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# ENHANCING SUSTAINABLE STUDENTS' MOBILITY: A CASE STUDY OF THE UNIVERSITY OF ALGIERS

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**ABSTRACT**

This study assesses student mobility's sustainability at the University of Algiers, identifying barriers and evaluating the impact of mobility patterns and infrastructure. Through a mixed-methods approach, including surveys and interviews, the research explores the daily transportation challenges of students. Key findings highlight barriers to sustainable mobility, including long commute times, inadequate pedestrian infrastructure, and safety concerns. The study also underscores the limited accessibility of transportation services for individuals with disabilities and the poor physical condition of public transportation infrastructure. The analysis reveals that while public transportation is widely used, it fails to meet the demands of the students, with overcrowding, poor maintenance, and limited accessibility options impacting the quality of commutes. To promote sustainable mobility, the study recommends improvements in traffic management, pedestrian infrastructure, and the safety and reliability of transportation services. The findings help policymakers and university administrators to enhance the sustainability and accessibility of student mobility in Algiers.

**KEYWORDS**

College Students, Barriers, Measuring Sustainability

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**Nomenclature:**
PT - Public transportation
COUS - Students' buses
ETUSA - Urban and Suburban Transport Company of Algiers

## 1. Introduction

Sustainable mobility has become a primary concern in urban areas (Spadaro, I., & Pirlone, F. (2021)). Additionally, Sustainable mobility encapsulates the contemporary endeavor to rebalance the pros and cons within the transportation sector. It signifies a departure from traditional transport planning, which viewed transport as a supportive infrastructure for economic advancement, towards a more evidence-based and risk-aware policy stance (Giorgi, L. (2003)).

In addition, everyone has an opinion on sustainable mobility, which remains as necessary today as it was in 1992, but its importance has grown due to limited progress. Moreover, making sustainable mobility a reality is perhaps the most difficult task among the many challenges of achieving sustainable development. (Holden, E., Gilpin, G., & Banister, D. (2019))

Furthermore, attaining sustainable mobility involves decoupling the link between increasing material prosperity and the adverse environmental effects of expanding physical mobility. Additionally, addressing the issue of sustainable mobility involves a multifaceted approach. This includes promoting transportation and communication technologies that are environmentally friendly, influencing the travel behavior of people, and reshaping the social and spatial structures of society in a way that supports sustainable practices (Frändberg, L., & Vilhelmson, B. (2010)).

Successful implementation of sustainable mobility relies significantly on expertise in the field. Moreover, Expertise in sustainable mobility, unlike traditional transportation expertise (formed by economics), is interdisciplinary, incorporating economic, environmental, spatial development, and decision-making elements (Giorgi, L. (2003)). Clearly, this sheds light on why achieving this type of mobility is challenging.

Likewise, the shift towards sustainable transportation poses a known socio-economic and environmental obstacle, notably among young adults in low- and middle-income nations. Nevertheless, there is insufficient extensive research on mobility patterns, especially among young adults residing in low- and middle-income nations. (Fondzenyuy, S. K., Jackai II, I. N., Tezong, S. L. F., Usami, D. S., Gonzalez-Hernandez, B., WOUNBA, J. F., ... & Persia, L. (2024)).

This study aims to assess the sustainability of student mobility at the University of Algiers, with a focus on identifying barriers that hinder sustainable transportation options for students. Specifically, the research addresses the following key questions:

1. **What are the primary barriers to sustainable student mobility in the context of the University of Algiers?**

This question explores factors such as the walkability of pedestrian routes to public transportation (PT) stations, the accessibility of these stations, the physical conditions of the stations, and the overall infrastructure design.

2. **How do transportation habits and preferences of students impact the sustainability of their daily commutes?**

Here, we investigate the transportation choices students make, including their preferred modes of transport, and how these choices affect the overall sustainability of campus mobility.

3. **What role does the physical condition of public transportation means play in influencing student mobility?**

This question seeks to understand the impact of the physical condition of Public Transportation vehicles on students' commuting experiences and how it serves as a barrier to sustainable mobility.

*To address these research questions, the study employs a mixed-methods approach:*

- **Literature Review**: A comprehensive review of 138 articles from 1981 to 2024 was conducted to identify existing gaps in the literature concerning campus mobility and the commuting habits of university students.
- **Questionnaire Surveys**: Surveys were distributed to students at the University of Algiers, focusing on their daily commuting experiences, transportation preferences, and perceptions of the current infrastructure.
- **Interviews:** In-depth interviews were conducted with a selection of students to gain qualitative insights into the specific challenges they face during their commutes.

Through these methods, the study aims to provide a comprehensive analysis of the factors influencing student mobility at the University of Algiers and to offer recommendations for enhancing the sustainability of

the university's transportation system. In doing so, this research addresses a key gap in the literature by focusing on student mobility in a developing country context. While much of the existing research has centered on developed nations, this study brings new perspectives to the challenges faced in less-resourced areas like Algiers. The insights gained can inform future studies and policy development in similar low- and middle-income regions, particularly in Africa, the Middle East, and Asia.

