

# School Mapping, Spatial Distribution and Enrolment Patterns in Public Junior Secondary Schools in Kwara State, Nigeria

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## Abstract:

Equitable access to junior secondary education depends not only on enrolment expansion but also on the spatial distribution of schools and the adequacy of physical infrastructure. In Kwara State, Nigeria, concerns persist regarding uneven school location, disparities in facilities, and fluctuating enrolment patterns. Despite the relevance of school mapping as a planning tool, limited empirical studies have integrated geospatial distribution, infrastructural assessment, and longitudinal enrolment data within a single analytical framework. This study examined school mapping, spatial distribution, physical resource allocation, and enrolment patterns in public junior secondary schools in Kwara State. A descriptive survey design was adopted, complemented with geospatial and descriptive statistical analyses. The population comprised 230 public junior secondary schools and 35,929 JSS 3 students. Spatial coordinates were collected using GPS and analysed with ArcGIS, including Average Nearest Neighbour Analysis to determine distribution patterns. Facility data were obtained through structured checklists, while enrolment data covering the 2013/2014–2019/2020 academic sessions were sourced from official records. The findings revealed clustered school distribution in major urban LGAs and more dispersed patterns in rural areas. Urban centres recorded higher enrolment but also showed signs of infrastructural strain, including classrooms requiring repairs and insufficient seating. Enrolment increased steadily until 2017/2018 before declining toward 2019/2020. The study concludes that spatial concentration does not necessarily ensure infrastructural adequacy and that integrated geospatial planning is essential for equitable and efficient resource allocation. By combining spatial, infrastructural, and longitudinal enrolment data, the research contributes context-specific evidence to

strengthen educational planning in Kwara State.

**Keywords:** School Mapping, Spatial Distribution, Enrolment Patterns, Geospatial Analysis, Educational Planning

**Abstrak:**

*Akses yang adil terhadap pendidikan menengah pertama tidak hanya bergantung pada perluasan pendaftaran tetapi juga pada distribusi spasial sekolah dan kecukupan infrastruktur fisik. Di Negara Bagian Kwara, Nigeria, kekhawatiran tetap ada mengenai lokasi sekolah yang tidak merata, kesenjangan fasilitas, dan pola pendaftaran yang berfluktuasi. Terlepas dari relevansi pemetaan sekolah sebagai alat perencanaan, studi empiris yang mengintegrasikan distribusi geospasial, penilaian infrastruktur, dan data pendaftaran longitudinal dalam satu kerangka analitis masih terbatas. Studi ini meneliti pemetaan sekolah, distribusi spasial, alokasi sumber daya fisik, dan pola pendaftaran di sekolah menengah pertama negeri di Negara Bagian Kwara. Desain survei deskriptif diadopsi, dilengkapi dengan analisis geospasial dan statistik deskriptif. Populasi terdiri dari 230 sekolah menengah pertama negeri dan 35.929 siswa kelas 3 SMP. Koordinat spasial dikumpulkan menggunakan GPS dan dianalisis dengan ArcGIS, termasuk Analisis Tetangga Terdekat Rata-Rata untuk menentukan pola distribusi. Data fasilitas diperoleh melalui daftar periksa terstruktur, sementara data pendaftaran yang mencakup sesi akademik 2013/2014–2019/2020 bersumber dari catatan resmi. Temuan menunjukkan distribusi sekolah yang berkelompok di LGA perkotaan utama dan pola yang lebih tersebar di daerah pedesaan. Pusat-pusat perkotaan mencatat pendaftaran yang lebih tinggi tetapi juga menunjukkan tanda-tanda tekanan infrastruktur, termasuk ruang kelas yang membutuhkan perbaikan dan tempat duduk yang tidak mencukupi. Pendaftaran meningkat secara stabil hingga 2017/2018 sebelum menurun menjelang 2019/2020. Studi ini menyimpulkan bahwa konsentrasi spasial tidak selalu menjamin kecukupan infrastruktur dan bahwa perencanaan geospasial terintegrasi sangat penting untuk alokasi sumber daya yang adil dan efisien. Dengan menggabungkan data pendaftaran spasial, infrastruktur, dan longitudinal, penelitian ini memberikan bukti spesifik konteks untuk memperkuat perencanaan pendidikan di Negara Bagian Kwara.*

*Kata kunci:* Pemetaan Sekolah, Distribusi Spasial, Pola Pendaftaran, Analisis Geospasial, Perencanaan Pendidikan

