A geospatial approach to evaluation of accessibility to secondary educational institution in Ogun State, Nigeria.

S A Ogunyemi¹, K H Muibi¹, O E Eguaroje¹, O O Fabiyi², A S Halilu¹
¹Cooperative Information Network, National Space Research and Development Agency, Obafemi Awolowo University Ile-Ife, Osun State, Nigeria.
²Regional Centre for Training in Aerospace Surveying, Ile Ife, Osun State, Nigeria

Email: samsonogunyemi@yahoo.com

Abstract. The study therefore examined the spatial distribution of secondary school and the accessibility levels to students in Yewa South local Government area of Nigeria and the factors that give rise to them with a view to providing a framework for effective placement of students. Primary and secondary data were used for the study. Primary data was collected using questionnaire and a hand-held GPS receiver used to capture the 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 school placement sheet and list of schools. The data analysis was carried out using network analysis. School location, 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. Settlements, roads, schools location, number of secondary schools, ward and school enrolments were used to generate both school accessibility and effective placement measure using network analysis. Network analyses were also performed to evaluate nearest school to student and a set of origin-destination (OD) matrix. However, the whole of 25 secondary schools in Yewa south were considered for network analysis ward by ward, and the results of the distance students travel from their settlements to their various schools were shown for all the secondary schools in each ward. Out of 415 Students, 210 students travel below 2km to their schools which constitute 50.60% total number of students in the local government area while 205 students travel above 2km to their schools which constitute 49.40%.

1. Introduction

Accessibility is a term often used in transport and land-use planning, and is generally understood to mean approximate ease of reaching [14,15]. 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 [4]. Accessibility is also defined as the extent to which the transport system enables individuals or goods to reach destination by means of transport mode(s) [5]. In other word, accessibility concerns both the pattern of activities and the links between the activities. 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 [9]. A location is defined to be accessible if the effort it takes to get there is acceptable to the target group; so the concept of accessibility incorporates not only the transport link between the origin and destination and the ability for travelling by the target group,
but also the characteristics of the destination and the objective of the trip [7]. Accessibility is travel impedance (distance or time) between students’ location and service points [1].

The public facility’s accessibility is defined as the distance to which people must travel to receive the service, or from which a service is provided to the whole community of interest in administration, economy, education, health etc. (China standard GB/T.50280.98, 1998) cited by [9]. Public facilities are important because they provide both desirable services to and impose undesirable impacts on those who do not have access to its use in the areas. Education is therefore an important part of these public facilities.

Education plays an important role in our society. United Nations Educational, Scientific, and cultural Organization indicates 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) of a country will increase 3% every year with increasing level of education. Education is a basic human right, and is indispensable for the realization of other human rights as a means for accessing broader social, economic, political and cultural benefits [17]. Because it is transformative and empowering, education contributes to building more just societies through reducing poverty and inequalities, enhancing acceptance of diversity, and promoting respect for the rule of law.

Secondary education serves as a link between the primary education and higher education, and plays a very important role in this respect. A child’s future can depend a lot on the type of education he/she receives at the secondary level. Apart from establishing the roots of education of a child, secondary education can be instrumental in shaping and directing the child to a bright future. This stage of education serves as means to move on to a higher stage as well as to provide generic competencies that cut across various domains of knowledge as well as skills. Providing secondary education to all, both boys and girls, with a focus on quality education assumes greater meaning today in our society.

Ogun State is one of the three States created from the defunct Western State of Nigeria in 1976 [16]. At that time, 19 States were created by the Federal Military Government with the State Capital at Abeokuta [6]. Ogun State at present has 20 Local Government Councils with almost three hundred and ninety six secondary schools [10]. However, this is evident that Ogun State is the first among others to have the influence of Western Education in Nigeria. The provision of educational infrastructure and accessibility has always remained a problem because the demand is always on the increase as a result of the growing population and continuous agitation for standard education in Ogun State.

Presently, the clamour for more standard classrooms, standard library and library equipment, books and science laboratories among others in the face of very limited funds is a serious challenge to the government [10]. Under a Federal System of government, it is an acceptable norm that every state in a federating unit shall derive its policy from the National Policy. Ogun State to a large extent is therefore not an exemption. Consequently, the Ogun State Education Policy is derived from: (i) National Policy on Education; (ii) Ogun State Educational Law; and (iii) Ogun State Education Policy. With 100% transition being expected from primary schools into Secondary Schools and neighborhood schools as advocated under the Universal Basic Education (UBE), the State Government between 2003 and 2007 increased the number of secondary schools from 265 to over 396. This is also to provide access for all primary school graduates as provided for in the UBE Act to Junior Secondary Schools with separate management, administration and infrastructure [13]. Though, this is a welcome development, yet, an optimum access to secondary school education was not provided in Ogun State.