This article is structured as follows: it begins with an introduction to the concept of sustainable student mobility, followed by a comprehensive literature review. The methodology section details the research design, data collection, and analysis techniques employed. The results section is divided into findings from questionnaires and interviews. This is followed by a discussion of the implications of these findings. The article then assesses the sustainability of student mobility and identifies the specific obstacles encountered in students' daily itineraries. After these analyses, targeted policy recommendations for sustainable and high-quality public transport are provided. In addition to that, the article summarizes the novelty and the contribution to the literature before it finally concludes with a summary of the main insights and a call for action to enhance student mobility at the University of Algiers.

## 2. Methodology

This study aims to assess the sustainability of student mobility at the University of Algiers, focusing on identifying barriers to sustainable practices. To achieve this, the methodology is structured to directly address the three core research questions outlined earlier:

- What are the primary barriers to sustainable student mobility in the context of the University of Algiers?
- How do transportation habits and preferences of students impact the sustainability of their daily commutes?
- What role does the physical condition of public transportation means play in influencing student mobility?

### 2.1. Research Design

A **sequential explanatory mixed-methods design** was chosen for this study, involving an initial quantitative phase followed by a qualitative phase. This approach allows for comprehensive exploration, with the quantitative data providing broad trends and the qualitative interviews offering deeper insights into individual experiences.

### 2.2. Data Collection Methods

#### 2.2.1. Questionnaire Surveys

A structured questionnaire was designed to collect quantitative data from a representative sample of the student population at the University of Algiers. The questionnaire was based on existing literature on sustainable mobility and was piloted with a small group of students to ensure clarity and relevance.

- **Sample size**: The survey was administered to a randomly selected sample of 800 students, with 401 complete and valid responses received (a 50.1% response rate). This sample size was chosen to provide robust statistical power, representing approximately 5% of the student population.
- **Survey instrument**: The questionnaire covered four main areas:

1. **Demographic Information:** Age, gender, economic status, family car ownership, employment status, and public transport usage.
2. **Transportation Habits and Preferences**: Frequency of public transport usage, preferred modes of transportation, commute duration and cost, and the number of transfers during a trip.
3. **Barriers to Sustainable Mobility:** Assessment of pedestrian routes leading to public transport stations, focusing on service quality, comfort, and safety.
4. **Impact of Public Transportation Conditions:** Evaluation of public transport stations and vehicles concerning service, comfort, performance, and safety.

- **Data collection process:** The survey was distributed in person to 800 students at the university over the course of one week. Students were allowed to take the surveys home to complete them. The following week, we collected the completed surveys, resulting in a total collection period of 15 days. Some students declined to participate, and we made efforts to ensure a gender balance, aiming for 50% males and 50% females

to avoid bias. After excluding incomplete surveys, we retained 401 valid responses, which is more than 5% of the student population (the target being 385, and our final sample was 401).

#### 2.2.2. Interviews

To complement the quantitative data, in-depth interviews were conducted with a purposive sample of 120 students from the central faculty, selected to ensure a diversity of experiences across gender, province, and transportation modes.

- **Sampling method**: A stratified sampling approach was used to ensure representation across different demographic groups, including both regular public transport users and students who rely on other modes of transportation (e.g., private cars, walking).
- **Interview structure**: Semi-structured interviews were conducted to explore the following key themes:

1. **Barriers to Mobility:** Students' experiences and challenges related to the physical condition, safety, cleanliness, comfort, service, and performance of public transportation infrastructure.
2. **Transportation Habits and Preferences:** Exploration of the factors influencing students' modal choices and their impact on sustainable mobility.
3. **Recommendations for Sustainable Mobility:** Students' suggestions for improving the sustainability of the university's transportation system.

- **Data collection process:** The interviews were conducted face-to-face, each lasting approximately 20–30 minutes. They were not recorded, as students did not feel comfortable being recorded. Instead, we took detailed notes during the interviews. Additionally, the interviewees preferred to remain anonymous, and their confidentiality was respected throughout the process.

### 2.3. Data Analysis

The data collected through questionnaires and interviews were analyzed to directly address the research questions:

- **Quantitative Analysis:** The data analysis was conducted using SPSS. In addition, statistical methods were used to analyze the questionnaire data, focusing on identifying patterns and correlations related to the barriers to sustainable mobility, transportation habits, and the condition of public transportation.
- **Qualitative Analysis:** Thematic analysis was applied to the interview data, enabling the identification of recurring themes and insights related to students' experiences and their recommendations for achieving sustainable mobility.