## INTRODUCTION

School mapping is a core component of educational planning concerned with the systematic analysis of the location, distribution, and utilisation of educational facilities in relation to the educational needs of a population. It involves a diagnostic assessment of existing schools, enrolment patterns, physical resources, and spatial accessibility to promote efficiency, equity, and optimal use of limited educational resources (Maige et al., 2022). Through school mapping, planners are able to determine where schools are adequately distributed, where gaps exist, and where additional facilities or resources are required to meet present and future demand. In the context of junior secondary education, access to schooling is not determined solely by enrolment figures but is also shaped by the spatial arrangement of schools and the adequacy of supporting facilities (Ansong et al., 2018). Although enrolment indicates participation at a given point in time, sustained participation across the three-year junior secondary cycle depends partly on how schools are located relative to learners' residences and the quality of the learning environment. Ojiri (2022) described school mapping as the process of estimating and diagnosing school requirements, identifying appropriate communities and sites for school location, determining enrolment capacity, and guiding the distribution of educational facilities and resources. This underscores the role of school mapping as a planning instrument for rational decision-making in the education sector.

Empirical studies have highlighted the importance of spatial factors in schooling outcomes. Komakech (2015) reported that the proximity of schools to learners' homes is associated with improved attendance and academic performance, while long distances to school may contribute to truancy and irregular attendance. Similarly, Akomolafe and Adesua (2016) emphasised that the physical school environment, including location and facilities, strongly influences learners' educational experience. These findings suggest that spatial distribution and physical resources are critical variables in understanding patterns of enrolment and participation in secondary education. In Kwara State, Nigeria, the distribution of public junior secondary schools has evolved within complex political, administrative, and demographic contexts (Alabi & Saidu, 2021; Salahu, 2020). In some cases, school locations have been influenced by non-technical considerations, resulting in uneven spatial distribution between urban and rural areas. Such imbalances may lead to situations where some communities have relatively high concentrations of schools while others experience limited access, increased travel distance, and pressure on existing facilities. These conditions have implications for enrolment patterns, utilisation of school resources, and overall efficiency of the education system.

School mapping is often intensified during periods of educational expansion or large-scale reform, when governments seek to extend access and accommodate growing student populations. Ideally, this process should be guided by clearly defined catchment areas, population distribution, and demand for schooling, with the objective of optimising human, material, and financial resources (Gbesoevi & Ola, 2021; John & Ogoniek, 2018). However, despite policy efforts and planning reforms, challenges relating to uneven school distribution and inadequate facilities persist in many contexts. Previous studies have produced mixed evidence on the extent to which geographical location influences educational outcomes, indicating the need for context-specific empirical investigations (Adeniyi et al., 2024; Hassan et al., 2025). Conceptually, school mapping entails the identification of existing inadequacies in school location, spacing, facilities, classrooms, furniture, and other infrastructural resources, with a view to improving access and equity (Akudo et al., 2021). It provides a framework for coordinating the establishment and management of schools in line with demographic realities and educational standards. By enhancing access and ensuring more balanced allocation of resources, effective school mapping can support improved enrolment patterns and more efficient utilisation of educational infrastructure (Adebayo & Ileuma, 2023). Given these considerations, there is a need for a systematic assessment of the spatial distribution of public junior secondary schools in Kwara State, alongside an examination of associated enrolment patterns and physical resources. Such an analysis is essential for understanding how existing school locations correspond with enrolment distribution across local government areas and for providing evidence to inform educational planning and policy decisions. Consequently, this study examines school mapping, spatial distribution, and enrolment patterns in public junior secondary schools in Kwara State, Nigeria.

One of the fundamental responsibilities of government is to ensure

equitable provision of social services, including education, across both urban and rural areas. In the education sector, this responsibility entails deliberate and evidence-based planning to ensure that schools are appropriately located, adequately resourced, and accessible to the populations they are intended to serve. Effective spatial distribution of schools is therefore central to achieving equitable access and efficient utilisation of educational facilities. In Kwara State, concerns persist regarding the spatial distribution of public junior secondary schools and the adequacy of educational facilities across local government areas (Abdulazeez, 2021; Mustapha et al., 2016). Observations suggest that while some urban locations have relatively high concentrations of schools and enrolment, other areas—particularly rural communities—may experience limited access, longer travel distances to school, and uneven allocation of physical resources. Such disparities have the potential to influence enrolment patterns, strain existing infrastructure in high-demand areas, and contribute to the underutilization of schools in less accessible locations. Despite the importance of school mapping as a planning tool, there is limited empirical evidence that systematically examines how public junior secondary schools in Kwara State are spatially distributed in relation to enrolment patterns and the availability of physical resources. Existing planning decisions are often implemented without comprehensive geospatial analysis that integrates school location, catchment areas, and enrolment distribution. This gap constrains the ability of policymakers and educational planners to make informed decisions aimed at improving equity, accessibility, and efficiency within the junior secondary school system.

