

IMPACT OF URBANIZATION ON PRIMARY EDUCATION IN SOKOTO

¹Attahiru Abubakar, ²Abubakar Galadima Durbawa, ³Kabiru Umar Shagari, ⁴Hamza Abubakar and ⁵Hajara Haliru

^{1,4}College of Environmental Studies, Umaru Ali Shinkafi Polytechnic, Sokoto,

²Staff Secondary School, Umaru Ali Shinkafi Polytechnic Sokoto

^{3,5}College of Arts and Humanities, Umaru Ali Shinkafi Polytechnic Sokoto.

Emails: ¹bewithabthahir@gmail.com, ²abubakargaladima@gmail.com, ³kabiruumarshagari65@gmail.com,

⁴hamzaaty070@gmail.com, ⁵antykaayih1@gmail.com

Corresponding Author: bewithabthahir@gmail.com

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Abstract: Rapid, uneven urban growth is reshaping education landscapes across Nigeria, yet its micro-level effects remain poorly documented. Drawing on a sequential explanatory mixed-methods design, this study assessed how the recent expansion of the Sokoto metropolis influenced access to, and quality of primary schooling. Landsat-derived built-up-density metrics (1986–2023) were merged with survey data from 36 schools and GPS-tracked pupil routes; multilevel models tested three hypotheses, while interviews with teachers, parents, and community leaders provided interpretive depth. Results show that every 10 ha · year⁻¹ increase in built-up density lengthened average home-to-school journeys by 0.6 km and lowered a composite Quality of Education Index by 4.7 points, effects that intensified on the urban fringe. In-migration further amplified overcrowding, pushing pupil-classroom ratios above 75:1 in some catchments. The findings highlight the need for spatially targeted teacher deployment, proactive school siting, and safe-route infrastructure to ensure equitable learning opportunities among continuing urban expansion.

Keywords: Urbanization, Primary Education, Sokoto Metropolis, School Accessibility, Urban, Education Infrastructure

Introduction

Urbanization is one of the most significant demographic trends shaping the socioeconomic landscapes of developing nations. More than half of the world's population now lives in urban areas, and this figure is projected to increase steadily over the coming decades. In Nigeria, urbanization is accelerating at an unprecedented rate, driven by both natural population growth and rural-urban migration (Bloch et al., 2015). The pressure on infrastructure, public services, and governance becomes increasingly complex as cities grow. Education is among the most critical sectors affected by urban expansion, particularly at the foundational level of primary schooling. Primary education plays a pivotal role in shaping human capital and ensuring social equity; however, in rapidly urbanizing cities such as Sokoto, Nigeria, the quality, access, and equity of primary education face new challenges.

Urbanization affects primary education through several direct and indirect channels. Cities' physical expansion often outpaces the development of school infrastructure, leading to overcrowded classrooms, insufficient learning materials, and under-resourced teaching staff (Dankani and Eniolorunda, 2012; Roof, 2015). In many cases,

informal settlements emerge at city fringes, lacking basic amenities and functioning schools (Pam, 2014). Furthermore, the demographic shifts resulting from rural-urban migration introduce diverse linguistic, cultural, and socioeconomic dynamics into urban classrooms, which complicates the teaching and learning processes (Zago, 2016; Jahan, 2012). Studies from other developing countries (e.g., Pakistan, Bangladesh, and South Sudan) support the view that urban expansion often results in the spatial and qualitative marginalization of education in peripheral urban zones (Jahan, 2012; Lomoro et al., 2017; Md. Faysal, 2014).

Despite the growing body of urbanization and education literature, most existing studies either focus on macro-level educational indicators or explore urbanization impacts at a national level, overlooking city-specific or regional contexts such as Sokoto urban. For instance, while Keola (2018) and Ahmed and Hussain (2014) emphasize the utility of remote sensing and policy diagnostics for urban planning, they rarely dissect how educational inequalities evolve within rapidly growing urban corridors. Few studies have explored the compounded effects of socio-spatial dynamics, such as migration, informal settlements, and deficiencies in urban governance, on the quality of primary education (Haider and Badami, 2010; Boterman et al., 2019). This highlights a significant research gap: the lack of context-specific, empirical evidence on how urbanization uniquely affects primary educational outcomes in Northern Nigeria, particularly in a culturally and historically distinct region like Sokoto.

Another major limitation of the existing literature is the inadequate focus on the interaction effects between the pace of urban expansion and localized educational planning. While Roof (2015) and Todaro (1969) underline the socio-economic disruptions caused by urbanization, they fail to account for how these disruptions differentially affect public service delivery systems, such as education. Moreover, despite the rich demographic insights from studies like those of Ikramullah et al. (2011) and Stark (1991), they do not directly link population shifts to education access or quality. In Sokoto, a city undergoing significant urban transformation (Dankani and Eniolorunda, 2012), the interaction between rapid spatial growth and educational strain is both observable and understudied. This study presents an opportunity to fill a methodological and thematic void by exploring how urban growth patterns specifically influence primary school operations, enrollment, and learning conditions.