## 3. Literature review

In this study, we conducted a comprehensive review of 138 scholarly articles spanning from 1981 to 2024. However, to maintain focus and relevance to our research objectives, we have included only those studies that directly address the key themes related to barriers to sustainable student mobility, the impact of transportation habits and preferences on sustainability, and the role of public transportation's physical condition in influencing student mobility.

### 3.1. Barriers to Sustainable Student Mobility

A significant body of literature highlights the barriers faced by students with disabilities in accessing university campuses. Early studies, particularly from the 1970s and 1980s, focused on the inclusion of students with physical disabilities in higher education, primarily in developed countries. For instance, Parkes (1998) and Huer (1991) examined the challenges faced by students with visual and communication impairments, respectively. However, there is a noticeable gap in research focusing on students with disabilities in third-world countries, including Algeria. This gap underscores the need for further investigation into the accessibility and inclusiveness of university campuses in these regions.

Additionally, the literature on campus infrastructure, including space utilization and accessibility features, reveals that while developed countries have made significant strides in accommodating diverse student needs, there is limited discussion on the socio-economic implications of campus infrastructure development in less developed regions. This is a critical barrier to sustainable mobility that needs further exploration, particularly concerning equity and social justice.

### 3.2. Impact of Transportation Habits and Preferences on Sustainability

The literature extensively covers students' mobility behavior, travel patterns, and transportation preferences within campus environments. Studies by Hsu et al. (2005) and Eboli et al. (2013) delve into pedestrian mobility and the walkability of campus environments. However, these studies predominantly focus on developed countries, often overlooking the unique challenges faced by students in third-world contexts. The research gap here lies in understanding how these transportation habits and preferences influence sustainability in regions like Algeria, where infrastructure and resources differ significantly from those in more developed areas.

Further, studies on the sustainability of mobility practices within campuses, such as those by Longo et al. (2015) and Gurrutxaga et al. (2017), provide valuable insights into non-motorized transportation modes and their potential to enhance sustainability. However, the literature lacks comprehensive evaluations of these practices' long-term effectiveness, particularly in regions with underdeveloped transportation systems.

### 3.3. Role of Public Transportation's Physical Condition in Influencing Student Mobility

Research has shown that the physical condition of public transportation significantly affects student mobility. Studies like those by Lee et al. (2009) and Gilson et al. (2013) have explored daily mobility patterns and the influence of transportation infrastructure on student experiences. However, much of this research has been conducted in developed countries, with little focus on regions like Algeria, where public transportation may be less reliable or well-maintained. The literature indicates a gap in understanding how the physical condition of transportation modes in these regions impacts students' commuting experiences and their ability to adopt sustainable mobility practices.

Moreover, the emerging concepts of "smart campuses" and "sustainable campuses," as explored by Torres-Sospedra et al. (2015) and Sottile et al. (2020), offer innovative solutions for enhancing campus mobility. However, these concepts are still relatively new in third-world countries, and their implementation faces challenges such as funding constraints and institutional resistance. There is a need for further research to evaluate the impact of these initiatives on student mobility and to develop strategies for their effective implementation in less developed regions.

### 3.4. Identified Research Gap

Despite the extensive body of literature on student mobility, there is a conspicuous gap in research focusing on the mobility behaviors of students commuting from their residences to university campuses, particularly in the context of Algeria. This gap is significant given the unique challenges faced by students in regions with underdeveloped transportation infrastructure. The present study aims to address this gap by exploring these specific mobility behaviors, contributing to a broader understanding of sustainable transportation planning in university settings.

## 4. Results

### 4.1. Questionnaire

This section presents the key findings from the questionnaire, focusing on how the data addresses the core research questions related to barriers to sustainable student mobility, the impact of transportation habits and preferences, and the physical condition of public transportation in Algiers.

#### 4.1.1. Demographic and Transportation Characteristics of Students

The survey collected responses from 401 students, providing insights into their demographic profiles and transportation habits:

- **Age Distribution:** The majority of respondents were aged 21-25 (54.9%), followed by 17-20 years (34.7%).
- **Gender:** Female students comprised 55.9% of the sample, while male students made up 44.1%.
- **Economic Status:** Most students identified as middle class (75.1%), with a smaller percentage indicating good (19%) or poor (6%) economic status.
- **Transportation Ownership:** A significant majority (79.7%) reported having access to a family car.

These characteristics provide a foundation for understanding the transportation behaviors and challenges faced by students.

#### 4.1.2. Daily Commute Patterns

Commute Duration and Costs:

- **Commute Duration:** A substantial proportion of students (45.4%) reported commute times exceeding one hour, highlighting the challenge of long commutes. Only 2% had a commute of less than 15 minutes. As reflected in the interviews, a student mentioned :" "I have to wake up really early every day because it takes me about two hours to get to the university, both in the morning and on the way back in the afternoon."
- **Commute Costs:** The majority of students (52.4%) reported daily commute costs between 41-100 DA, indicating a moderate financial burden associated with transportation.
- **Transportation Routes:** 38.9% of students used direct routes, while others required one (28.2%), two (22.7%), or more than two correspondences (10.2%), reflecting the complexity and potential inefficiencies in their daily travel. A student noted in the interviews: "I wake up very early to travel from my province, Reghaya, and I have to change transportation three times. It's especially exhausting during the winter."

