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# Exploring Urban Student Mobility Patterns in Kebbi State, Nigeria: Education and Sustainability Implications

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**ABSTRACT**

This study examines the mobility patterns, transportation needs, and decision-making processes of urban students in Kebbi State, Nigeria. Using a mixed-methods approach combining survey research and statistical analysis, we found that transportation issues significantly impact students' access to higher education. Our results show that academic performance, socio-economic status, transportation mode, and distance to campus are significant predictors of student mobility patterns (R-squared = 0.63, Adjusted R-squared = 0.59). The findings highlight the need for student-centred mobility solutions that promote equal access to higher education, sustainable urban development, and improved academic performance. To address these challenges, policymakers should consider investing in affordable and efficient transportation systems, implementing transportation subsidies for low-income students, and promoting mixed-use development and walkable campuses. By doing so, we can create more inclusive and sustainable urban environments that support the educational and economic aspirations of urban students.

Keywords: Higher Education, Student Mobility, Transportation, Urbanization, Accessibility

## 1. Introduction

The rapid growth of urbanization has significant implications for higher education, particularly in terms of student mobility. As cities expand, understanding urban students' movement patterns becomes crucial for ensuring educational access, promoting academic performance, and supporting sustainable urban development (Xiang & Stillwell, 2023).

Urbanization has led to increased reliance on public transportation, walking, and cycling. However, limited transportation options, inadequate public transportation systems, and high transportation costs can result in reduced accessibility, decreased enrolment, and lower academic performance. This is a significant concern, as empirical studies highlight the impact of transportation on urban students' scholastic achievements and general well-being (Hopson et al., 2024).

Recent studies emphasize the importance of understanding students' mobility patterns and developing effective transportation systems catering to their unique needs (Bierbaum et al., 2021; Moreno et al., 2023). Despite this, the lack of understanding of urban students' mobility patterns and transportation needs hinders the development of effective solutions. This study addresses this knowledge gap by examining the movement patterns, decision-making processes, and related aspects of urban students pursuing higher education in Kebbi State. By exploring urban students' mobility patterns in Kebbi State, this study contributes to the creation of student-centred mobility solutions that advance equal access to higher education, encourage sustainable urban development, and improve academic performance.

1. To investigate urban students' mobility patterns and transportation needs.

2. To identify the challenges and barriers urban students face in accessing higher education due to transportation issues.

3. Examine the impact of mobility on academic performance and overall experience.

4. To develop effective solutions to improve urban students' mobility and access to higher education.

## 2. Related literature

Existing research emphasizes the importance of understanding urban students' mobility patterns, transportation modes, and decision-making processes. This literature review synthesizes existing research on urban students' mobility, exploring their transportation modes, decision-making processes, and associated factors. Previous research indicates that urban students rely heavily on public transportation, walking, and cycling (Liu et al., 2023). For example, a study by Caruth (2018) found that 60% of urban students use public transportation to commute to campus. Additionally, Trček and Mesarec (2022) discovered that walking and cycling are popular modes of transportation among urban students, with 40% using these modes regularly. Safety and security concerns impact mobility decisions for 55% of female students (Loukaitou-Sideris et al., 2024).

Studies identify affordability, convenience, accessibility, and sustainability as key factors influencing urban students' mobility decisions (Liu et al., 2023). For instance, Munawar et al. (2022) found affordability and convenience are top priorities for students when choosing transportation modes. Khalifa et al. (2024) discovered that environmental concerns also influence transportation choices. Research highlights the correlation between urban students' mobility patterns and academic success and well-being. Banerjee et al. (2020) found that reliable transportation access correlated positively with academic performance. Mobility patterns affect students' mental health and overall satisfaction with their school experience (Park et al., 2020).

Understanding urban students' mobility patterns is essential for promoting academic success, well-being, and sustainable urban development. This literature review highlights the need for higher education institutions and policy planners to prioritize student-centred mobility solutions, including affordable, accessible and convenient public transportation.

## 3. Methodology

### *3.1 Study area*

Kebbi State is located between latitude $10^0$ N to $14^0$ N and longitude $4^0$ E to $7^0$ E with a total land area of 36,229 square kilometers (Figure 1). The state shares borders with Sokoto State to the north, Zamfara State to the east, Niger State to the south, and Benin Republic to the west.