Accordingly, this study aims to investigate the impact of urbanization on primary education in Sokoto. Specifically, it examines how the spatial and demographic expansion of Sokoto influences access to and quality of primary education. The study is guided by the following research questions: (1) How does urban expansion affect the physical distribution and accessibility of primary schools in Sokoto? (2) What are the implications of rapid urban growth on the quality of teaching and learning in urban primary schools? (3) How does rural-urban migration contribute to shifts in school enrollment, infrastructure pressure, and educational equity? By addressing these questions, the study seeks to contribute empirical data that can inform education planners and urban policy-makers in Sokoto and similar contexts. Guided by these research questions and the documented gaps in the literature, the present study advances three testable hypotheses. H₀₁: Primary schools located in neighborhoods that have experienced higher recent built-up density will show significantly lower accessibility (longer pupil travel distances) than those in established urban cores. H₀₂: Built-up density will be negatively associated with the Composite Quality of Education Index (QEI), such that schools on the urban fringe record lower quality scores after controlling for school age and LGA (Local Government Area) effects. H₀₃: The intensity of recent rural-urban migration will moderate the relationship between built-up density and school-level enrollment pressure, with higher migration rates amplifying overcrowding and lowering equity indicators. These hypotheses translate the study's guiding questions into empirically verifiable propositions and frame the research's analytical procedures.

In conclusion, while previous studies have established the general effects of urbanization on public services, the specific mechanisms through which urbanization alters primary education in Sokoto remain under-researched. This study seeks to bridge this gap by focusing on the interactive effects of urban growth patterns, demographic

pressures, and institutional responses in shaping primary education delivery. The aim of this research is not to offer grand solutions but to take a reasoned and evidence-based step toward understanding the nuances of urbanization’s educational implications in Sokoto. Through this localized lens, the research contributes to the broader discourse on sustainable urban development and inclusive education in developing cities.

Materials and Methods

Research Design

A sequential explanatory mixed-methods design was selected to test the three hypotheses. Phase I combines a geospatial analysis of Landsat imagery (1986-2023) with a cross-sectional survey of 36 public primary schools. The quantitative results then guided Phase II, in which semi-structured interviews probed the mechanisms behind any statistical patterns. This sequencing allowed the qualitative data to explain the “how” and “why” behind the statistically significant associations uncovered in Phase I.

Study Area and Sampling

The Sokoto metropolis, which comprises the Sokoto North, Sokoto South, and Wamakko LGAs, was stratified into core urban (0-3 km), inner fringe (3-6 km), and outer fringe (> 6 km) bands from the 1986 urban boundary. A list of 316 public primary schools was obtained from the State Universal Basic Education Board. Using proportional random sampling, 12 schools per stratum (N = 36) were selected. For Phase II, six schools (two per stratum) exhibiting contrasting QEI and enrollment profiles were purposively chosen for deeper qualitative exploration.