#### 4.1.3. Pedestrian Routes to Public Transport Stations

The quality and safety of pedestrian routes leading to public transport stations (PTS) significantly impact the overall commuting experience:

- **Walking Distance**: Most students (76.6%) walked between 5-20 minutes to reach PTS, with 17.5% walking more than 20 minutes.
- **service**: 61.3% noted the presence of garbage bins, but only 33.4% reported shaded routes, and 39.2% cited good quality sidewalks. One student said : " […] *Streets like Hassiba are dangerous due to incidents of aggression, theft, and damaged sidewalks"*
- **Comfort**: Proximity services (67.3%) and wider streets (64.8%) were valued, but access to green spaces (23.7%) and seating (16.7%) was limited.
- **Security**: The presence of police officers was reported by 43.1% of students, while 58.6% noted the absence of harassment, indicating moderate safety concerns.

#### 4.1.4. Public Transport Stations

- **comfort**: Only 16.2% of students found good quality chairs available at stations, and a slight majority (53.4%) reported the existence of chairs in general. One student noted: "*"Overcrowding is an issue at all public transportation (PT) stations. Bus stations lack seating and are often in disrepair. Some bus stations are so bare that they are recognizable only to those familiar with the area".*
- **Safety**: Students were evenly split in their perceptions of safety at PTS, with 50.1% feeling safe and 49.9% expressing concerns. A student said: "*" Traffic congestion, a huge lack of buses, anarchic departure policies, and insecurity at the bus stations".*
- **Service Quality**: 62.1% of students found stations to be physically accessible, but only 27.9% reported the presence of clear signage, indicating areas for improvement in service quality.

#### 4.1.5. Means of Public Transportation

**Usage and Preferences**

A majority of students (52.9%) used public transportation regularly, with the subway (52.1%) and personal cars (48.9%) being the preferred modes.

Challenges in Public Transportation

- **Crowding:** 91% of students reported crowded conditions, and 81.3% expressed discomfort with standing during their commute. One student highlighted: "*Harsh braking, slow movement, overcrowding, discomfort in standing and no tolerance for mistakes."*
- **Lack of Comfort:** The absence of air conditioning (74%) and comfortable chairs (73.6%) were significant issues. A student pointed: "There is no air conditioning in the buses of Algiers, which makes traveling in hot weather extremely uncomfortable and at times causes a sensation of faintness".
- **Safety:** High levels of harassment (70.1%) and fights (80.8%) were reported, with limited surveillance (22.2%) and control agents (34.4%) exacerbating safety concerns. A female student highlighted: ""There's a serious lack of security throughout the entire transport system, leading to organizational chaos, with girls often facing verbal and physical harassment, including inappropriate touching and theft, on buses and trains".

### 4.2. Interviews

This section summarizes the findings from the interviews conducted with 120 students, focusing on how these insights address the key research questions related to barriers to sustainable student mobility, transportation habits, and the conditions of public transportation in Algiers.

#### 4.2.1. Overview of Interview Participants

The interviews were conducted with a balanced group of students, with 60% female and 40% male participants, aged 17 to 25. These students were selected to represent a broad range of experiences across different provinces of Algiers, ensuring a comprehensive understanding of the commuting challenges they face.

#### 4.2.2. Public Transportation Usage and Preferences

A majority of the interviewees (83.3%) reported using public transportation regularly, which highlights the significant reliance on these services among students. Additionally, the most preferred modes of transport were the subway, chosen by 66.7% of students, followed by personal cars (61.7%), taxis (58.3%), and ETUSA buses (54.2%). This variety in transportation choices reflects the different daily habits of students and shows the importance of both public and private options in their lives.

However, students face several challenges in their daily commutes. For 80% of students, road congestion was identified as a major cause of long commute times, presenting a significant barrier to efficient mobility. Additionally, 69.2% of students expressed concerns about safety, particularly when using private buses, where issues like reckless driving and the presence of non-students were commonly reported. For female students, safety concerns were especially severe, with 81.7% of them mentioning incidents of sexual harassment, making safety a critical issue that requires attention.

Students also highlighted key concerns related to sustainable mobility. While 81.7% of students acknowledged that they have access to multiple transportation modes, including subways, tramways, and various buses, many pointed out that coverage is often inadequate, particularly for the subway and COUS buses. This leads to long waits and limits accessibility, making commuting more difficult. Furthermore, 80% of students noted that the high cost of alternative transportation options, such as taxis and ride-hailing apps, restricted their choices, forcing them to rely on less reliable public transport.