Furthermore, although enrolment data are routinely collected, they are rarely analysed alongside spatial distribution and resource availability to assess whether current school locations adequately correspond to population demand across urban and rural settings. The absence of such integrated analysis limits understanding of how spatial factors shape enrolment patterns and the effective utilisation of public junior secondary schools in the state. Against this background, the problem addressed in this study is the lack of systematic, spatially informed analysis of school mapping, distribution of public junior secondary schools, and associated enrolment patterns in Kwara State, Nigeria. Addressing this problem is necessary to provide empirical evidence that can guide educational planning, support more balanced allocation of resources, and enhance access to junior secondary education across the state.

This study is guided by a set of research questions focusing on public junior secondary schools in selected Local Government Areas of Kwara State. **Firstly**, what is the spatial pattern of distribution of public junior secondary schools across the selected Local Government Areas? **Secondly**, how are physical resources—including classrooms, seating facilities, blackboards, water supply, toilets, and health facilities distributed among public junior secondary schools in Kwara State across urban and rural Local Government Areas? **Thirdly**, what are the enrolment patterns of public junior secondary schools in Kwara State from the 2013/2014 to the 2019/2020 academic sessions across the selected Local Government Areas? Through these sequential questions, the study seeks to provide a comprehensive

understanding of spatial distribution, resource allocation, and enrolment dynamics within public junior secondary education in Kwara State.

School mapping is a systematic and analytical process within educational planning that focuses on the rational provision, distribution, and utilisation of educational facilities to meet the educational needs of a defined population within a specific geographical area (Obasi, 2018). Historically, school mapping emerged from detailed analyses of educational systems and teaching-learning conditions across regions and sub-regions, to inform evidence-based decisions for future educational development (Bifuh-Ambe, 2025).

The primary objective of school mapping is to enhance access to education by ensuring that schools are appropriately located, adequately resourced, and efficiently utilised. As an integral component of educational planning, school mapping addresses both the spatial distribution of educational institutions and the allocation of physical resources such as classrooms, furniture, and instructional materials. Akudo et al. (2021) described school mapping as a continuous process of determining and reviewing the school network and educational facilities to ensure internal efficiency and alignment with educational goals and objectives within a given geographical area. This process is particularly relevant at the state and local government levels, where educational needs and resource constraints are more clearly defined.

School mapping is closely related to micro-level educational planning and school plant planning. It involves periodic assessment of the availability, condition, and utilisation rates of educational facilities to identify deficiencies, redundancies, and future needs (John & Ogondiek, 2018). Through the systematic collection and analysis of demographic data and information on existing facilities, school mapping provides a basis for decisions regarding the relocation of underutilised facilities, the expansion of overcrowded schools, and the establishment of new institutions in underserved areas. Gbesoevi and Ola (2021) defined school mapping as a set of techniques and procedures used to identify future educational needs at the local level and to plan measures required to meet those needs. According to Obasi (2018), school mapping adopts a forward-looking and dynamic approach that links educational policies with infrastructure, staffing, and equipment requirements.

The school map and school plant represent the physical manifestation of a society's educational goals, programmes, and priorities. Consequently, the development of educational facilities should follow clearly defined educational objectives rather than precede them. Nurhayati (2021) emphasised that when school infrastructure development is not guided by systematic planning, it results in inefficiencies such as uneven distribution of schools, underutilization of facilities, and inequitable access to education. Barrett et al. (2019) further outlined the scope of school mapping to include the rationalisation of existing facilities – through consolidation, relocation, or improved utilisation of staff and infrastructure as well as the provision of new facilities, including additional schools, classrooms, personnel, and equipment. Overall, school mapping serves as a critical planning tool for promoting equity, efficiency, and effectiveness in the

education system by aligning educational infrastructure with population distribution and enrollment demand.

Students' retention in junior secondary schools refers to the ability of the education system to ensure that students who are enrolled at the beginning of the junior secondary cycle remain in school until the completion of the programme (Uchegbue & Amalu, 2020). Retention is widely regarded as an important indicator of internal efficiency in education, as it reflects the extent to which educational resources invested in students result in successful programme completion (Caruth, 2018). Scholars have identified multiple factors that influence student retention at the junior secondary school level, including school-related variables (location, physical facilities, learning environment, and administrative practices) and student-related factors (academic preparedness and socio-economic background) (Bala, 2025; Koomson, 2019; Mduwile, 2025). Talbert (2012) emphasised that effective enrolment practices, particularly ensuring appropriate student placement and readiness for the level of education, can enhance persistence and reduce attrition. When students' abilities are well matched to the academic demands of the programme, schools are more likely to experience higher levels of retention.