Kebbi State was created in 1996 from the former Sokoto State. The state has a long history dating back to the medieval period, with the Kanem-Bornu Empire and the Hausa Kingdoms influencing the region. The state is home to the famous Kebbi Kingdom, which was a major power in the region during the 14th to 16th centuries. The kingdom was known for its rich agricultural land, strategic location, and strong trade networks.

Kebbi State is situated in the Sudan Savannah region of Nigeria, with a total area of 36,229 square kilometers. The state shares borders with Sokoto State to the north, Zamfara State to the east, Niger State to the south, and Benin Republic to the west.

Kebbi State has a tropical savannah climate with two distinct seasons: the wet season and the dry season. The state's vegetation is characterized by grasslands, shrublands, and deciduous forests. The state is home to several tree species, including the iconic baobab tree, acacia trees, and mango trees. The state's vegetation is also influenced by the Niger River, which supports a variety of riparian forests and wetlands. The state's agricultural land is suitable for crops such as rice, millet, sorghum, and cowpeas.

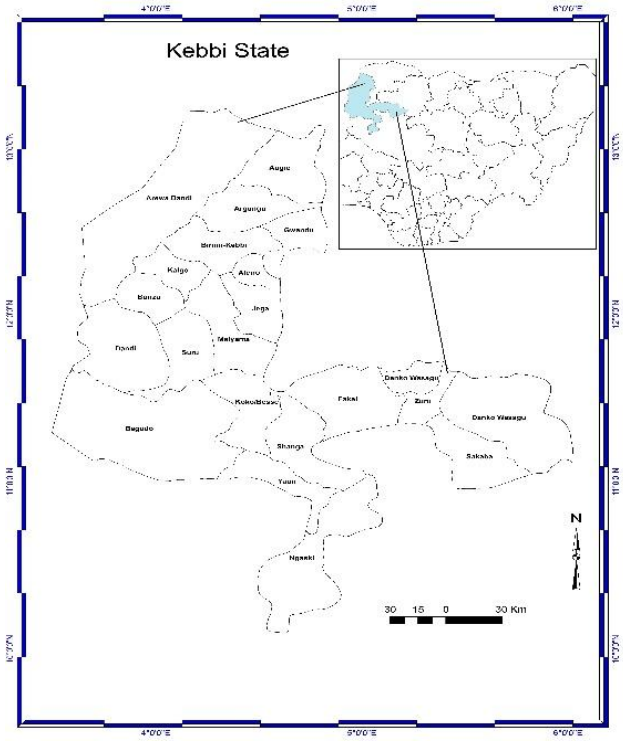


Figure 1. Location map of Kebbi State.

### *3.2 Data*

This research employed a mixed-methods approach that combines qualitative and quantitative data collection and analysis methods. A survey was designed to develop a questionnaire to gather data on students' mobility patterns, transportation modes, and factors influencing their decisions (Ribeiro et al., 2020). The survey is administered to a sample of students enrolled in selected higher education institutions in Kebbi State (Biancardi et al., 2023). This approach will enable the collection of both quantitative and qualitative data, providing a comprehensive understanding of urban students' mobility patterns and the factors that influence them.

### *3.3 Method of data analysis*

The survey data collected is pre-processed and transformed into a suitable format for analysis. Data analysis was conducted using R statistical software available in the literature to identify patterns and trends in urban students' mobility patterns (Perez-Encinas et al., 2021). First, we performed correlation analysis to measure the strength of the relationship between the variables to be included in the model. Multiple linear regression models (Equation 1) are used to quantify relationships between variables. By this data analysis method, this study aims to provide a comprehensive understanding of urban students' mobility patterns in Kebbi State, Nigeria.

$$Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_n X_n + \varepsilon \quad (1)$$

where Y is the value of the dependent variable, $\beta_o$ is the constant intercept, $\beta_1$, $\beta_2$, $\beta_3$, $\beta_n$ are the slope coefficients of the independent variables $X_1$, $X_2$, $X_3$, $X_n$, while $\varepsilon$ is a standard error of component.