The lack of accessibility for students with disabilities was another significant issue, with 80% of students emphasizing the absence of adequate facilities, such as mobility aids, and highlighting the poor accessibility of public transport. Overcrowding was a nearly universal complaint, with 91.7% of students reporting consistently crowded conditions across all modes of transport, particularly during peak hours. This not only causes discomfort but also contributes to delays and makes commutes more challenging. Additionally, environmental concerns also weighed heavily on students' minds, as 85% expressed worries about the levels of pollution and noise associated with their daily commutes, which adds to the stress of the journey.

Furthermore, specific transportation modes presented their own unique issues. For COUS buses, students reported significant safety concerns, especially due to the presence of non-students and insufficient security measures. Moreover, discomfort was another common issue, as cramped seating and inadequate services made commuting unpleasant. One student mentioned, "*There are insufficient COUS buses serving Draria, resulting in unbearable morning and evening traffic congestion. Streets like Hassiba are dangerous due to incidents of aggression, theft, and damaged sidewalks*." Additionally, the infrequent and poorly timed bus schedules often did not align with students' class times, leading to further frustration. As one student stated, "*There is only one COUS bus that goes to Draria, so when I finish classes at 1 PM or 5 PM, I cannot go home because it only departs at 3:30 PM.*"

For students using the tramway, delays caused by traffic congestion were a frequent complaint, as cars and motorcycles often disregarded tram routes, causing significant slowdowns. Overcrowding on the subway was also a major concern, even though students acknowledged that this is a common issue worldwide. One student recounted, "*Sometimes when we arrive at the tram station, the display that shows the waiting time until the tram arrives doesn't work properly. There was even a time when the controllers announced, 'There is an accident on the tramway lane, it will be delayed.' Personally, I had no other option because taking a taxi wasn't feasible; they refused to stop for us. The traffic congestion is unbearable*."

Private buses were frequently mentioned in connection with safety issues, including reckless driving, fights, and harassment. The lack of a regulated schedule and poor maintenance of these buses added to the difficulties faced by students. One student remarked, "*Buses do not have specific schedules; they operate as*

*they please*." Another added, "*Leaving the bus door open while in motion. I heard that once a ticket worker fell while the bus was moving. Fortunately, he didn't die but was severely injured.*"

Students who used the train encountered various problems as well. Delays and disorganization were common complaints, but safety concerns were also a major issue. One student shared, "*Last time I was on the train, there was a massive breakdown, and the train stopped. We waited for a long time because they couldn't open the doors, and there was no emergency exit.*"

Accessibility for disabled students was another area where many challenges were highlighted. The interviews revealed a significant gap in services for students with disabilities. Many students mentioned that there were inadequate transportation options and a lack of facilities to assist those with mobility difficulties. One student reflected on an encounter in the subway, saying, "*I met a blind lady who needed assistance at the subway station, and I noticed there was no tactile paving like in other countries. Having spent a few months in Europe, I observed a blind couple living independently across the street because the country prioritized accessibility for people with disabilities. In our country, we've failed her; she needs assistance wherever she goes*."

## 5. Discussion

### 5.1. Overview of Student Mobility Patterns

The survey responses revealed that the majority of students face significant challenges in their daily commutes, particularly with long commute times, high costs, and multiple transfers. For instance, 45.4% of students reported commute times exceeding one hour, and only 2% had a commute of less than 15 minutes.

These findings indicate a substantial barrier to sustainable student mobility. Long commute times can negatively impact students' academic performance and overall well-being.

### 5.2. Quality of Pedestrian Routes

Students highlighted several issues with pedestrian routes leading to public transport stations, such as the lack of shaded routes (only 33.4% reported this), poor quality sidewalks (39.2%), and limited access to seating (16.7%).

The inadequacies in pedestrian infrastructure not only discourage walking but also contribute to a less sustainable and less accessible transportation system.

### 5.3. Safety and Accessibility of Public Transport Stations

While 50.1% of students felt safe at public transport stations, an almost equal percentage (49.9%) expressed concerns about safety. Furthermore, only 27.9% noted the presence of clear signage, and 16.2% found good quality chairs available.

The mixed perceptions of safety and the poor quality of facilities at transport stations underscore the need for improvements in both security measures and station amenities.

### 5.4. Public Transportation Challenges

The interviews revealed that 80% of students cited road congestion as a major barrier to efficient mobility, while 91.7% reported overcrowding across all public transportation modes. Additionally, 81.7% of female students reported incidents of harassment, particularly in private buses.

These challenges highlight critical barriers to sustainable mobility, with safety concerns being particularly pronounced for female students.

### 5.5. Specific Issues by Mode of Transportation

***COUS Buses:***

Students reported significant safety concerns due to the presence of non-students and insufficient security measures. Additionally, complaints about the infrequent and poorly timed schedules were common.