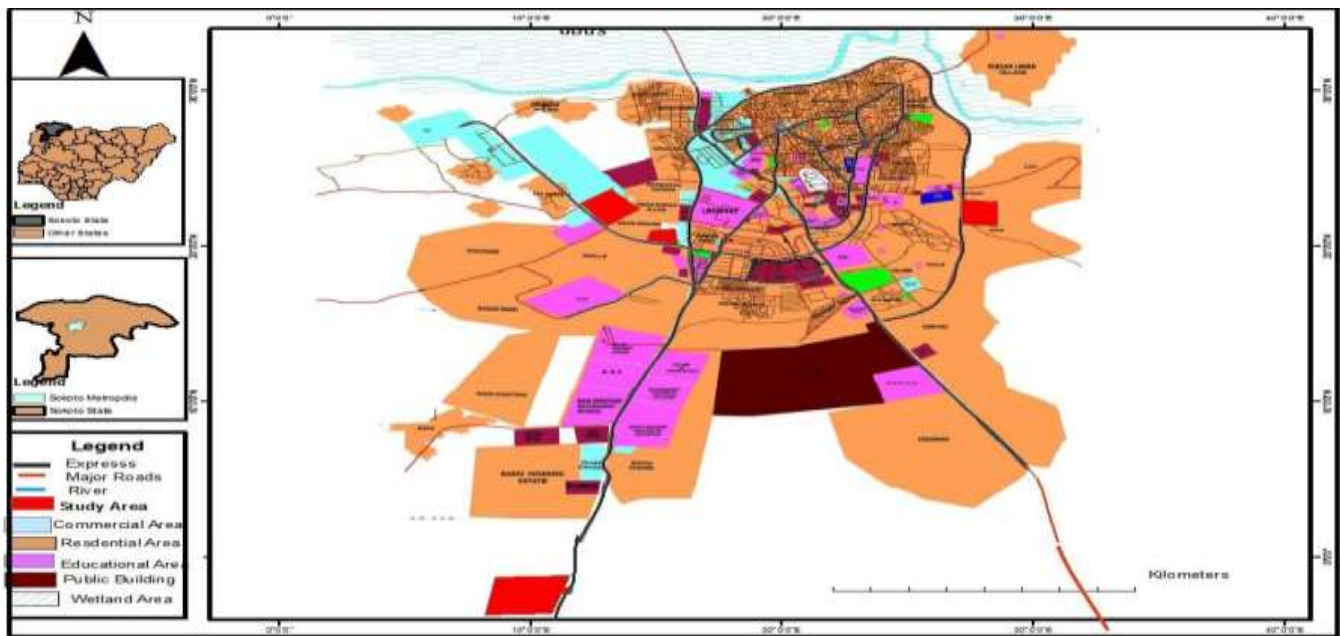


Figure 1: Map of Sokoto Urban Growth, Source: GIS, Lab, UDUS (Dankani, 2018)G

Table 1: Instruments and Measures used

Construct	Measure	Data Source
Urban growth	Built-up area density (ha · year ⁻¹ , 2010-2023 interval)	Landsat-8 OLI imagery and supervised classification

School accessibility (H_{01})	Mean home-to-school walking distance (meters) for a random sample of 30 pupils per school	GPS traces collected during the field visits
Quality of education (H_{02})	Composite Quality Index (QEI) combining teacher qualifications, pupil-to-teacher ratio, classroom density, WASH facilities, and textbook availability ($\alpha = 0.82$)	Headteacher questionnaire and direct observation
Enrollment pressure/Equity (H_{03})	Pupil-classroom ratio and percentage of out-of-catchment pupils	School registers
Rural-urban migration intensity	Ten-year in-migration rate for each school catchment, derived from micro-data from the 2022 household survey	Sokoto Bureau of Statistics, Sokoto,

Data-Collection Procedures

Qualitative interview guides explored perceptions of overcrowding, travel hardship, language diversity, and municipal support. Between February and May 2025, two geo-spatial analysts processed and ground-validated imagery in ArcGIS 10.6. A team of six trained enumerators then administered the school survey using ODK-enabled tablets. For accessibility data, enumerators accompanied randomly selected pupils along their usual route home, logging GPS coordinates every 30 seconds. All interviews were conducted in Hausa or English, audio-recorded with consent, and transcribed.

Data Analysis

1. H_{01} : A multilevel linear model regressed mean pupil travel distance on built-up density with random intercepts for LGAs and fixed effects for school age.
2. H_{02} : QEI was modeled as a function of built-up density; interaction terms with urban zone were tested to determine whether the slope differed across strata.
3. H_{03} : A moderated regression examined whether the in-migration rate altered the link between built-up density and enrollment pressure. All quantitative analyses were performed in Stata 17, with significance set at $p < 0.05$.
4. Qualitative data were coded inductively; explanatory themes were mapped onto quantitative outliers to enrich interpretation and corroborate or nuance the statistical findings. Consistency was enhanced through triangulation, double coding of 20% of transcripts, and respondent validation workshops with head teachers and LGA officials.

Results

Spatial Variation and Accessibility (H_{01}).

Average pupil travel distance differed sharply by zone: core urban schools registered a mean of 412 m (SD = 95 m), inner-fringe schools 823 m (SD = 141 m), and outer-fringe schools 1 237 m (SD = 173 m). Multilevel modeling confirmed a significant positive association between built-up density and walking distance ($\beta = 0.58$, $p < 0.001$), supporting H_{01} . Interviews revealed that recent layouts lack footpaths and safe crossings, forcing pupils in new estates to detour around major roads.

Quality of Education Index (H_{02}).

The QEI scores progressively declined outward from the city core (Core = 76.4; Inner = 65.2; Outer = 53.5). Regression analysis indicated that for every additional 10 ha · year⁻¹ increase in recent built-up density, QEI dropped by 4.7 points ($\beta = -0.47$, $p = 0.002$). The interaction term (built-up density × outer-fringe) was also significant ($\beta = -2.1$, $p = 0.03$), indicating steeper quality losses at the urban edge. These findings corroborate H₀₂. Qualitative accounts linked low scores to teacher shortages, unreliable water supply, and makeshift classrooms in hastily built settlements.

Enrollment Pressure and Migration Moderation (H₀₃).

