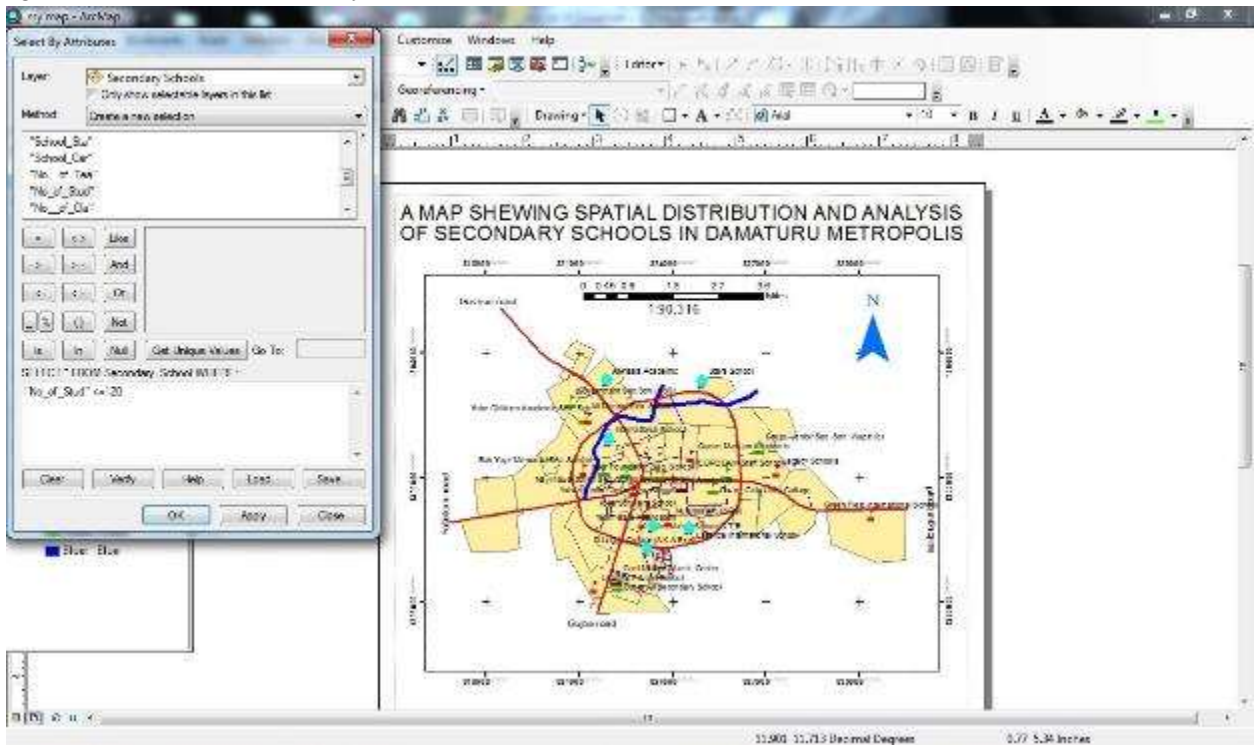


Figure 8.0 shows the secondary schools with less than 120 students

Figure 7.0 and 8.0 above shows that out of 30 secondary schools, 21 are haven more than 120 students and the remaining 9 has less the 120 students.