These findings suggest that improving the safety and reliability of COUS buses could play a crucial role in enhancing sustainable student mobility, particularly in reducing reliance on less sustainable forms of transportation like personal cars.

***Tramway and Subway:***

Delays caused by traffic congestion and the disregard of tram routes by other vehicles were major concerns. Overcrowding in the subway was also a significant issue.

Improving the efficiency and reliability of the tramway and subway systems could make these more attractive options for students, helping to reduce road congestion and promote more sustainable urban mobility.

***Private Buses:***

Students frequently mentioned safety issues, including reckless driving, fights, and harassment, as well as the lack of a regulated schedule.

Enhancing regulation and safety measures for private buses could address these significant barriers, encouraging more students to use these services without fear of safety risks.

5.6. Implications for Policy and Practice

The findings from both the questionnaire and interviews suggest that significant improvements are needed in several areas, including the safety and reliability of public transportation, the quality of pedestrian infrastructure, and the inclusivity of transportation services for all students.

Policymakers and university administrators should prioritize the enhancement of public transport safety measures, improve infrastructure to support pedestrian access, and ensure that all students, including those with disabilities, have reliable and safe transportation options. Additionally, addressing overcrowding and ensuring more consistent public transportation schedules will be essential in promoting sustainable student mobility in Algiers.

## 6. Assessing Sustainable Mobility

To assess the sustainability of student mobility, we utilize a model by Dominique Gillis, Ivana Semanjski, and Dirk Lauwers (2016), focusing on relevant indicators for our study. Despite the general perception of mobility as sustainable due to widespread public transport use and proximity to stations, specific indicators reveal key challenges.

### 6.1. Congestion and Delays

A significant 45.4% of students experience commutes exceeding one hour, with 80% attributing this to congestion. Students often resort to walking long distances to avoid traffic delays. Tram delays, caused by other vehicles disregarding tram routes, further exacerbate these issues.

### 6.2. Commuting Travel Time

Most students face extended travel times, with 45.4% reporting durations longer than one hour.

### 6.3. Mobility Space Usage

Transportation infrastructure in Algiers is inefficient, with tramway paths and sidewalks frequently used by motorcyclists and cars due to the absence of dedicated bike lanes.

### 6.4. Quality of Public Areas

Pedestrian routes leading to public transport stations (PTS) suffer from significant deficiencies. Major issues include the absence of shade (66.6%), poor cleanliness (52.4%), and lack of seating (83.3%). Public transport stations themselves also face challenges, such as a lack of shade (69.1%) and substandard chairs (83.8%).

### 6.5. Access to Mobility Services

Although multiple transport options exist (subway, tramway, private buses), coverage is inadequate, especially for COUS buses. Students from areas like Erghaia and Draria report significant issues with transportation availability.

### 6.6. Security and Traffic Safety

Private bus drivers often neglect safety, leading to a majority (66.7%) of students feeling unsafe. Additionally, harassment (70.1%) and fights (80.8%) are prevalent, with insufficient surveillance and control measures.

### 6.7. Noise Hindrance

Noise from COUS buses, due to their aging condition, is a significant disturbance, with 80% of students reporting unbearable noise levels that cause headaches. Traffic noise is a widespread issue, affecting 83.3% of students.

### 6.8. Air Polluting Emissions

Algiers suffers from high pollution levels, with 85% of students expressing concerns. "Dirty rains," attributed to environmental contamination, are also a reported phenomenon.

### 6.9. Comfort and Pleasure

Students experience substantial discomfort during commutes, with 91% citing overcrowded conditions, and 74% reporting the absence of air conditioning.

### 6.10. Accessibility for Mobility-Impaired Groups

A staggering 76.8% of students reported a lack of accessibility for people with disabilities. Inadequate infrastructure and limited facilities highlight significant challenges for these groups.

### 6.11. Affordability of Public Transport

While most students (82%) find commuting costs reasonable, the lack of subscriptions for private buses imposes a financial burden on poorer students (6% of the population).

### 6.12. Functional Diversity

Despite a multimodal transport system, limited coverage and high costs limit students' options, forcing many to rely on less-preferred private buses.

### 6.13. Intermodal Connectivity and Integration

Although physical connectivity is generally good, with 81.7% of students noting effective connections, service timing is a significant issue. Poor intermodality, especially concerning buses, limits the effectiveness of the transportation system.

### 6.14. Occupancy Rate

Overcrowding is a persistent issue, with 91.7% of students reporting consistent congestion across all modes of public transport, particularly during peak hours.

### 6.15. Opportunity for Active Mobility

Walking is common, with 57.7% of students walking 11-20 minutes daily. However, pedestrian routes are lacking in essential services like shade (66.6%) and green spaces (76.3%), with high incidences of harassment (41.4%).