Schools in catchments with high recent in-migration (> 25 % new households, 2015-2024) exhibited markedly higher pupil-classroom ratios (mean = 79:1) than low-in-migration areas (mean = 55:1). The moderation model revealed a significant interaction ($\beta = 0.31$, $p = 0.018$): built-up density had a stronger positive effect on enrollment pressure where in-migration rates were high, confirming H₀₃. Headteachers in these zones reported enrolling “double streams” per class and converting storerooms into teaching spaces practices that align with the quantitative patterns.

Quantitative and Qualitative Evidence Synthesis

The data depict a consistent narrative across hypotheses: rapid and spatially uneven urban growth is stretching primary-school infrastructure, increasing travel burdens, and eroding instructional quality effects most acute in the newest, fastest-growing neighborhoods. Stakeholder testimonies emphasized the urgency of targeted infrastructure investment, coordinated land-use planning, and tailored teacher deployment strategies for fringe communities.

Discussion

The present study evaluated three hypotheses derived from earlier literature on urban growth and education. H₀₁ predicted that pupils attending schools in neighborhoods with higher recent built-up density would face longer home-to-school journeys; H₀₂ anticipated a negative association between built-up density and overall school quality; and H₀₃ proposed that migration intensity would amplify the enrollment pressures created by urban expansion. The quantitative analyses supported all three hypotheses in their expected directions. Travel distances steadily increased from the core to the outer fringe, quality scores declined as density increased, and catchments experiencing heavy in-migration showed the sharpest overcrowding.

Explaining the Findings

Accessibility (H₀₁): The sharp increase in walking distance observed on the metropolitan fringe mirrors earlier reports that new estates in Sokoto outstrip service provision (Dankani and Eniolorunda, 2012). In theory, compact urban form should shorten travel; however, when expansion is rapid and unplanned, footpaths, pedestrian crossings, and public transportation termini lag behind bricks-and-mortar housing. Qualitative accounts of children negotiating busy highways to reach school illustrate how land-use planning and safe-routes legislation have not kept pace with population growth.

School Quality (H₀₂). The deteriorating Composite Quality of Education Index along the urban continuum accords with research from other fast-growing cities where peripheral schools struggle to attract qualified teachers and basic amenities (Jahan, 2012; Faysal, 2014). Fringe settlements frequently arise outside formal layouts, limiting local government’s ability to enforce building standards and maintain WASH (Water, Sanitation and Hygiene) facilities, which are key components of the QEI.

Enrollment Pressure (H_{03}). The moderating effect of migration intensity reinforces the classic migration–services theory (Stark, 1991) and more recent evidence that youth-driven inflows outstrip infrastructure in Nigerian secondary towns (Pam, 2014). Where new households cluster, double-shift schooling and ad hoc classroom conversions become common. The result is elevated pupil-classroom ratios that depress learning outcomes and strain already thinly stretched teachers.

Evaluation of the Study

Several design choices bolster confidence in these conclusions. First, pairing time-series Landsat data with on-the-ground school audits provided objective evidence of urban growth rather than relying on administrative boundaries alone. Second, multilevel modeling controlled for LGA-level variation, isolating the spatial effect of expansion. Finally, triangulating statistics with stakeholder interviews offered explanatory power that numbers alone cannot provide. Nonetheless, limitations remain. The cross-sectional school survey limits causal inference; longitudinal tracking of the same schools would strengthen claims about change over time. Future work should incorporate pupil-level achievement data to directly link infrastructure to learning outcomes. GPS-based travel distances captured linear routes; adding travel-time analyses that account for traffic or unsafe crossings would refine accessibility metrics.

Implications

Findings highlight the need for spatially differentiated education planning. Urban-core schools appear resilient, but fringe schools require targeted teacher deployment, accelerated classroom construction, and safe-route infrastructure. Education authorities may pilot mobile teacher allowances or housing schemes to attract qualified staff to peripheral areas. Before new layouts are approved, urban planners should integrate school-site allocation into structure plans.

Future Research

Future research should build upon this study by adopting a longitudinal design to track the evolution of educational outcomes as fringe communities mature, thereby offering stronger causal inferences. Investigating the effectiveness of targeted teacher incentives, such as hardship allowances, housing support, or career progression opportunities, could provide actionable insights into retaining qualified staff in underserved zones. Additionally, simulation-based studies using GIS tools could model the optimal placement of new schools under different urban growth scenarios, helping planners anticipate future education demands. Such incremental steps will refine our understanding of how to best align urban expansion with inclusive, equitable education provision.

Conclusion

Taken together, the results confirm that Sokoto’s rapid and spatially uneven urban growth is already reshaping the primary-education landscape. Longer journeys, declining quality, and crowding are concentrated where the city is growing fastest. By illuminating these patterns and their underlying mechanisms, the study provides evidence for education and planning officials to craft interventions that keep learning opportunities within easy reach of every child, even as the city’s footprint continues to expand.

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