

Exploring Sustainable Transportation Perceptions Among Politeknik Negeri Ujung Pandang Students: A Mixed-Methods Study Using Mental Mapping and Unstructured Interviews

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Article Info	Abstract
Keywords: Mental Mapping; Sustainable Transportation; Tropical Urban; GIS; Mobility Pattern Received: 12 April 2025 Accepted: 22 September 2025 Published: 20 October 2025	This study investigates student perceptions of sustainable transportation at Politeknik Negeri Ujung Pandang, Indonesia, within the context of a tropical urban environment. Combining mental mapping exercises, unstructured interviews, and GIS spatial analysis, the research analyzes mobility patterns and attitudes toward sustainable transportation among 165 students commuting to and from campus. Correlation analysis revealed that routes utilizing sustainable transportation (e.g. walking, cycling) were most common within a 1,000-meter radius of the campus, with safety, travel distance, and time emerging as key determinants of mode choice. The findings highlight the challenges of promoting sustainable mobility in tropical settings, where factors such as extreme heat, seasonal rainfall, and fragmented infrastructure influence commuting behavior. This study underscores the need for climate-responsive urban planning and targeted interventions, such as shaded walkways, secure cycling lanes, and improved public transit connectivity, to enhance the adoption of sustainable transportation in tropical university environments.

1. Introduction

The global push for sustainable urban mobility has placed a strong emphasis on non-motorized transportation modes, such as walking and cycling, as key solutions to traffic congestion, environmental pollution, and public health challenges. Sustainable urban mobility aims to create transport systems that are environmentally friendly, socially inclusive, and economically viable. However, the successful adoption of these modes is highly contingent on local contexts [1,2] particularly in the rapidly urbanizing regions of the Global South. In cities like Makassar, Indonesia, the need for such integrated and low-impact mobility solutions is critical. Tropical urban environments present a distinct set of challenges [3], where extreme heat, heavy seasonal rainfall, and often fragmented infrastructure create significant barriers to sustainable transportation [4,5]. Promoting non-motorized modes in these settings therefore requires a nuanced understanding that moves beyond conventional planning models developed for temperate climates. Addressing the unique interplay of environmental and infrastructural factors is essential for developing effective strategies to improve quality of life and reduce negative externalities in tropical cities.

Sustainable transportation in the tropics is not merely a matter of providing infrastructure but of addressing a complex interplay of environmental and perceptual factors. Previous studies have established that factors like distance [6], travel time [7], and safety [8] are universal determinants of mode choice. In tropical contexts, research has begun to highlight the additional deterrent of thermal discomfort and the lack of weather-protected routes [9]. Yet, a significant gap remains in understanding the integrated mobility behaviour of specific populations, such as university students, whose daily commuting patterns are highly regular and concentrated within campus-adjacent areas. Previous studies that focused on mobility behaviour of university students in tropical areas often rely on singular methodological approaches like quantitative surveys [10-12], thereby failing to capture the nuanced perceptions that underlie mobility patterns.

The challenge of promoting sustainable mobility in tropical settings is thus twofold: first, to objectively map the physical constraints, and second, to understand the subjective perceptual landscapes of commuters. While tools like buffer analysis in Geographic Information Systems (GIS) are effective for quantifying the spatial range of walking, for instance, they cannot reveal why a short, physically viable route is perceived as undesirable or unsafe. Conversely, subjective methods alone may lack the spatial rigor needed for planning. This points to a critical methodological gap, the need to integrate objective spatial metrics with qualitative data on human experience.

This study aims to fill this gap by investigating student commuting at Politeknik Negeri Ujung Pandang, Indonesia. The novelty of this research lies in its integrative methodology, which combines mental map exercises with GIS-based spatial analysis, a structured questionnaire, and unstructured interviews. Mental mapping directly captures students' perceived routes [13], barriers [14], and preferences [15,[16], offering an invaluable layer of subjective spatial understanding. When synthesized with objective buffer analysis of travel distances, this approach provides a more holistic view of the decision-making processes behind sustainable transportation

2. Research Methodology

2. 1. Study Area

This study adopted a mixed-methods approach to investigate the mobility patterns of students at Politeknik Negeri Ujung Pandang (PNUP), Indonesia, focusing on their use of walking as a transportation mode. The study area, including the defined buffer zone for spatial analysis, is illustrated in Figure 1. The methodology integrates quantitative and qualitative techniques to ensure comprehensive insights into factors influencing walking behavior. The study area, as presented in Figure 1, encompasses the PNUP campus and its surrounding neighborhoods within a defined buffer zone, representing distances of up to 1,000 meters from the campus center. This spatial delineation enables analysis of students' walking routes and accessibility patterns relative to the campus.