Within the context of educational planning, school location and facility adequacy are frequently discussed as structural factors that may influence students' continued participation in schooling. Long travel distances, inadequate classrooms, insufficient seating, and poor sanitary facilities may affect attendance patterns and learning conditions, which in turn can influence students' progression through the junior secondary cycle. Although retention is shaped by multiple interacting factors, the spatial distribution of schools and the availability of physical resources remain important considerations in planning for improved educational outcomes (Barrett et al., 2019).

In the present study, students' retention is conceptually linked to school mapping through enrolment continuity at the junior secondary level. By examining how schools are spatially distributed and how physical resources are allocated across different locations, the study provides a framework for understanding how planning decisions may relate to enrolment patterns and the completion of the junior secondary school cycle. The literature reviewed indicates that school mapping is a foundational tool in educational planning that supports equitable access, efficient resource utilisation, and informed decision-making. It also highlights that students' retention at the junior secondary level is a key indicator of educational system efficiency and is potentially influenced by structural factors such as school location and facility adequacy. These concepts provide the theoretical grounding for examining school mapping, spatial distribution, and enrolment patterns in public junior secondary schools in Kwara State, Nigeria.

## RESEARCH METHOD

This study adopted a descriptive survey research design complemented with geospatial and descriptive statistical analyses. The design was considered appropriate because it enabled the systematic description of existing conditions relating to the spatial distribution of public junior secondary schools, the

availability of physical facilities, and enrolment patterns across Kwara State without manipulation of variables. The study was conducted in Kwara State, Nigeria, which is administratively divided into three senatorial districts: Kwara Central, Kwara North, and Kwara South. The state comprises a mixture of urban and rural settlements with varying levels of population density, infrastructural development, and access to educational facilities. Public junior secondary schools in the state operate under the Universal Basic Education programme. The population of the study consisted of all public junior secondary schools in Kwara State and all students enrolled in these schools. Specifically, the population included 230 public junior secondary schools and 35,929 students who progressed to Junior Secondary School Three (JSS 3) across the state during the period under review.

Based on official enrolment records: Kwara Central Senatorial District had 102 public junior secondary schools with 19,510 JSS 3 students; the Kwara North Senatorial District had 80 public junior secondary schools with 11,325 JSS 3 students; and the Kwara South Senatorial District had 48 public junior secondary schools with 5,094 JSS 3 students. A multi-stage sampling procedure was employed for the study. Stage One: Stratified random sampling was used to categorise public junior secondary schools into the three senatorial districts (Kwara Central, Kwara North, and Kwara South) to ensure geographical representation. Stage Two: Purposive sampling was adopted to focus exclusively on JSS 3 students, as the study emphasised students who had completed the junior secondary school cycle. This resulted in a total of 35,929 JSS 3 students across the state. Stage Three: A proportional sampling technique was applied using 10% of the JSS 3 population in each senatorial district.

This yielded: 1,951 JSS 3 students from Kwara Central, 1,133 JSS 3 students from Kwara North, and 509 JSS 3 students from Kwara South. Stage Four: A simple random sampling technique was used to select the final respondents from each senatorial district, resulting in a total sample size of 3,593 JSS 3 students. In addition, all 230 public junior secondary schools in the state were included for the spatial and facilities assessment, making the school-level component of the study a census. Both primary and secondary data were used for the study.

Primary data were obtained through direct observation of school facilities and the collection of spatial coordinates of school locations. Secondary data were sourced from official records of the Kwara State Ministry of Education and the State Universal Basic Education Board (SUBEB). These records included enrolment data for public junior secondary schools from JSS 1 to JSS 3 for seven consecutive academic sessions (2013/2014–2019/2020). Two checklists were designed based on the study variables: Location of Schools Checklist (LSC): This instrument was used to collect information on the spatial location of schools, accessibility, and geographical positioning. School Facilities Checklist (ScFC): This checklist was used to assess the availability and condition of physical facilities such as classrooms, seating facilities, blackboards, water supply, toilet facilities, and school health facilities. The instruments (LSC and ScFC) were subjected to face and content validity by experts in educational planning and administration to ensure that they adequately measured the variables of interest. Necessary modifications

were made based on the experts' recommendations before final administration.

