Journal of Tropical Resources and Sustainable Science
Website : http://journal.umk.edu.my/index.php/jtrss/
eISSN : 2462-2389
Vol: 13 Issue 2, 2025, 287-293
DOI: https://doi.org/10.47253/jtrss.v13i2.1939

RESEARCH ARTICLE

Assessing the relationship between walkability factors and walking behaviours among university students using structural equation model

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ARTICLE HISTORY
Received : 20 July 2025
Accepted : 6 September 2025
Online : 15 December 2025

KEYWORDS
Walkability factors,
walking behaviours,
campus,
structural equation model

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ABSTRACT

Walkability in university campuses has attracted more attention in Malaysia due to its influence on student health, mobility, and environmental sustainability. However, few studies have examined the determinants of walking behaviour in local higher learning institutions. This study investigates the relationship between determinants of walkability and walking behaviours among students at Universiti Malaysia Kelantan (UMK), Bachok Campus. A quantitative approach was adopted to gain deeper insights into the determinants of pedestrian behaviours. Quantitative data were collected from a purposive sample of 300 students through a structured survey in May and June 2024 and were analysed using SPSS Version 28.0 and AMOS. This study reveals that among the three factors encouraging walkability on campus, only Amenities and Environmental Factors significantly influence student walking behaviours. In contrast, despite high ratings, Pedestrian Safety and Infrastructure factors showed no statistical effect. These findings highlight the importance of campus environments enriched with amenities and environmental features in shaping students' walking behaviours. Prioritising such elements can promote more active, sustainable, and engaging mobility patterns across the campus.

1. INTRODUCTION

The concept of walkability has gained increasing attention in campus planning due to its multifaceted benefits for student wellbeing, environmental sustainability, and academic engagement. Traditionally regarded as a physical infrastructure attribute, walkability is now reconceptualised as a dynamic interaction between spatial design, behavioural intention, and emotional experience. Recent research underscores this evolving understanding by demonstrating that walkable campus environments contribute to mobility and psychological and academic outcomes. For example, Liao & Zhu (2025) and Liao et al. (2022) report that campus environments designed with pedestrian- oriented features evoke positive emotional responses, enhance students' mental health, and increase their willingness to engage in daily walking routines. Wang et al. (2025) further support this relationship by showing that walkability promotes mental clarity and social interaction, which, in turn, contribute to improved academic performance. In parallel, highlight the importance of incorporating community needs, environmental comfort, and infrastructure quality into campus design, particularly in tropical and harsh climatic conditions. These findings suggest that walkability should not be assessed solely through physical connectivity or accessibility but must also account for emotional satisfaction, behavioural motivations, and cultural context.

Campus walkability remains a critical yet under-optimised component of sustainable university development in Malaysia, particularly in tropical and suburban environments. Recent scholarship reveals that a complex interplay of physical infrastructure, environmental comfort, and institutional planning strategies influences walkability. A systematic review by Demdoum et al. (2024), identified pedestrian infrastructure, connectivity, safety, and thermal comfort as key built environment attributes shaping walkability across Malaysian settings. However, the review also underscored a significant lack of research on behavioural dimensions and student experiences. Similarly, Harun et al. (2020) highlighted that comfort, accessibility, and spatial connectivity are essential to promoting pedestrian-friendly campus streets, advocating for strategic design interventions tailored to student mobility patterns. Ken Keat et al. (2016) observed that infrastructural issues such as disconnected walkways, inadequate signage, and insufficient shading commonly hinder walking behaviours, even when facilities are located within proximity. Ramakreshnan et al. (2020) also emphasised that students' willingness to walk is closely tied to the availability of safe, continuous, and well-connected pedestrian routes. Their subsequent study (Ramakreshnan et al., 2024) further identified structural deficiencies in street connectivity, weak institutional commitment, and limited land-use integration as persistent obstacles to effective campus walkability.