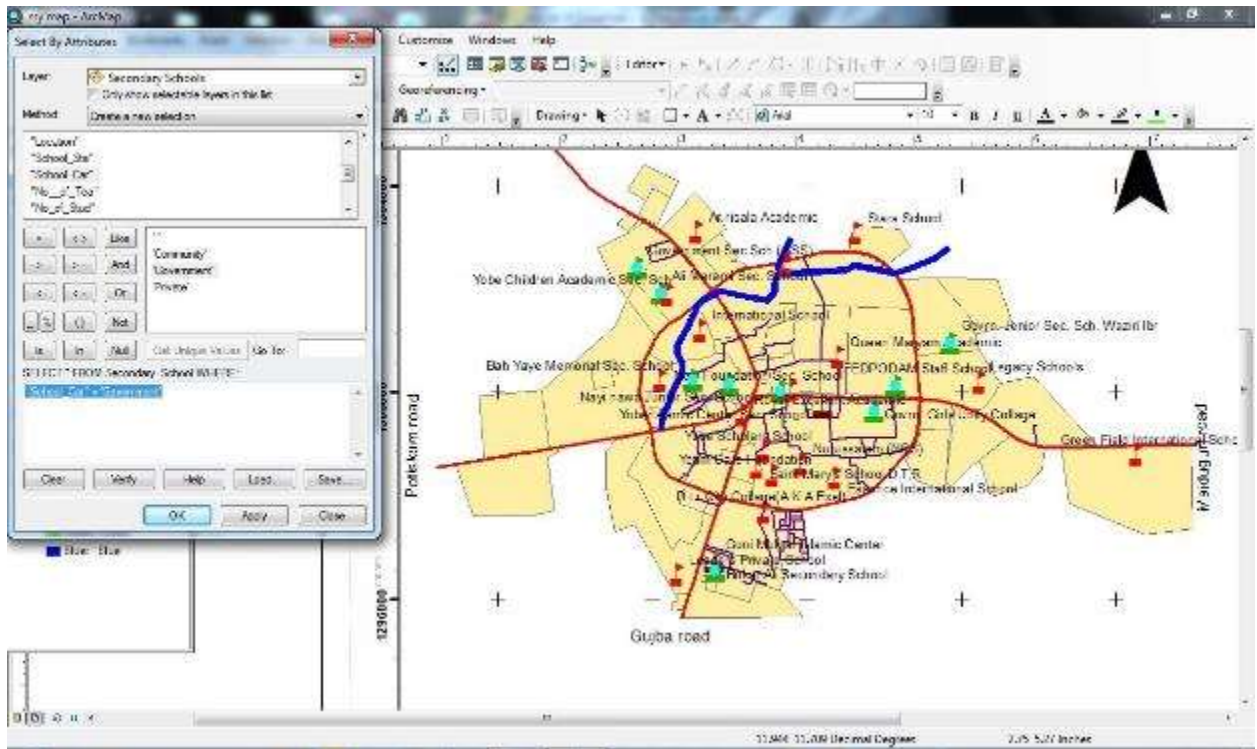


Figure 9.0 shows the secondary schools Own by government

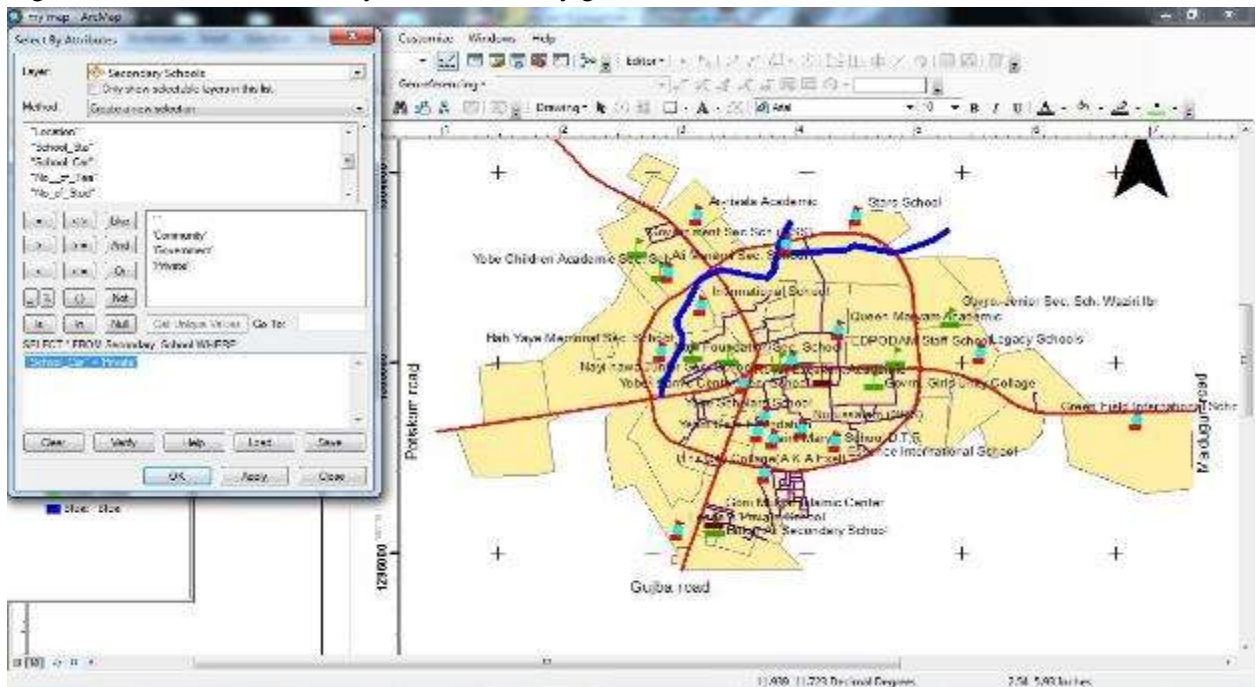