Data were collected through field visits to public junior secondary schools. Spatial coordinates of school locations were obtained using a Global Positioning System (GPS) device, while physical facilities were assessed using the School Facilities Checklist. Enrolment data were extracted from official administrative records to ensure accuracy and reliability. The data collected were analysed using both geospatial and descriptive statistical techniques. Geospatial analysis was conducted using ArcGIS software, including the application of the Average Nearest Neighbour Analysis (ANNA) to determine the spatial distribution patterns of public junior secondary schools. Descriptive statistics, including frequency counts, percentages, mean, and standard deviation, were used to analyse enrolment patterns and the distribution of physical facilities. Approval to access school records and facilities was obtained from the appropriate educational authorities. The study relied solely on institutional data, and no personal identifying information of students was collected, ensuring confidentiality and ethical compliance.

## RESULTS AND DISCUSSION

### Results

Research Question 1: What is the spatial pattern of distribution of public junior secondary schools across selected Local Government Areas in Kwara State?

The spatial distribution of public junior secondary schools across selected Local Government Areas (LGAs) in Kwara State was examined using descriptive statistics and geospatial analysis. Attribute and spatial data were analysed using ArcGIS, and the Average Nearest Neighbour Analysis (ANNA) was employed to determine whether the distribution of schools in each LGA was clustered, random, or dispersed.

**Table 1 Distribution of Public Junior Secondary Schools and Enrolment Across Selected Local Government Areas in Kwara State**

Senatorial District	LGA	Locality	Number of Schools	Percentage of Schools (%)	Total Enrolment (2013/14–2019/20)	Enrolment (%)
Kwara Central	Ilorin West	Urban	70	68.63	171,064	83.87
		Rural	32	31.37	32,892	16.13
	Asa	<b>102</b>	<b>100.00</b>	<b>203,956</b>	<b>100.00</b>	
Kwara South	Ifelodun	Urban	57	71.25	37,682	78.00
		Rural	23	28.75	10,626	22.00
	Isin	<b>80</b>	<b>100.00</b>	<b>48,308</b>	<b>100.00</b>	
Kwara North	Moro	Urban	27	56.25	28,583	57.60
		Rural	21	43.75	21,002	42.40
	Pategi	<b>48</b>	<b>100.00</b>	<b>49,585</b>	<b>100.00</b>	
<b>Aggregate</b>			<b>230</b>		<b>301,849</b>	

*Note.* Enrolment figures represent cumulative enrolment from JSS 1 to JSS 3 for the period 2013/2014–2019/2020.

The results in Table 1 indicate an uneven spatial distribution of public junior secondary schools across the selected LGAs. Urban LGAs consistently recorded higher numbers of schools and enrolment compared to their rural counterparts. Ilorin West LGA accounted for the highest proportion of schools (68.63%) and enrolment (83.87%) within Kwara Central Senatorial District, while Asa LGA recorded comparatively lower figures. A similar pattern was observed in Kwara South and Kwara North Senatorial Districts, where Ifelodun and Moro LGAs recorded higher concentrations of schools and enrolment than Isin and Pategi LGAs, respectively.

Further spatial analysis using the Average Nearest Neighbour Analysis (ANNA) revealed variations in distribution patterns across LGAs. In Ilorin West LGA, the Nearest Neighbour Ratio (NNR = 0.797,  $z = -3.25$ ) indicated a statistically significant clustered pattern of school distribution. Similarly, Ifelodun LGA exhibited a clustered pattern (NNR = 0.700,  $z = -4.33$ ), suggesting a concentration of schools around major settlements. In contrast, Moro LGA demonstrated a dispersed pattern of distribution, as indicated by a Nearest Neighbour Ratio of 2.40 with a positive  $z$ -score of 4.62, reflecting wider spacing between schools. Visual inspection of spatial maps further suggested relatively random to dispersed patterns in Asa and Isin LGAs, while Pategi LGA showed evidence of localised clustering around specific settlements. Overall, the findings indicate that the spatial distribution of public junior secondary schools in Kwara State varies across LGAs, with clustered patterns more prominent in urban areas and dispersed or random patterns more common in rural areas.

Research Question 2: How are physical resources distributed among public junior secondary schools in Kwara State across urban and rural Local Government Areas?

The distribution of physical resources in public junior secondary schools across selected Local Government Areas (LGAs) in Kwara State was examined using descriptive statistics. The physical resources assessed included classrooms, seating facilities, blackboards, sources of safe water, toilet facilities, and school health facilities. Results are presented according to urban and rural LGAs to highlight spatial variations in resource availability.