In Ogun State, accessibility to secondary education has persistently remained low. At the inception of secondary education in the country, accessibility to this level of Education was limited only to sons and daughters of the chiefs. However, there are high disparities in the rates of accessibility in the regions; some are closer to their schools while some are far away from their school location [11,12]. In Yewa South, in term of accessibility to secondary education, urban areas are more favoured than rural areas. In rural area, secondary schools operate below their optimum enrolment with girls more favoured than boys in the lower classes and vice versa in the upper classes.
In the use of GIS based accessibility analysis for education planning, where expected marked area size is a key factor in the location decision, there is a need for simple and effective indicators of school accessibility that can be easily visualized. Analysis based on the concept of accessibility is therefore ideally suitable to be integrated with GIS [7,8]. In this study, accessibility will be focused to analyze demand as the most important geographical factor in the secondary school planning.

1.1 Statement of research problem
The role of education cannot be overemphasized in the development of any nation [3]. Accessibility to education at all level helps to equip people with the potentials to overcoming the constraints to development [2]. In Yewa south local government, despite the quantitative expansion in secondary education, accessibility to this education level is still low. Disparities in attendance between urban and rural children are significant and schools are few in areas of real demand for secondary education. These disparities are perceived to be a result of a combination of factors which include accessibility, parents’ attitude, social and economic factors. This study intends to investigate the spatial distribution and accessibility to secondary education in Yewa south Local Government in Ogun State.

1.2 Aim of the study
The aim of the study is to examine the spatial distribution of secondary school, identify the accessibility level to residents in the study area and the factors that give rise to them.

1.3 Objectives
- To identify spatial pattern of secondary schools in Yewa South local government.
- To examine the level of accessibility to secondary schools in Yewa south.
- To propose a framework for effective placement of students to secondary schools in the Local government.

1.4 Study area
Yewa South Local Government in Ogun State lies between Longitudes 2°47′24″E and 3°6′48″E of the Greenwich Meridian and Latitudes 6°37′46″N and 6°55′42″N of the Equator. The area is bounded in the East by Ifo and Ado – Odo/ Ota local Government and in the West by Ipokia Local Government and north by Yewa North. The Local government area is inhabited predominantly by the Yoruba speaking people of South Western Nigeria. It has a total land area of 629.38 square kilometers, with population of 150,850 (NPC, 2006). There are (15) fifteen public secondary schools and (10) ten registered private secondary schools in the study area (Ministry of Education Science and Technology). The Local Government is divided into ten (10) wards (Ilaro I, Ilaro II, Ilaro III, Iwoye, Idogo, Owode I, Owode II, Ilobi/Erinja, Oke – Odan and Ajilete).

![Figure 1. Yewa south local government.](image-url)
2. Materials and method

2.1. Data sources and collection
The data used in this research include primary and secondary data. Primary data was collected using questionnaire and a hand-held GPS receiver. The GPS receiver is 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 school placement sheet and list of schools.

The administrative map was scanned and geo referenced to WGS 1984 UTM Zone 31N. 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 digitized roads were converted to network dataset for distance analysis between the schools and the settlements. The data obtained from the administered questionnaire, School data and GPS point coordinates of secondary schools were typed into excel spread sheet 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 network 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. Settlements, road network, schools location GPS coordinates, number of secondary schools, ward and school enrolments were used to generate both school accessibility and effective placement measure to schools using network analysis. Network analyses were also performed to evaluate nearest school to student and a set of origin-destination (OD) matrix. Neighbourhood Centroid-to-Schools were used for both nearest school and origin–destination analysis in order to find the shortest distance.

3. Results and discussion

3.1. Spatial pattern of secondary schools
The field survey and data collected reveal that there are 25 secondary schools in Yewa South local government area out of which fifteen (15) are public secondary schools and ten (10) registered private secondary schools. The local government is divided into ten (10) wards (Ilaro 1, Ilaro 2, Ilaro 3, Iwoye, Idogo/Ipaja, Owode 1, Owode 2, Ilobi/Erinja, Ajilete and Oke–odan). The below figures 2 and 3 show the distribution pattern of the secondary schools and settlement pattern in Yewa South Local Government.