## 7. The obstacles to sustainable mobility in the student's daily itinerary

After analyzing the findings from both the questionnaire and the interviews, and assessing the sustainability of student mobility, we have identified several obstacles to sustainable mobility in their daily routines:

### 7.1. Traffic congestion

To begin with, let's address a recurring issue voiced by the majority of students: traffic congestion. Algiers faces significant challenges, particularly during peak hours, resulting in public transport delays, accidents, and heightened social stress.

### 7.2. Long commuting times

Secondly, we need to mention the prolonged commuting time. As previously mentioned, some students endure up to four hours of travel each day. This issue results in frustration and fatigue, affecting their energy levels before the day even begins.

### 7.3. Quality of public areas

The bad condition and factors -like service, safety and comfort- of public areas used by PT users, such as pedestrian routes leading to PT stations and PT stations. These issues with the quality of pedestrian routes and public transport stations were commonly reported by students as affecting their daily experience.

### 7.4. Limited access to transportation options

The lack of access to diverse transportation options and services remains a pressing issue. As previously discussed, while Algiers offers several options, they are not sufficiently accessible across the city. Numerous students have expressed feeling constrained in their choices. When buses are delayed, their only recourse often involves taxis, which are not only costly but may also be unavailable at times.

### 7.5. Security and traffic safety

As previously noted, private bus drivers frequently exceed speed limits and engage in dangerous racing, jeopardizing lives. Additionally, a significant number of students have reported instances of harassment, even on COUS buses—despite their designation by the government for student use exclusively. It is concerning that these buses, intended solely for students, are utilized by individuals from various demographics, exploiting their free accessibility.

### 7.6. Noise pollution

Many students find the noise generated by buses, particularly COUS buses, to be unbearable at times.

### 7.7. Environmental pollution

High traffic levels contribute significantly to pollution in Algiers, which students perceive as a major issue affecting their daily lives. Additionally, the presence of construction sites, particularly for future subway lines, contributes to air pollution due to the dust generated.

### 7.8. Lack of comfort

The comfort level in the daily itinerary of students, particularly in pedestrian routes leading to public transport stations, is notably compromised. The absence of essential amenities such as green spaces, Scenic views, and seating areas contributes to an overall sense of discomfort. Similarly, in public transport stations, the lack of chairs and shaded areas further diminishes the comfort of students while waiting for transportation. Additionally, within public transport vehicles themselves, overcrowding, insufficient seating, and the absence of amenities like air conditioning and scenic views significantly detract from the overall comfort of the commuting experience.

### 7.9. Accessibility for mobility-impaired groups

The unease of access to transportation services and infrastructure for individuals with mobility impairments, such as those who use wheelchairs or have difficulty walking or blind people, is noted. Other passengers have to help them to access the stations – in the subway – or the ETUSA buses. However, private buses are completely inaccessible for people with wheelchairs and very difficult to access for people that have difficulties in walking. Moreover, it’s the same thing for most COUS buses.

### 7.10. Affordability

Public transportation is accessible to individuals in the middle class, but remains financially out of reach for the poorest groups. To address this disparity, the government introduced COUS buses; however, their coverage across Algiers is incomplete, and they often fail to meet the demand from students. Consequently, students resort to private buses or other alternatives due to these limitations.

### 7.11. Coverage gaps in public transport

The limited coverage of COUS buses and other public transport modes leaves many areas underserved, forcing students to seek alternative transportation methods.

### 7.12. Intermodal integration

Most students perceive Algerian public transportation as lacking in intermodal integration. While tramway and subway systems are efficiently synchronized with schedules and ticketing systems, students desire similar integration for other modes of transportation. This is particularly relevant as buses, including private buses, ETUSA buses, and COUS buses, constitute the most commonly utilized means of transportation.

### 7.13. Overcrowding

Public transportation in Algiers experiences overcrowding, primarily stemming from insufficient transport options during peak hours. This overcrowding creates conditions conducive to instances of sexual harassment and theft.

### 7.14. Poor quality infrastructures for active mobility

Many students encounter poorly maintained pedestrian routes in their daily travels, with a lack of dedicated bike lanes exacerbating the issue.

### 7.15. Physical condition of PT means:

The public transportation system in Algiers, excluding the tramway, subway, and select ETUSA buses, is in poor condition. This includes torn or dirty seats, presence of insects, excessive noise, slow speed due to aging buses, and various maintenance issues such as broken windows, seats, and doors on COUS buses. These conditions often lead to overcrowding and difficulties for passengers boarding and alighting.

## 8. Sustainable and High-quality Public Transport — Policy Recommendations:

### 8.1. Traffic Congestion

- Implement smart traffic systems for real-time traffic monitoring and adaptive signal control.
- Promote carpooling, ride-sharing, and dedicated bus lanes.