Regarding environmental comfort, Ramlee et al. (2023) demonstrated that tropical vegetation, particularly the presence of shade trees and ground covers, plays a vital role in reducing thermal stress and encouraging walking. Their later work (Ramlee et al., 2024) expanded on this by identifying critical walkability enhancers, including high-quality continuous paths, shaded routes, strong visual connectivity between campus nodes, and safe pedestrian crossings. Kasim et al. (2018) also found that incorporating green elements, such as tree-lined avenues, native plantings, and rest areas, improves pedestrian comfort and student wellbeing. Meanwhile, Wan Mohamad et al., (2020) showed that native vegetation supports biodiversity, thereby enhancing the sensory and aesthetic appeal of walking environments. Furthermore, Wali & Frank (2024) argued that increased walkability must be accompanied by street-level safety features such as traffic calming and secure pedestrian zones. Without these elements, walkable environments may unintentionally raise safety risks.

While these studies contribute valuable insights, they do not fully explain how specific walkability factors relate to walking behaviours, particularly behaviour intentionally chosen for environmental reasons and practised over time. Existing literature often treats walkability as a static physical attribute rather than a dynamic interaction between space and behaviour. Few studies in Malaysia have examined the psychological, motivational, or socio-environmental aspects that influence students' decisions to walk sustainably. This gap limits the ability of campus planners and policymakers to design interventions that go beyond aesthetics and connectivity to encourage long-term behavioural change. Therefore, this study examines how key walkability factors, namely pedestrian safety, thermal comfort, connectivity, accessibility, and environmental aesthetics, influence walking behaviours among university students. The study also aims to understand how these physical attributes and students' attitudes, perceptions, and intentions shape their willingness to walk within the campus environment. This study aims to contribute to a growing body of research advocating walkability as both a design principle and a behavioural outcome, essential to advancing the sustainability agenda in higher education environments.

2. MATERIALS AND METHODS

2.1. Data collection

This study adopted a quantitative, cross-sectional survey design to explore the factors that shape walkability and their relationships with students' walking behaviours at Universiti Malaysia Kelantan (UMK) Bachok Campus. The campus was chosen as the study site because of its pedestrian-friendly layout, where academic buildings, student hostels, green spaces, and recreational areas are closely integrated, creating a suitable setting for understanding how students experience walking in their daily routines.

A total of 300 undergraduate students were selected through purposive sampling, focusing on those who frequently walk on campus. The participants represented a range of faculties and academic years, ensuring a broad mix of perspectives and experiences. Data were gathered using a self-administered physical questionnaire distributed over four weeks (May–June 2024). Before the main data collection began, the questionnaire was pilot tested with 50 students in both English and Malay to evaluate its clarity, reliability, and cultural suitability. Feedback from this pilot study was used to refine the final version of the instrument. To ensure accessibility and capture a diverse range of participants, data collection stations were strategically set up near the main entrances of academic buildings, student hostels, and commonly used pedestrian routes across the campus. This placement made it easier to reach students during their daily movements, allowing the researchers to engage with those who were actively walking within the campus environment and better reflect the actual walking population.

The questionnaire contained three main sections, initially developed in English and later translated into Malay. The first section collected demographic information, including gender, age, nationality, race, vehicle use, and estimated daily walking distance. The second section included 52 items assessing aspects of walkability, such as infrastructure quality, pedestrian safety, environmental comfort, and campus amenities, which respondents rated on a 10-point Likert scale from 1 (not important at all) to 10 (very important). The third section focused on walking behaviours, using 15 items that explored students' reasons and preferences for walking across different areas of the campus. These were also rated on a 10-point Likert scale, from 1 (not preferred) to 10 (highly preferred).

Ethical considerations were carefully observed throughout the study. Participation was voluntary, and all participants were informed of the study's purpose, procedures, and their right to withdraw at any stage without penalty. Informed consent was obtained before data collection. Participants were also assured of confidentiality and anonymity, and no identifying information was recorded or reported at any point in the research.