![Figure 2. Distribution of schools](image_url)
Figure 3. Distribution of settlements in Yewa south local government.

3.2. Spatial accessibility to secondary schools and travel distance analysis

Network analysis was performed in GIS environment to evaluate the accessibility pattern, nearest school to students and a set of origin to destination (OD) matrix was also carried out. Neighbourhood Centroid - to -Schools was used for both nearest school and origin – destination analysis in order to find the shortest distance. The road network analysis carried out between the students’ residents and school locations show different categories of distances students need to travel to get to their various schools.

3.2.1. Travel distance analysis. The travel distance analysis between settlements and school locations for all the secondary schools in each ward reveal the mean distance of 0.88km for Yewa College High School, 0.97km Auntie Kemi Model School, 0.25km Poly Staff college, 1.39km Idojo/ Ipaja High School, 0.97km Area Community Secondary School, 0.94km Baptist High School, 0.63km Itoju High School, 0.27km Anglican high School, 0.25km Emmanuel high School, 0.42km Deuteronomy Secondary school, 1.05km Owode Secondary School, 0.60km Area Community High School, 0.62km Able God Secondary School, 2.51km Holy Child Secondary School, 1.15km Glorious Foundation School, 0.84km Army Day Secondary School, 1.77km Kings College, 2.18km Queen Unique Secondary School, 2.87km Oke Odan Grammar School, 0.13km Muslim Progressive High School, 1.67km Optimum Model School, 1.38km Ipade Ola School, 0.35km Oronna High School, 1.23km Iwoye High School and 1.19km Ajilete High School. In all, Muslim Progressive High School has the least mean distance with 0.13km and Oke Odan Grammar School has the highest mean distance with 2.87km.

However, effort was made to show the results of the whole of 25 secondary schools for network analysis ward by ward in the local government to see the travel pattern of students from their settlements.
to their various schools, and the result of the distance students travel from their settlements to their various schools was shown for all the secondary schools in each ward. See figure 4 to 12.

**Figure 4a.** Yewa college  
**Figure 4b.** Auntie kemi  
**Figure 4c.** Poly staff college

**Figure 4.** Result of distance travelled by students to school in Ilaro ward 1.

**Figure 5a.** Idogo/IPaja high school  
**Figure 5b.** Area high school

**Figure 5.** Result of distance travelled by students to schools in Idogo/IPaja ward.
Figure 6a. Baptist high school

Figure 6b. Emmanuel high school

Figure 6c. Deuteronomy secondary school

Figure 6d. Itolu high school

Figure 6e. Anglican high school

Figure 6. Result of distance travelled by students to schools in Ilaro ward 3.
Figure 7a. Owode Secondary School

Figure 7b. Area Comm. High School

Figure 7c. Able God school

Figure 7d. Holy child school

Figure 7e. Glorious school

Figure 7. Result of distance travelled by students to schools in Owode ward 2.
Figure 8a. Army day secondary school

Figure 8b. Kings college

Figure 8c. Queen unique school

Figure 8. Result of distance travelled by students to schools in Owode ward 1.

Figure 9a. Muslim progressive high school

Figure 9b. Oke Odan grammar school

Figure 9. Result of distance travelled by students to schools in Oke Odan ward.
Figure 10a. Oronna high school

Figure 10b. Ipade Ola model school

Figure 10c. Optimum model school

Figure 10. Result of distance travelled by students to schools in Ilaro ward 2.

Figure 11. Result of distance travelled by students to schools in Iwoye ward.

Figure 12. Result of distance travelled by students to schools in Ajilete ward.
3.3. **Accessibility level assessment using UNESCO standard**

The total sample in the Local Government area is four hundred and fifteen (415) students using total population of students in each school as a frame. To validate the result from network analysis using GIS, the accessibility level was also examined from the information obtained from the respondents. The responses of students with respect to distance they travel from their residents to their various schools were categorized based on the UNESCO standard of 2km (walking distance to school) to determine number of students that are disadvantaged in terms of distance to schools.

The first categories are the percentage of those that travel below 2km, these include; Oronna high School 86.6%, Optimum success College 66.67%, Ipade Ola Model School 100%, Muslim Progressive High School 94.44%, Deuteronomy Model School 100%, Anglican High school 100%, Emmanuel High School 76.92%, Baptist High School 58.33%, Area Community high school 100%, Auntie Kemi Model School 83.33%, Poly Staff College 100%, Ajilete High School 57.14%, Able God School 100% and Glorious Foundation School 57.14% while the second categories are the percentage of those that travel above 2km, these include; Oke Odan Grammer school 77.78%, Itolu High School 53.57%, Yewa College High school 81.88%, Queen Unique Secondary School 85.71%, Army Day Secondary school 73.08%, Area Community High School 57.14%, Owode Secondary school 65.85% and Holy Child School 66.67%.