**Table 2 Distribution of Classrooms and Classroom Conditions in Public Junior Secondary Schools in Kwara State**

LGA	Locality	Number of Classrooms	% of Total Classrooms	Classrooms Under Construction (%)	Classrooms in Need of Major Repair (%)	Classrooms with Insufficient Seating (%)
Ilorin West	Urban	446	40.8	27.7	36.8	39.9
Asa	Rural	141	12.9	13.4	10.0	11.4
Ifelodun	Urban	199	18.2	46.3	24.6	18.3
Isin	Rural	76	7.0	4.9	2.8	6.2
Moro	Urban	140	12.8	4.0	13.6	17.1
Pategi	Rural	91	8.3	3.7	12.2	7.1
<b>Total</b>		<b>1,093</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Note.* Percentages are based on the total number of classrooms and reported conditions across the selected LGAs.

The results in Table 2 indicate notable disparities in the distribution and condition of classroom facilities across the LGAs. Ilorin West LGA accounted for the highest proportion of classrooms (40.8%), followed by Ifelodun LGA (18.2%). Rural LGAs, particularly Isin and Asa, recorded the lowest proportions of classrooms. A substantial proportion of classrooms under construction was observed in Ifelodun LGA (46.3%), while Ilorin West LGA recorded the highest proportion of classrooms in need of major repairs (36.8%) and classrooms with insufficient seating (39.9%).

**Table 3 presents the distribution of other key physical resources, including blackboards, water supply, toilet facilities, and school health facilities.**

**Distribution of Selected Physical Resources in Public Junior Secondary Schools in Kwara State**

Resource Category	Key Findings Across LGAs
Blackboards	Usable blackboards were most prevalent in Ilorin West LGA (57.7%), while rural LGAs recorded substantially lower proportions.
Safe Water	Boreholes and wells constituted the main sources of water in most LGAs; some schools reported no access to safe water.
Toilets	Pit and flush toilets were the dominant toilet types, with pit toilets more common in rural LGAs.
Health Facilities	First aid boxes were the most commonly available health facility; sick bays and employed nurses were scarce across most LGAs.

*Note.* Detailed distributions by LGA are reported in the study dataset.

Overall, the findings reveal an uneven distribution of physical resources across public junior secondary schools in Kwara State. Urban LGAs generally recorded higher availability of classrooms and facilities, while rural LGAs showed lower levels of infrastructure provision. Variations were also observed in the condition and adequacy of facilities, indicating differences in the quality of the learning environment across locations.

Research Question 3: What are the enrolment patterns of public junior secondary schools in Kwara State from the 2013/2014 to 2019/2020 academic sessions across the selected Local Government Areas?

Students' enrolment patterns in public junior secondary schools across selected Local Government Areas (LGAs) in Kwara State were examined using descriptive statistics. Enrolment data covering the 2013/2014 to 2019/2020 academic sessions were aggregated for Junior Secondary School (JSS) levels 1–3 to identify spatial and temporal variations across urban and rural LGAs.

Table 4 presents cumulative enrolment figures by LGA and senatorial district for the period under review.

**Cumulative Enrolment in Public Junior Secondary Schools Across Selected LGAs in Kwara State (2013/2014–2019/2020)**

Senatorial District	LGA	Locality	Cumulative Enrolment	Percentage (%)
Kwara Central	Ilorin West	Urban	171,064	83.87
	Asa	Rural	32,892	16.13
<b>Total</b>			<b>203,956</b>	<b>100.00</b>

Kwara South	Ifelodun	Urban	37,682	78.00
	Isin	Rural	10,626	22.00
<b>Total</b>			<b>48,308</b>	<b>100.00</b>
Kwara North	Moro	Urban	28,583	57.60
	Pategi	Rural	21,002	42.40
<b>Total</b>			<b>49,585</b>	<b>100.00</b>
<b>Aggregate</b>			<b>301,849</b>	

*Note.* Enrolment figures represent the cumulative number of students enrolled in JSS 1–3 across the 2013/2014–2019/2020 academic sessions.

The results in Table 4 show that enrolment was consistently higher in urban LGAs compared to rural LGAs across all three senatorial districts. Ilorin West LGA recorded the highest cumulative enrolment (171,064 students), accounting for 83.87% of enrolment in Kwara Central Senatorial District. In contrast, Asa LGA accounted for 16.13% of enrolment within the same district. Similar patterns were observed in Kwara South and Kwara North Senatorial Districts, where Ifelodun and Moro LGAs recorded higher enrolment figures than Isin and Pategi LGAs, respectively. To further illustrate enrolment trends over time, Table 5 presents annual enrolment figures across the academic sessions.