Figure 10.0 shows the secondary schools Own by Private own schools

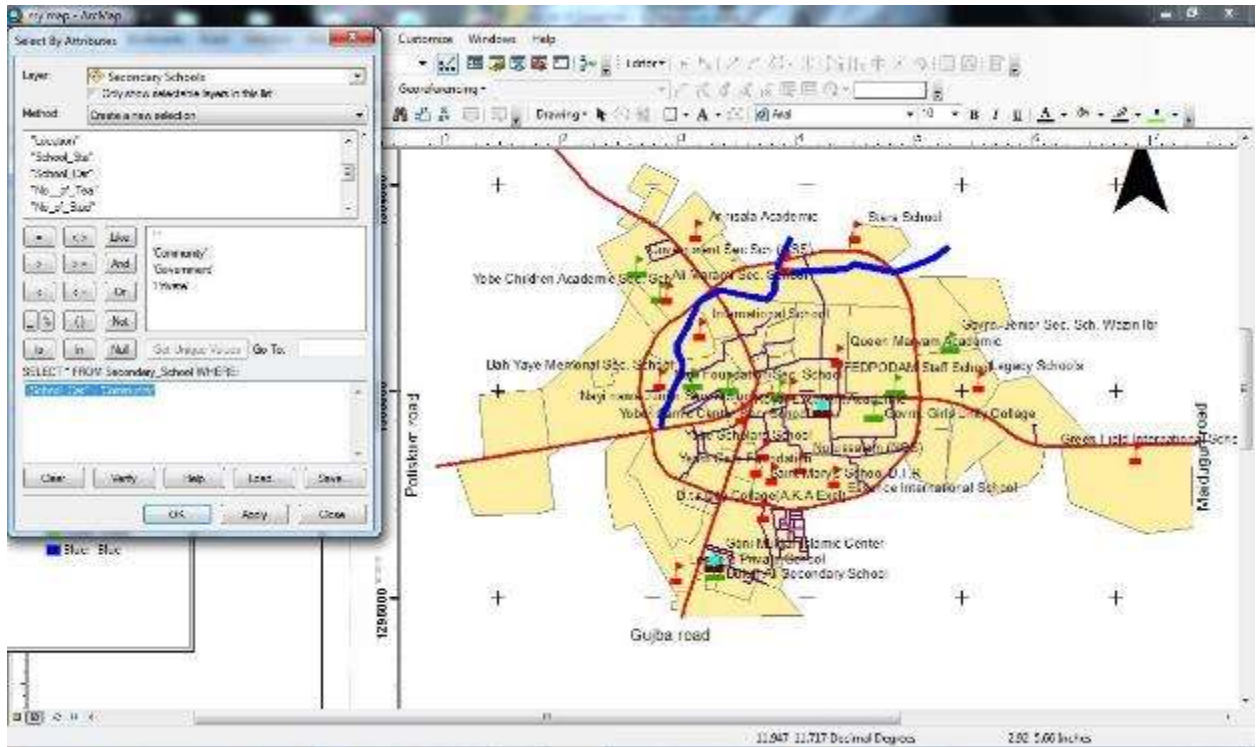
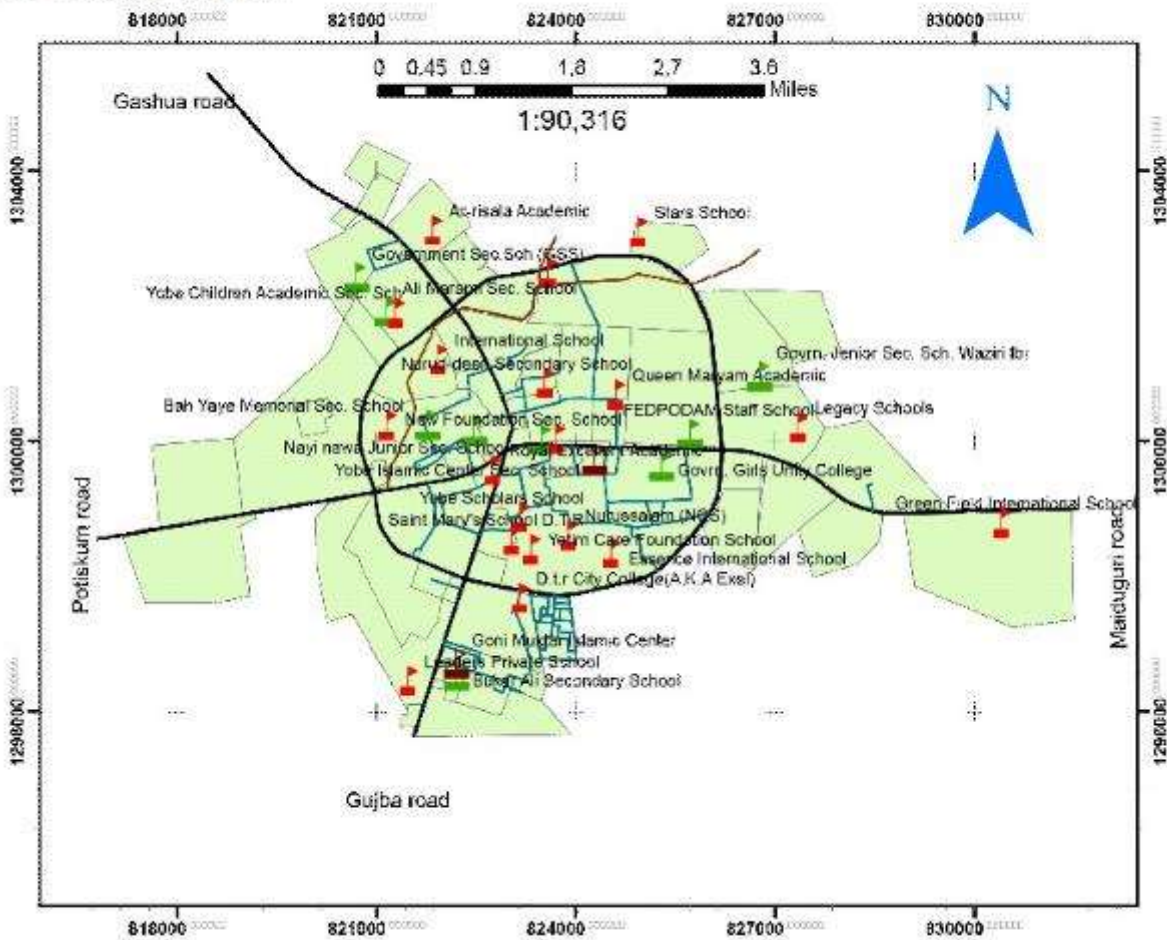