2.2. Data analysis

Structural Equation Modelling (SEM) was performed using AMOS Version 29.0 to examine the relationships between the three identified walkability factors (independent variables) and walkability behaviours (dependent variable). This analysis builds upon prior research by (Ramlee et al., 2024), which employed Exploratory Factor Analysis (EFA) to identify the key dimensions of walkability among university students. The earlier phase of the study focused on uncovering the underlying structure of walkability-related items, leading to the identification of three core constructs: Pedestrian Safety and Comfort, Pedestrian and Cyclist Infrastructure, and Amenities and Environmental Factors.

In the current phase, SEM extends this work by testing the structural relationships among these constructs and their influence on walking behaviours. This progression from EFA to SEM strengthens the study's methodological rigour by moving from exploratory to confirmatory analysis, enabling a more comprehensive understanding of how the identified factors interact. Through this approach, the study provides empirical evidence on how campus walkability features shape students' actual walking behaviours, thereby reinforcing both the theoretical framework and practical applications of walkability research in university settings (Liao et al., 2022; Zhang et al., 2024).

The proposed model was evaluated using standard goodness-of-fit indices, including the Chi-square (χ^2) statistic, Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). Additionally, path coefficients, critical ratios (C.R.), and p-values were examined to determine the strength and significance of the hypothesised relationships (Fornell & Larcker, 1981; Hui & Bateson, 2013). This modelling approach enabled the researchers to assess how specific environmental and infrastructural attributes influence students' likelihood of walking on campus, offering valuable insights for sustainable mobility planning and evidence-based campus design.

3. RESULT AND DISCUSSION

3.1. Demographic profiles

The demographic composition of the study sample (N = 300) is presented in Table 1. Most respondents were male (59.0%), while females accounted for 41.0% of the sample. Regarding age distribution, an overwhelming proportion (96.0%) fell within the 20–29 age group, reflecting the typical undergraduate student demographic. A small fraction (4.0%) was aged 30–39, and no participants were recorded in the 40–49 age category. The sample was predominantly Malaysian, comprising 99.7% of respondents, with only 0.3% identifying as non-Malaysian. Ethnically, Malay students constituted the largest proportion at 49.3%, followed by those identifying as Chinese, Indian, Bumiputera, and others.

Table 1: Demographic profile of respondents (N=300)

		Frequency (N)	Percent (%)
Gender	Male	177	59.0
	Female	123	41.0
Age group	20-29	288	96.0
	30-39	12	4.0
	40-49	0	0
Nationality	Malaysian	299	99.7
	Non-Malaysian	1	0.3
Race	Malay	148	49.3
	Chinese	43	14.3
	Indian	51	17.0
	Bumiputera	57	19.0
	Others	1	0.3

3.2. Descriptive analysis

The descriptive analysis in Table 2 showed that students rated walkability factors and behaviours highly, indicating their importance and frequent practice on campus. For Pedestrian Safety and Comfort (PCS), mean scores ranged from 7.43 to 8.29. The highest-rated item was protection from rainy weather (M = 8.29), followed by safe crosswalks (M = 8.19) and separation between pedestrian and vehicle routes (M = 8.14), highlighting students' concern for comfort and safety. The lowest-rated item in this group, buffer from vehicle noise (M = 7.43), was still necessary.

In the Pedestrian and Cyclist Infrastructure (PCI) category, scores ranged from 7.73 to 8.32. The most important feature was the visibility of crosswalks at night (M = 8.32), showing that students value safety in low-light conditions. Other key items included clear sidewalks (M = 8.20) and shaded walkways (M = 8.10), indicating a preference for comfort and easy navigation. For Amenities and Environmental Factors (AEF), item means ranged from 7.55 to 8.18. The highest-rated item was beautiful landmarks and murals (M = 8.18), followed by resting places (M = 7.93) and meeting points (M = 7.96), showing the importance of attractive and social spaces. Items like the presence of wild animals (M = 7.69) and water dispensers (M = 7.55) were rated slightly lower but remained relevant. Walkability Behaviours (WB) had somewhat lower but moderate-to-high mean scores, ranging from 6.90 to 7.27. The most common behaviours included walking late at night (M = 7.27) and walking to sports facilities (M = 7.25). Students also frequently walked between buildings (M = 7.24), to the library (M = 7.22), and to attend events (M = 7.17). The lowest-rated behaviour was walking while using smartphones (M = 6.90), possibly due to safety concerns. These findings suggest that students value pedestrian safety, comfort, accessible infrastructure, and walkable amenities, and that they actively walk throughout the campus.