### 8.2. Long Commuting Times

- Increase the frequency of public transport and introduce express services.
- Expand the public transport network to reduce commute times.

### 8.3. Quality of Public Areas

- Upgrade pedestrian infrastructure with better lighting and green spaces.
- Enhance public transport stations for cleanliness, safety, and comfort.

### 8.4. Limited Access to Transportation Options

- Diversify transport options by increasing the availability of trams, buses, and shared bicycles.
- Promote alternative transport services like bike-sharing and electric scooters.

### 8.5. Security and Traffic Safety

- Enforce strict safety regulations and increase security presence on public transport.

### 8.6. Noise Pollution

- Reduce noise through noise-reducing technology and promote the use of electric vehicles.

### 8.7. Environmental Pollution

- Transition to clean energy buses and enforce green construction practices.

### 8.8. Lack of Comfort

- Enhance comfort in public transport with air conditioning and comfortable seating.
- Improve station amenities for a more pleasant waiting experience.

### 8.9. Accessibility for Mobility-Impaired Groups

- Retrofit vehicles and stations for full accessibility and provide assistance services.

### 8.10. Affordability

- Subsidize public transport costs for students and low-income individuals.

### 8.11. Coverage Gaps in Public Transport

- Expand service areas and improve schedule reliability.

### 8.12. Intermodal Integration
- Develop integrated ticketing systems and synchronize schedules for seamless transfers.

### 8.13. Overcrowding
- Increase the fleet size and manage demand using data analytics.

### 8.14. Poor Quality Infrastructures for Active Mobility
- Build dedicated bike lanes and maintain pedestrian routes.

### 8.15. Physical Condition of Public Transport Means
- Regularly maintain vehicles and upgrade the aging fleet for safety and comfort.

## 9. Novelty and Contribution to the Literature

In contrast to previous studies on sustainable student mobility, which have largely focused on developed countries as we mentioned before in the literature review, this research addresses a critical gap by exploring the unique challenges faced by students in a developing country context, specifically in Algiers. While much of the existing literature emphasizes issues like transportation habits and preferences in urban settings, this study contributes by offering new perceptions into the specific barriers to sustainable mobility in less-resourced areas. The findings reveal significant challenges such as inadequate transportation coverage, safety concerns, and poor accessibility for students with disabilities—areas that have been underexplored in prior research. By offering a detailed analysis of these issues and providing targeted recommendations , this study not only fills an important gap in the literature but also lays the groundwork for future research on improving student mobility in similar settings especially in African capitals, the middle east, south and eastern Asia. Moreover, the policy implications derived from the findings could inform sustainable transportation strategies in other low- and middle-income countries.

## 10. Conclusions

This study provides a comprehensive assessment of student mobility at the University of Algiers, focusing on the sustainability challenges associated with daily commuting. The research identifies several significant barriers that hinder sustainable mobility, including pervasive traffic congestion, prolonged commute times, inadequate pedestrian infrastructure, and numerous safety concerns, particularly related to harassment and reckless driving. Overcrowding, noise pollution, and environmental issues further exacerbate the difficulties faced by students in their daily commutes. Moreover, the limited accessibility of transportation services for individuals with disabilities and the poor physical condition of public transportation infrastructure present additional obstacles to achieving sustainable student mobility.

The analysis of student mobility patterns reveals that while public transportation is widely used, the existing infrastructure fails to meet the demands of the student population. Overcrowding, poor maintenance, and limited accessibility options significantly impact the quality of student commutes, underscoring the urgent need for enhancements in these areas.

To promote sustainable mobility, it is crucial to address the identified barriers by improving the safety, reliability, and inclusivity of transportation services. Implementing measures such as better traffic management, enhancing pedestrian infrastructure, and providing more accessible transport options will contribute to a more sustainable and efficient mobility system for students.

Ultimately, the study calls for a collaborative effort among policymakers, university administrators, and transportation authorities to prioritize and implement the necessary changes. By doing so, the University of Algiers can enhance the overall commuting experience for students, promoting a more sustainable and accessible urban environment.

### Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors) utilized the ChatGPT tool in order to enhance the readability and language of the paper through paraphrasing. After employing this tool, the authors thoroughly reviewed and edited the content as necessary, taking full responsibility for the publication's content.

**Ethical Considerations**

This study adhered to ethical principles of confidentiality and respect for participants. All participants voluntarily agreed to participate and were informed of the study's purpose and scope. Their anonymity was fully ensured, as no personally identifiable information was collected. Survey and interview responses were anonymized during data collection and analysis to maintain participants' privacy.

The study posed no risks to participants, and their feedback was collected in a manner that prioritized their comfort and ensured voluntary participation.

**Conflict of Interest Statement**

The author(s) declare that there are no conflicts of interest regarding the publication of this manuscript. The research was conducted independently, without any financial or personal relationships that could be perceived as influencing the results or interpretation of the study.

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