Table 5 Annual Enrolment Trends in Public Junior Secondary Schools in Kwara State (2013/2014–2019/2020)

Academic Session	Total Enrolment
2013/2014	39,822
2014/2015	41,306
2015/2016	43,951
2016/2017	45,783
2017/2018	47,621
2018/2019	41,960
2019/2020	41,406

*Note.* Figures represent aggregated enrolment across the selected LGAs and JSS levels.

The results in Table 5 indicate a gradual increase in enrolment from the 2013/2014 academic session to a peak in 2017/2018, followed by a decline in the 2018/2019 and 2019/2020 sessions. This pattern suggests temporal variation in enrolment levels over the study period. Overall, the findings demonstrate that enrolment patterns in public junior secondary schools in Kwara State varied across LGAs and over time, with consistently higher enrolment recorded in urban LGAs than in rural LGAs throughout the period under review.

## Discussion of Findings

The study provides an integrated assessment of how spatial configuration, infrastructural provision, and enrolment dynamics interact within the public junior secondary school system in Kwara State. Rather than reflecting a uniformly planned network, the overall pattern suggests a system shaped by demographic concentration and uneven infrastructural alignment across locations. Geospatial analysis indicates that school distribution corresponds broadly with settlement structure, with higher institutional concentration in urban centres and wider spacing in rural areas. This configuration reflects demographic density but also

signals an imbalance in access and infrastructural spread. The spatial pattern is therefore neither entirely random nor uniformly planned; instead, it reveals differentiated planning outcomes across local contexts. Infrastructure analysis further demonstrates that resource availability and adequacy do not increase proportionately with school concentration. While urban areas possess a larger share of facilities, these locations also exhibit signs of infrastructural pressure, including repair needs and capacity strain. Rural areas tend to operate with fewer facilities overall, reflecting limited infrastructural expansion. Over time, enrolment showed an upward trajectory before experiencing a decline toward the end of the study period, indicating that demand for junior secondary education is dynamic rather than static. This temporal variation underscores the need for flexible planning mechanisms capable of responding to demographic and systemic shifts.

The findings are consistent with Mustapha et al. (2016), who reported uneven spatial distribution of primary schools in Ilorin West LGA, with clustering around urban settlements. Similarly, Akudo et al. (2021) emphasised that school mapping often reveals imbalances in facility provision when planning is not systematically aligned with demographic realities. The present study extends these observations to junior secondary schools across multiple senatorial districts, confirming that spatial concentration remains a persistent planning issue. The observed association between urban concentration and higher enrolment aligns with Ansong et al. (2018), who found that geographical and infrastructural factors significantly influence junior high school enrolment patterns. Komakech (2015) also established that proximity to school positively affects attendance, which may help explain why clustered urban LGAs recorded higher enrolment levels. However, the findings also introduce nuance. While urban LGAs had higher concentrations of schools and enrolment, they simultaneously recorded significant infrastructural strain, including classrooms requiring major repairs and insufficient seating. This partially diverges from studies such as Akomolafe and Adesua (2016), which emphasised the positive role of adequate facilities in enhancing student experience. The present findings suggest that concentration of schools does not necessarily equate to optimal facility conditions; rather, high enrolment may create pressure that compromises infrastructure quality. Furthermore, the dispersed pattern observed in Moro LGA contrasts with the clustering trend seen in other LGAs, indicating that spatial configurations vary according to settlement structure and demographic density. This supports John and Ogondiek's (2018) assertion that school mapping outcomes are context-specific and influenced by local geographic and administrative dynamics.

The results signify that school mapping in Kwara State reflects broader structural patterns common in developing education systems: urban concentration of infrastructure, rural under-provision, and infrastructure strain in high-demand areas. The clustering of schools in urban LGAs corresponds with population density and administrative centralisation, but it simultaneously creates uneven access for rural communities. From a systems perspective, the findings highlight the interaction between spatial planning and internal efficiency. When schools are clustered in urban areas, rural students may face longer travel distances,

potentially affecting sustained participation and progression. At the same time, over-enrolment in urban schools may reduce facility adequacy, thereby affecting the quality of the learning environment. The temporal enrolment trend – steady growth followed by decline may reflect broader socio-economic or policy-related dynamics during the study period. While the data do not establish causation, the fluctuation underscores the need for adaptive planning mechanisms capable of responding to demographic and contextual shifts. In the larger phenomenon of educational development in Nigeria, the study reinforces the critical importance of integrating geospatial analysis into educational planning. Without systematic spatial assessment, infrastructure expansion may continue to mirror existing inequalities rather than correct them.