Table 2: Descriptive analysis of all constructs

Construct	Item Description	Mean	Std. Deviation
Pedestrian Safety and Comfort			
B10	Segregation between pedestrian and vehicles route	8.1433	1.77952
B1	Reducing pedestrian conflict	7.6033	2.03136
B17	Cross walks to cross the roads safely	8.1867	1.73065
B25	Trees planted along the sidewalk clearly direct my way	7.9500	1.74480
B29	Aesthetics experience of the landscape surrounding the walkways	8.0867	1.76906
B16	Grass or dirt strip to separate roads from sidewalks	8.0967	1.74857
B26	Crosswalk marks at each main street junction	7.8067	1.82035
B27	Parks, gardens, recreational areas, and green space in the campus	7.9367	1.71146
B36	Protection from rainy weather	8.2933	1.75620
B2	Buffer from vehicles noise	7.4300	1.85740
B6	Seating/waiting area for pedestrian on streets	7.8800	1.69761
Pedestrian and Cyclist Infrastructure			
B8	Bicycle lane for cyclist	7.7333	1.77748
B46	Pedestrian signals and signage placed at appropriate places	7.9667	1.80826
B20	Sidewalk clearance from obstruction elements	8.1967	1.62896
B48	Pedestrian walkways shaded with tree canopies or roofs	8.0967	1.61742
B19	Proximity between the buildings inside the campus	7.9533	1.72076
B21	Crosswalk marks need to be visible during the night	8.3233	1.58551
Amenities and Environmental Factors			
B50	Water dispensers along the walkways	7.5500	1.89194
B49	Adequate resting places or gazebo along the walkways	7.9300	1.77641
B33	Existence of wild animals	7.6867	1.91154
B42	Small stops point/meeting area.	7.9567	1.71988
B34	Beautiful landmarks, murals, and wall paintings as attractive factors	8.1800	1.68634
B9	Jogging track	7.8233	1.64351
Walking Behaviours			
C1	Walking between different academic buildings for classes, labs, and lectures	7.2400	1.87281
C2	Walking around campus, either for relaxation or socializing with friends	7.1133	1.82527
C3	Walking to and from the campus library or study spaces for research, studying, or group projects	7.2167	1.90310
C4	Engaging in walking for leisure and exercise, often around campus green spaces or designated walking paths	7.1433	1.98054
C5	Walking to attend campus events, meetings, workshops, or extracurricular activities	7.1700	2.01361
C6	Holding discussions or collaborative sessions while walking across campus, providing a change of scenery, and promoting physical activity	7.0900	1.99545
C7	Walking with friends or classmates to catch up, share stories, or simply enjoy each other's company	7.1500	1.92349
C8	Students walking to and from sports facilities, gymnasiums, or recreational areas for physical activities	7.2533	1.90822
C9	Walking back to dorms or housing after attending campus parties, events, or social gatherings	7.1467	1.98282
C10	Exploring different parts of the campus, discovering new buildings, or taking scenic routes for a change of scenery	7.0667	2.13481
C11	Utilizing green spaces on campus for walks, relaxation, or outdoor study sessions	7.1200	1.96940
C12	Students with disabilities navigating the campus using accessible pathways and ramps	7.0167	2.09388
C13	Walking to sports facilities, stadiums, or gymnasiums for athletic events, games, or personal workouts	7.1400	1.94069
C14	Walking on campus paths during late hours, either heading back from late classes or taking nighttime strolls	7.2700	1.90680
C15	Walking while using smartphones or other devices to stay connected, listen to music, or engage in virtual activities	6.9000	2.28196

3.3 Structural equation model

The structural equation model in Figure 1 incorporated three exogenous latent variables: Pedestrian Safety and Comfort (PCS), Pedestrian and Cyclist Infrastructure (PCI), and Amenities and Environmental Factors (AEF). Multiple observed indicators derived from prior factor analysis, along with the endogenous variable Walking Behaviours (WB), represented these constructs.