Figure 11.0 shows the secondary schools Own by Community

Figure 9, 10 and 11 above revealed that there are 9, 19 and 2 secondary schools respectively that are owned by government, private and community.

Figure 12 below is a composite map that combined all the layers which generally revealed that the secondary schools within Damaturu are clusterly sited despite the population / settlement across the town.

# A MAP SHEWING SPATIAL DISTRIBUTION AND ANALYSIS OF SECONDARY SCHOOLS IN DAMATURU METROPOLIS



## Summary, Recommendation and Conclusion

### Summary

The primary aim of this research is to mapped, Analyze and determine the distribution pattern of secondary schools within Damaturu metropolis and the results revealed that there are thirty (30) secondary schools which comprises of 19 from private, 9 from government and 2 from community. Out of the whole number of these schools, only 12 were sited out-side the ring road and the remaining 19 are within and almost at the Centre and south eastern part of the metropolis.

### Conclusion

The integration of Geographic information system (GIS) software and techniques was successful in mapping, analyzing and determining the distribution pattern of secondary schools within Damaturu metropolis.

### Recommendation

Haven successfully achieved the aim of this work; the following recommendations are hereby made:

*Spatial Distribution and Analysis of Secondary Schools in Damaturu Metropolis*

- 1- the use of GIS software and techniques be adopted in carrying out similar work
- 2- the government and policy makers should make use of this work particularly the results achieved as a guide in siting further schools.
- 3- The future researchers should use this work as a guide in conducting similar work
- 4- As the results revealed that the secondary schools in the study area are clusterly sited, the government should ensure the need for uniform siting of secondary schools in the study areas so that the members of the community will benefit
- 3- it is recommended that Further research should be carried out to improve on this work.

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