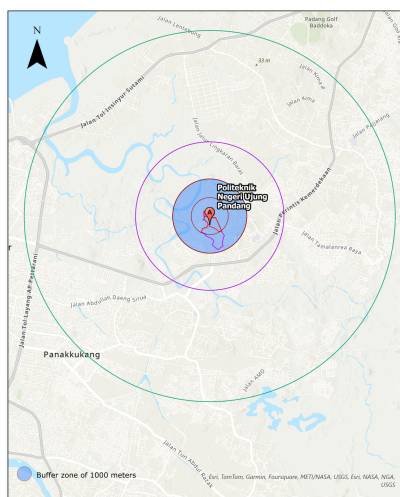


FIGURE 1. Study area

2.2. Research Design

The research design combined qualitative and quantitative methodologies to address the study's objectives. A total of 165 students from various departments at Politeknik Negeri Ujung Pandang (Campus 1) participated as respondents. Each respondent completed a questionnaire and drew a corresponding mental map, resulting in 165 mental maps and 165 questionnaires collected. Furthermore, 20 respondents were purposively selected for in-depth interviews to obtain richer qualitative insights into their perceptions and motivations regarding walking behavior. To keep the ethical consideration, the study used ID 1-165 for the respondents.

Data Collection

Data were collected through three complementary instruments: mental mapping, questionnaires, and unstructured interviews. Mental maps were used to explore how students perceive their environments [17,18], during their commutes to and from campus. Participants were instructed to sketch their daily routes, marking key landmarks (e.g., bus stops, eateries) [19], [20] and transportation modes (e.g., walking, motorcycles). These mental maps were subsequently analyzed using GIS software (ArcGIS Pro) to identify spatial patterns, congestion points, and infrastructure barriers.

Questionnaires were employed to understand student perceptions related to sustainable transportation, specifically the choice to walk. The questionnaire consisted of four variables: demographic data [21], mobility patterns (including primary transportation modes, walking frequency, travel duration, and distance), driving and limiting factors [22] which is assessed through a Likert scale (1-5) measuring the perceived importance of elements such as sidewalk availability, safety, weather, and cost savings [21], and open-ended questions exploring reasons for choosing or avoiding walking. The quantitative data from the questionnaires were analyzed using descriptive statistics.

To contextualize the quantitative findings, semi-structured interviews were conducted with 20 purposively selected participants (7 walkers, 13 non-walkers). The interviews focused on walking experiences, challenges (e.g., sidewalk conditions), and suggestions for improvement. All interviews were audio-recorded, transcribed verbatim, and anonymized to ensure confidentiality.

3. Results and Discussion

Figure 1 and its corresponding data in Table 1 present the results of a spatial analysis using buffer zones to categorize student commuting distances. The buffers were created as concentric zones around the campus (<400 meters, 400–1000 meters, 1000–2000 meters, and >2000 meters) to facilitate the analysis of walking behavior against standardized distance intervals. The results demonstrate a strong inverse correlation between distance and the likelihood of walking. The data indicates that the maximum threshold for walking under local conditions is 1000 meters, with the highest proportion of walkers (16%) residing within the 400–1000 meter zone. This categorization confirms that walking is primarily a mode for those living in close proximity to the campus.

The analysis of questionnaire data, as shown in Table 2, reveals a clear hierarchy of factors influencing students' walking behavior. This table examines the perceptions of both walking and non-walking students. Cost-saving emerged as the most positively regarded factor (Mean = 3.1), however, this score remains only moderately positive. In contrast, infrastructural and environmental factors, such as the availability of pedestrian facilities (Mean = 1.7), safety from crime (Mean = 1.8), and supportive weather conditions (Mean = 1.9) were consistently rated poorly, acting as significant obstructions to walking.

TABLE 1. Distribution of walkers and non-walkers by distance from campus, categorized via Buffer Analysis.

Distance (meters)	Walkers (%)	Non-Walkers (%)
<400	9	91
400-1000	16	84
1000-2000	0	100
> 2000	0	100

TABLE 2. Factors influencing walking behavior from questionnaires and interviews.

Factors	Mean	Interview Result
Availability of pedestrians	1.7	The infrastructure was often unavailable or in poor condition
Safety from crime	1.8	Safety might be a concern in certain areas
Supportive weather	1.9	Respondents find the tropical weather (rain/heat) was not supportive enough for walking
Cost-saving	3.1	Saving money is generally important, but not enough to make them walk.

TABLE 3. Importance of walking factors among walker-only respondents.