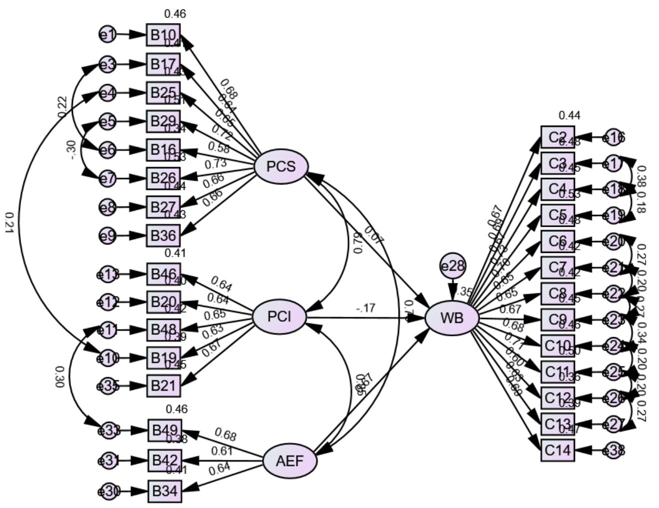

Figure 1: Structural Equation Model of Walkability Factors and Walkability Behaviours

Table 3: Reliability and Convergent Validity of Constructs

Construct	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Pedestrian Safety & Comfort (PCS)	0.443	0.863	0.864
Pedestrian & Cyclist Infrastructure (PCI)	0.415	0.780	0.780
Amenities & Environmental Factors (AEF)	0.414	0.679	0.680
Walkability Behaviours (WB)	0.451	0.914	0.914

The measurement model was evaluated for reliability and validity, as shown in Table 3. Internal consistency was confirmed, with Average Variance Extracted (AVE) ranging from 0.680 to 0.914 and Composite Reliability (CR) ranging from 0.679 to 0.914, indicating acceptable to strong reliability across all constructs. Convergent validity was partially supported: although Cronbach's alphas ranged from 0.414 to 0.451, slightly below the recommended 0.50 threshold, the high CR values and significant factor loadings (all > 0.58, $p < .001$) suggest acceptable convergent validity.

Table 4: The Discriminant Validity Index Summary

Construct	Pedestrian Safety & Comfort (PCS)	Pedestrian & Cyclist Infrastructure (PCI)	Amenities & Environmental Factors (AEF)	Walkability Behaviours (WB)
Pedestrian Safety & Comfort (PCS)	0.929			
Pedestrian & Cyclist Infrastructure (PCI)	0.612	0.883		
Amenities & Environmental Factors (AEF)	0.574	0.648	0.824	
Walkability Behaviours (WB)	0.496	0.428	0.671	0.956

Discriminant validity presented in Table 4 was assessed using the Fornell–Larcker criterion (Fornell & Larcker, 1981), comparing the square root of AVE with inter-construct correlations. The square roots of AVE for all constructs; PCS (0.929), PCI (0.883), AEF (0.824), and WB (0.956), were higher than their respective inter-construct correlations, confirming that each construct is distinct.

The structural model in Table 5 also demonstrated excellent overall fit, with $\chi^2/df = 1.682$ ($\chi^2 = 210.25$, df = 125), RMSEA = 0.048 (90% CI = 0.041 to 0.054), PCLOSE = 0.706, and CFI = 0.937. Incremental indices such as IFI (.937) and TLI (0.928) further supported a strong model t (Hui & Bateson, 2013). Absolute fit indices, including GFI (0.881) and AGFI (.855), were acceptable but slightly below ideal thresholds. The model showed high parsimony (PCFI = 0.826, PRATIO = 0.882) and predictive relevance, with ECVI (2.529) outperforming both saturated (2.910) and independence models (14.449). HOELTER's critical N = 201 indicates acceptable model stability for large sample inference. Despite a slightly elevated RMR (0.150), all other indices confirm that the measurement and structural model adequately fit the data.