Several implications emerge from the findings. Educational planners in Kwara State should institutionalise routine geospatial analysis in school siting decisions. The clustered patterns in urban LGAs and dispersed or under-provided rural LGAs indicate the need for a more balanced, data-driven allocation of new schools and facilities. While increasing the number of schools in underserved rural areas is important, attention must also be given to rehabilitating and upgrading facilities in high-enrolment urban schools. Planning efforts should therefore address both expansion and quality improvement simultaneously. The urban-rural disparities in enrolment and facility distribution suggest inequitable access to junior secondary education. Addressing these disparities is essential for achieving inclusive and equitable quality education in line with national and global educational objectives. Future studies could incorporate population density data, travel-distance modelling, and student progression rates to deepen understanding of how spatial configuration influences retention and completion. Longitudinal and mixed-method approaches would further clarify the relationship between infrastructure distribution and educational outcomes. In summary, the findings demonstrate that school mapping in Kwara State reveals significant spatial and infrastructural imbalances that have direct implications for enrolment patterns and educational equity. Integrating geospatial evidence into policy and planning processes is therefore essential for promoting more balanced and efficient provision of junior secondary education across the state.

## CONCLUSION

This study examined school mapping, spatial distribution, physical resource allocation, and enrolment patterns in public junior secondary schools in Kwara State using integrated geospatial and descriptive analyses. Several findings stand out as particularly significant in relation to existing literature. First, while previous studies have consistently reported uneven spatial distribution of schools – often emphasising rural under-provision this study demonstrates a more complex pattern. Urban areas not only show clustered school distribution and higher enrolment, but also exhibit substantial infrastructural strain, including classrooms requiring major repairs and insufficient seating. This finding differs from research that tends to equate higher school concentration with infrastructural advantage.

The results indicate that concentration may generate pressure on facilities

rather than automatically ensuring adequacy. Second, the identification of varying spatial configurations clustered, dispersed, and relatively random patterns across LGAs adds nuance to earlier studies that present distribution largely as a binary urban–rural imbalance. The evidence suggests that spatial patterns are context-sensitive and shaped by settlement structure and local administrative dynamics. This contributes to a more differentiated understanding of school mapping outcomes within a single state. Third, the study integrates seven years of enrolment data with spatial and infrastructural analysis. While many earlier studies examined either spatial distribution or facility adequacy independently, this research synthesises location, resource condition, and enrolment trends within one analytical framework.

The temporal fluctuation in enrolment steady growth followed by decline highlights the dynamic nature of educational demand and underscores the need for adaptable planning systems. The value of this research lies in its methodological integration and empirical scope. By combining GPS-based mapping, Average Nearest Neighbour Analysis, facility audits, and longitudinal enrolment data, the study provides a comprehensive evidence base for educational planning in Kwara State. It moves beyond descriptive counts of schools to examine how spatial configuration and infrastructure conditions relate to participation patterns. In doing so, it strengthens the application of geospatial tools in educational planning at the subnational level and offers context-specific evidence to inform more equitable and efficient resource allocation.

Despite its contributions, the study has certain limitations. First, the analysis focuses on selected LGAs rather than all LGAs in Kwara State, which may limit generalisability across the entire state. Second, the study relies primarily on descriptive and geospatial statistical techniques; it does not employ inferential modelling to establish causal relationships between spatial factors, infrastructure adequacy, and enrolment outcomes. Third, socio-economic, demographic, and household-level variables that may influence enrolment and retention were not incorporated into the analysis. Additionally, the study period ends with the 2019/2020 academic session and does not capture potential post-2020 educational disruptions or reforms. Future research should expand the spatial scope to include all LGAs in the state and incorporate population density, household characteristics, and travel-distance modelling to provide deeper insight into accessibility and equity.

The use of multivariate statistical models could help clarify the extent to which spatial distribution and infrastructural variables predict enrolment, retention, and completion rates. Longitudinal studies extending beyond 2020 would also enable examination of more recent trends and policy impacts. Furthermore, mixed-method approaches incorporating qualitative perspectives from school administrators, teachers, and students would enrich understanding of how spatial and infrastructural realities influence educational experiences on the ground. In conclusion, the study demonstrates that public junior secondary education in Kwara State is characterised by spatial concentration, infrastructural disparities, and evolving enrolment demand. By integrating geospatial analysis with facility and enrolment data, the research provides a nuanced and policy-

relevant understanding of school mapping and its implications for educational equity and planning.

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