Out of 415 respondents, 210 students travel below 2km to their schools which constitute 50.60% total number of students in the local government area while 205 students travel above 2km to their schools which constitute 49.40%. This means, students that travel below 2km distance to secondary schools constitutes the highest percentage which is informed by nearness of secondary schools to their residents while students that travelled above 2km distance to secondary school constitutes the lowest percentage which is informed by school facilities, peer group, absence of secondary school, availability of teachers and parental influence.

3.4. **A model of spatial redistribution of secondary schools in the study area**

3.4.1. **Classroom capacity.** The third objective of this study is to propose a model for redistribution of secondary schools in Yewa South. To achieve this objective, (UNESCO standard 2002) model was used (classroom capacity 1 teacher: 30 Students) with the total population of students in each classroom to get the number of classrooms needed.

| S/n | Name of School       | Total Enrolment | No of Classroom | Classroom Capacity | Excess | No of classroom needed |
|-----|----------------------|-----------------|-----------------|--------------------|--------|------------------------|
| 1.  | Yewa College         | 1434            | 14              | 420                | 1014   | 48                     |
| 2.  | Emmanuel High. Sch.  | 208             | 3               | 90                 | 118    | 7                      |
| 3.  | Muslim High Sch.     | 504             | 8               | 240                | 264    | 17                     |
| 4.  | Area Comm. Sch.      | 996             | 9               | 270                | 726    | 33                     |
| 5.  | Anglican High Sch.   | 190             | 3               | 90                 | 100    | 6                      |
| 6.  | Itowe High Sch.      | 322             | 6               | 180                | 142    | 11                     |
| 7.  | Itolu High Sch.      | 1131            | 9               | 270                | 861    | 38                     |
| 8.  | Iwoye High school    | 142             | 3               | 90                 | 52     | 5                      |
| 9.  | Oronna high Sch.     | 511             | 5               | 150                | 361    | 17                     |
| 10. | Owode Sec. Sch.      | 1190            | 9               | 270                | 920    | 40                     |
| 11. | Army Day Sch.        | 1121            | 10              | 300                | 821    | 37                     |
| 12. | Baptist High Sch.    | 80              | 3               | 90                 | -      | 3                      |
| 13. | Idogo Ipaia High Sch.| 53              | 3               | 90                 | -      | 3                      |
| 14. | Area High Sch.       | 69              | 3               | 90                 | -      | 3                      |
| 15. | Oke – Odan Gram Sch. | 58              | 3               | 90                 | -      | 3                      |
|     | Total                | 8009            | 91              | 2730               | 5379   | 271                    |

Total population/ 30 = Number of classrooms
1434/30 = 47.8 ≈ 48 (forty eight classrooms) are needed in Yewa College senior secondary school.
Table 2. Junior school classroom capacity.

| S/n | Name of School       | Total Enrolment | No of Classroom | Classroom Capacity | Excess (No of classroom needed) |
|-----|----------------------|-----------------|-----------------|-------------------|---------------------------------|
| 1.  | Yewa College         | 1747            | 15              | 450               | 1297                            |
| 2.  | Emmanuel High. Sch. | 281             | 3               | 90                | 191                             |
| 3.  | Muslim High Sch.     | 398             | 7               | 210               | 188                             |
| 4.  | Area Comm. Sch.      | 2161            | 10              | 300               | 1861                            |
| 5.  | Anglican High Sch.   | 361             | 3               | 90                | 271                             |
| 6.  | Iyewa High Sch.      | 393             | 8               | 240               | 153                             |
| 7.  | Itolu High Sch.      | 1338            | 12              | 360               | 978                             |
| 8.  | Iwoye High school    | 474             | 3               | 90                | 384                             |
| 9.  | Oronna High sch.     | 789             | 7               | 210               | 579                             |
| 10. | Owode Sec. Sch.      | 1253            | 10              | 300               | 953                             |
| 11. | Army Day Sch.        | 1806            | 9               | 270               | 1536                            |
| 12. | Baptist High Sch.    | 149             | 3               | 90                | 59                              |
| 13. | Idogo Ipaja High Sch.| 207             | 3               | 90                | 117                             |
| 14. | Area High Sch.       | 233             | 3               | 90                | 143                             |
| 15. | Oke – Odan Gram Sch. | 380             | 3               | 90                | 290                             |
|     | **Total**            | **11970**       | **99**          | **2970**          | **9000**                        |