Table 5: Goodness-of-Fit Indices for the Structural Equation Model

Fit Index	Model Value	Threshold	Interpretation
Chi-square Minimum Discrepancy divided by Degrees of Freedom (CMIN/DF)	1.682	< 2.0	Excellent
Root Mean Residual (RMR)	0.150	< 0.08	Too High
Goodness-of-Fit Index (GFI)	0.881	≥ 0.90	Slightly Below
Adjusted Goodness-of-Fit Index (AGFI)	0.855	≥ 0.85	Acceptable
Root Mean Square Error of Approximation (RMSEA)	0.048	< 0.05	Excellent
p-value for Close Fit of RMSEA (PCLOSE)	0.706	> 0.05	Good Fit
Normed Fit Index (NFI)	0.859	≥ 0.90	Nearly Acceptable
Relative Fit Index (RFI)	0.840	≥ 0.90	Nearly Acceptable
Incremental Fit Index (IFI)	0.937	≥ 0.90	Excellent
Tucker-Lewis Index (TLI)	0.928	≥ 0.90	Excellent
Comparative Fit Index (CFI)	0.937	≥ 0.90	Excellent
Parsimony Ratio (PRATIO)	0.882	≥ 0.50	Strong Parsimony
Parsimony Comparative Fit Index (PCFI)	0.826	≥ 0.50	Strong Parsimony
Expected Cross-Validation Index (ECVI)	2.529	Lower = Better	Good Prediction
HOELTER (.05)	201	≥ 200	Acceptable Sample Size

3.4. Path analysis

The standardised regression weights for all constructs in the measurement model were examined to assess indicator reliability (see Table 6). Ten items were removed from the final structural model due to low factor loadings or redundancy. For the PCS construct, items B1, B2, and B6 were dropped, while PCI excluded item B8. For the AEF construct, items B9, B33, and B50 were removed because their loadings were below the acceptable threshold. In the WB construct, items C1 and C15 were excluded. These removals were necessary to improve model fit, ensure construct reliability, and retain only the strongest indicators for each latent variable.

All items demonstrated acceptable to strong factor loadings, supporting their validity as reflective indicators of their respective latent constructs as presented in Table 7. For PCS, the indicator estimates ranged from 0.839 to 1.097, with critical ratios (C.R.) exceeding the recommended threshold of 8.0, indicating substantial and significant contributions to the latent construct. PCI items (B19–B21, B48, B46) yielded estimates ranging from 0.961 to 1.075, all statistically significant ($p < .001$), supporting their validity as indicators. The AEF construct included three items (B34, B42, B49) with standardised loadings ranging from 0.877 to 0.893, indicating acceptable indicator strength. The WB construct, represented by 13 items (C2–C14), showed strong standardised loadings ranging from 0.922 to 1.109, confirming its robustness as a reflective construct. These results demonstrate that all items adequately represent their respective latent variables, supporting the reliability and convergent validity of the measurement model.