## 4. Results

The results of the correlation analysis between the selected variables are presented in Table 1. To explore the links between urban student mobility patterns and other characteristics, we calibrate a multiple linear regression model was applied. The dependent variable was travel behaviour (BH), assessed as the average distance travelled per week. Independent variables included are academic achievement (AA), social class (SC), travel mode (TM), commute distance (CD), age (A), and gender (G).

Table 1. Correlation matrix for the variables included in the model.

| | BH | AA | SC | TM | CD | A | G |
|---|---|---|---|---|---|---|---|
| BH | 1 | 0.35 | -028 | 0.58 | 0.42 | -0.25 | 0.18 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| AA | 0.35 | 1 | 0.40 | 0.12 | 0.08 | -0.10 | 0.05 |
| SC | -028 | 0.40 | 1 | -0.20 | -0.15 | 0.05 | -0.08 |
| TM | 0.58 | 0.12 | -.020 | 1 | 0.35 | -0.15 | 0.10 |
| CD | 0.42 | 0.08 | -0.15 | 0.35 | 1 | -0.20 | 0.12 |
| A | -0.25 | -0.10 | 0.05 | -0.15 | -0.20 | 1 | -0.05 |
| G | 0.18 | 0.05 | -0.08 | 0.10 | 0.12 | -0.05 | 1 |

The results of the multiple regression model for the parameters are presented in Table 2. Academic performance (AA) positively affects mobility patterns, indicating that better-performing students travel farther. Social class (SC) has a positive impact, suggesting higher SC students travel more. Travel mode (TM) significantly influences mobility patterns, with certain modes (e.g., public transport) associated with greater travel distances. Commuting distance (CD) is the strongest predictor, indicating students living farther away travel more. Age (A) and gender (G) have insignificant effects on mobility patterns.

Table 2. Coefficients and tests of model performance

| Independent Variables | Coefficients (β) | Standardized Coefficients (β) | t-value | p-value |
|---|---|---|---|---|
| (Constant) | 10.23 | | 4.52 | .001 |
| AA | 0.23 | 0.17 | 2.85 | .005 |
| SC | 0.19 | 0.14 | 2.41 | .016 |
| TM | 0.38 | 0.29 | 4.17 | .001 |
| CD | 0.49 | 0.37 | 5.29 | .001 |
| A | -0.07 | -0.05 | -0.83 | .406 |
| G | 0.04 | 0.03 | 0.51 | .609 |

R-squared = 0.63

Adjusted R-squared = 0.59

## 5. Discussion

The significant correlation between mobility patterns and academic performance confirms earlier findings that high-achieving students typically commute farther to school (Yeung & Nguyen-Hoang, 2020). This could be because high-achieving students seek high-quality education, frequently requiring travelling to far-off schools.

According to studies, pupils from higher socioeconomic classes travel more for school (Hwami & Bedeker, 2024), possibly because they have more financial means and access to transportation. This suggests that social class has a substantial impact on mobility patterns.

The impact of modes of transportation on patterns of mobility aligns with studies that highlight the role of transportation infrastructure in determining student mobility (Rodríguez-Rad et al., 2023). Longer trips can be made easier, especially with public transit.

Distance to school is strongly correlated with mobility patterns, which is consistent with research showing that closeness to the institution is a major determinant of student mobility (Restaino et al., 2020). Students who live further away from campus typically travel more.

Some studies that suggest gender disparities in commuting behaviour (Pani et al., 2023) and age-related mobility differences (Ozbilen et al., 2022) are contradicted by the negligible effects of gender and age on mobility patterns; however, this may be due to the urban context and the population sampled.

## 6. Conclusion

This study contributes to understanding urban student mobility patterns for higher education, highlighting the interplay between academic, socio-economic, and environmental factors. The findings inform strategies for improving student mobility, enhancing urban planning, and promoting sustainable transportation.

This study highlights the need for higher education institutions and policy planners to prioritize student-centred mobility solutions, including affordable, accessible, and convenient public transportation. By understanding urban students' mobility patterns and addressing their challenges and barriers, we can promote equal access to higher education, sustainable urban development, and improved academic performance.

**Conflict of interest**

The authors have reported no conflict of interest.

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