Total population/30 = Number of classrooms

\[
1747/30 = 58.2 \approx 58 \quad \text{(fifty eight classrooms)} \quad \text{are needed in Yewa College Junior secondary school.}
\]

The UNESCO sets 1:30 as a model for classroom capacity. This simply means one teacher per thirty students in a class. None of the secondary schools in the study area meets this standard. Therefore, effort was made to calculate the needed number of classroom as against the observed number of classrooms in each school. The calculation for the needed number of classrooms was done by considering the total population of students in each school. The total population of students was divided by thirty (30) to ascertain the number of classrooms needed and this was documented in tables 1 and 2.

4. Conclusions

This study investigated the spatial distribution and accessibility to secondary educational Institutions in Yewa South Local Government, Ogun State and the factors responsible. It also proposes framework for effective placement of students to secondary schools in the study areas, using UNESCO Standard (walking to school 2km and classroom capacity 1:30). Other analyses to aid decision for future planning were carried out using Network analysis within a GIS environment. This research has been able to demonstrate the dynamic capabilities of Geographic Information System application in spatial distribution and accessibility to secondary schools analysis in Yewa South Local Government Area.

This study will help zonal educational authorities and ministry of education to visualize the location of secondary schools on the map and also to consider the nature of accessibility when placing students to secondary school.
References

[1] Biba, S, K M Curtin, and G Manca. (2010) "A new method for determining the population with walking access to transit." International journal of geographical information Science: 347-364.

[2] Denga. D.I. (2000) Evolving a new education culture: The universal basic education focus international journal of research in basic and life-long education, VOL. 1 (1&2), pp. 1-6

[3] Eamon, M. K. (2005). Social-demographic, school, neighborhood, and parenting influences on academic achievement of Latino young adolescents. Journal of youth and adolescence, 34(2), 163-175.

[4] Geurs K. T. and Ritsema J.R. (2001). Accessibility measures, review and applications. Bilthoven, Rijksinstituut voor Volksgezondheid en milieu (RIVM).

[5] Handy, S. L. (1997) Measuring accessibility: an exploration of issues and alternatives “Environment and planning 29: 1175 – 1194.

[6] Ijaduola K A (1998). Education in Nigeria: An historical perspective. Ijebu-Ode: published by Lucky Odoni (Nig.) Enterprises, pp 68 – 90.

[7] Jong T. and Ritsema J.R (1999), “Accessibility analysis and spatial competition effects in the context of GIS – supported service location planning.” Compute, environ. and urban system.

[8] Jong T., Ritsema J. and Toppen F. J. (2001). “GIS as a tool for location service center.” proceedings of the second European GIS conference (EGIS): 509 – 517.

[9] Lu, Y. (2004). Evaluation of accessibility to primary schools, pp 26 – 31.

[10] Ogun State Education Hand Book (2007). Trends in educational development in Ogun State 229 - 233.

[11] Oni, A. O. (2007a). Graph-theoretic analysis of intra-community road network: Case study of Covenant University, Nigeria. Paper presented at the college seminar/workshop held at college of science & technology conference room, Covenant University, Ota, Nigeria.

[12] Oni, A. O. (2007b). Analysis of accessibility and connectivity of Ikeja arterial roads. Paper presented at the 1st national conference organized by department of estate management, Yaba College of Technology, Lagos.

[13] Owolabi, J. (2006). Quantitative methods of educational planning. Moboroda: Published by Lucky Odoni Enterprises, Nigeria.

[14] Sikdar P.K., Kanagadurai, B, Mahesh Chand and Singh A.K. (2002), “ Rural road network planning based on functional accessibility”, proceedings of the international conference on advances in civil engineering, january 3-5, IIT Kharagpur.

[15] Sikdar, P.K, Kanagadurai, B, Prasada Rao, I., and Jain, P.K., (2002) “GIS based functional accessibility approach for rural road network planning – a case study”, ROTRAN 2002, IIT Kharagpur, Vol-II, pp 57-69.

[16] Taiwo C O (1980). The Nigerian education system: Past present and future lagos: Thomas Nelson (Nigeria) Ltd., pp 66 – 90.

[17] World Bank (2002). Human development sector for African region, Uganda post primary education.