	Availability of pedestrians	Safety from crime	Supportive weather	Cost-saving
Mean	3.86	3.71	3.57	4.86

The qualitative data derived from interviews provide important context for these quantitative scores. Respondents explicitly stated that the "infrastructure was often unavailable or in poor condition," confirming the low score for pedestrian facilities. Concerns about safety in specific areas and the fact that "the tropical weather (rain/heat) was not supportive enough" further explain the low ratings for safety and weather. Notably, while respondents acknowledged that "saving money is generally important," they consistently qualified that this alone was "not enough to make them walk," highlighting that financial motivation is insufficient to overcome other significant barriers.

Interestingly, as shown in Table 3, the perspective shifts when examining the subgroup of students who do walk. For these individuals, the ratings for all factors are significantly higher. The mean score for cost-saving rises to 4.86, while factors such as pedestrian facility availability (3.86), safety (3.71), and weather (3.57) are viewed far more favorably. This suggests that walkers, likely due to living closer to campus (as indicated by the buffer analysis), experience a different reality, one where short distances make infrastructural deficiencies and weather inconveniences more manageable. Thus, the primary motivator of cost-saving dominates their decision-making.

This interpretation is strongly supported by the buffer analysis (Table 1), which established that walking is almost exclusively confined to students living within 1,000 meters of campus. The combination of all three data sources paints a coherent picture that the decision to walk is influenced by multiple factors that interact critically. Proximity, as identified through spatial analysis, acts as a fundamental enabling factor. For those living within this ideal distance, perceived infrastructural and environmental barriers are lower (as seen in the walkers' data in Table 3), which in turn allows the motivating factor of cost-saving to become the decisive element. For those beyond this distance, the combined barriers of poor infrastructure, safety concerns, and unsupportive weather (as consistently reported in the main survey) render financial incentives ineffective, leading to a near-universal dependence on motorized transport.

This study examines the need for a comprehensive approach to promote sustainable mobility at Politeknik Negeri Ujung Pandang. It highlights that while emphasizing the economic benefits is important, the primary focus should be on systematically eliminating both physical and perceived barriers to walking within the essential 1-kilometer catchment area surrounding the campus. Walking is fundamental to sustainable urban mobility [23], especially for students, as it provides environmental, health, and social advantages. University campuses and school zones are ideal settings for encouraging walking [12, 24], but achieving success requires improvements in infrastructure [25, 26], policy [1], and student attitudes.

4. Conclusion

This study investigated student perceptions and patterns of sustainable transportation at Politeknik Negeri Ujung Pandang, Indonesia, within a tropical urban context. By integrating questionnaires, mental mapping, and unstructured interviews, this research offers a comprehensive mixed-methods perspective on the factors that facilitate or obstruct walking as a primary mode of transportation.

The findings demonstrate that the decision to walk is not determined by a single factor, but by a critical interplay of distance, infrastructure, and environmental conditions. Spatial analysis established a clear distance decay effect, with walking almost exclusively confined to a 1,000-meter radius from the campus. Within this zone, the perceived barriers of poor pedestrian infrastructure, safety concerns, and unsupportive tropical weather were significant enough to deter the majority of students. Notably, the subgroup of students who do walk reported a markedly more positive perception of these same factors, indicating that shorter distances make infrastructural and environmental challenges more manageable. For these individuals, the powerful

motivator of cost-saving becomes the decisive factor, underscoring the economic dimension of sustainable mobility choices.

The integration of mental maps with Geographic Information Systems (GIS) uncovered a disconnect between the physical environment and student perceptions. It highlighted specific problem areas, such as clogged sidewalks and unsafe routes, that quantitative data alone might overlook. This combination of subjective experiences and objective spatial data is essential for creating transportation planning that is centered around user needs.

In practical terms, this study underscores that promoting sustainable mobility in a tropical campus environment requires targeted, multi-faceted interventions. Simply promoting the benefits of walking is insufficient. Efforts must prioritize the improvement of the pedestrian environment within the crucial 1-kilometer catchment area. Key recommendations include the development of shaded and continuous walkways, the enforcement of clear sidewalks free from obstruction, and the enhancement of street lighting to improve safety. Addressing these very specific, perceived barriers is essential to unlock the latent potential for walking, particularly among students for whom cost saving is a significant motivation.

The limitation of this study is that it focuses on a single campus and relies on self-reported data. Future research could use GPS tracking to validate the mental maps and route choices. Additionally, expanding the study to include other institutions would help test whether the identified distance threshold and perceived barriers are transferable.

In conclusion, this study contributes to the field of sustainable transportation by showing that in a tropical urban environment, proactive and context-sensitive improvements to infrastructure are essential for promoting a shift towards non-motorized mobility. It emphasizes that for sustainable transportation to be a viable option, it must be safe, comfortable, and convenient.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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