Table 6: The standardized regression weights for all constructs

Construct			Estimate	S.E.	C.R.	P
WB	<---	PCS	0.079	0.142	0.560	.575
WB	<---	PCI	-0.209	0.265	-0.788	.431
WB	<---	AEF	0.736	0.247	2.987	.003
B10	<---	PCS	1.000			
B17	<---	PCS	0.912	0.092	9.938	***
B25	<---	PCS	0.945	0.093	10.212	***
B29	<---	PCS	1.050	0.096	10.892	***
B16	<---	PCS	0.839	0.092	9.117	***
B26	<---	PCS	1.097	0.099	11.044	***
B27	<---	PCS	0.938	0.091	10.319	***
B36	<---	PCS	0.952	0.093	10.222	***
B19	<---	PCI	1.000			
B48	<---	PCI	0.981	0.108	9.065	***
B20	<---	PCI	0.961	0.108	8.908	***
B46	<---	PCI	1.075	0.120	8.955	***
B21	<---	PCI	0.985	0.106	9.257	***
B34	<---	AEF	0.893	0.098	9.138	***
B42	<---	AEF	0.877	0.099	8.859	***
B49	<---	AEF	1.000			
C2	<---	WB	0.922	0.090	10.218	***
C3	<---	WB	1.001	0.074	13.458	***
C4	<---	WB	1.000			
C5	<---	WB	1.109	0.091	12.172	***
C6	<---	WB	1.053	0.099	10.597	***
C7	<---	WB	0.947	0.095	9.947	***
C8	<---	WB	0.939	0.094	9.996	***
C9	<---	WB	1.005	0.098	10.259	***
C10	<---	WB	1.101	0.106	10.382	***
C11	<---	WB	1.053	0.098	10.736	***
C12	<---	WB	0.948	0.103	9.230	***
C13	<---	WB	0.922	0.095	9.674	***
C14	<---	WB	0.993	0.095	10.489	***

Table 7: Summary of the standardized regression weights for all constructs

Fit Index	Model Value	Threshold	Interpretation
Pedestrian Safety & Comfort (PCS)	B10–B36	0.839 – 1.097	All good (strong C.R. > 8.0)
Pedestrian & Cyclist Infrastructure (PCI)	B19–B21, B48, B46	0.961 – 1.075	All significant
Amenities & Environmental Factors (AEF)	B34, B42, B49	0.877 – 0.893	Acceptable
Walkability Behaviours (WB)	C2–C14	0.922 – 1.109	Strong indicator set

Table 8: Structural Path Estimates and Significance Results

Path	Estimate	S.E.	C.R.	p-value	Interpretation
WB ← PCS	0.079	0.142	0.560	0.575	Not significant
WB ← PCI	-0.209	0.265	-0.788	0.431	Not significant, negative effect
WB ← AEF	0.736	0.247	2.987	0.003	Significant positive effect

The results indicate differential effects among the three walkability factors as presented in Table 8. The path from PCS to WB was positive but statistically non-significant ($\beta = 0.079$, $p = 0.575$), suggesting that although comfort and safety may conceptually contribute to walkability perceptions, they did not exert a meaningful influence in this study context. Similarly, PCI exhibited a negative but non-significant relationship with walkability ($\beta = -0.209$, $p = 0.431$), implying that the presence of infrastructure alone does not significantly shape students' overall perception of walkability and may even be perceived negatively under certain conditions, such as poor maintenance or lack of integration with user needs. In contrast, AEF showed a strong, statistically significant positive effect on WB ($\beta = 0.736$, $p = 0.003$), confirming that students' perceptions of a walkable campus are primarily influenced by environmental factors such as shading, cleanliness, greenery, and the presence of social or resting amenities.

3.5. Discussion

Structural equation modelling (SEM) findings support the argument that amenities and environmental factors are the most influential determinants of walking behaviours among university students. The strong path coefficient ($\beta = 0.736$, $p = 0.003$) underscores the importance of environmental quality, aesthetic appeal, and access to functional amenities in motivating students to walk. This result aligns with Ramlee et al.'s (2023, 2024) findings, which identified thermally comfortable walking environments, adequate shading, visually engaging landscapes, and social spaces as key factors enhancing walkability on tropical campuses. The current results extend these insights by showing that these factors are appreciated and statistically significant drivers of walking behaviour when tested through SEM.

In contrast, Pedestrian Safety and Comfort and Pedestrian and Cyclist Infrastructure did not show statistically significant effects (PCS: $\beta = 0.079$, $p = 0.575$; PCI: $\beta = -0.209$, $p = 0.431$). This result echoes previous findings by Ken Keat et al. (2016), who noted that while basic infrastructure, such as crosswalks and signage, is essential, their influence may plateau once a minimum level of adequacy is met. The high mean scores observed in the descriptive analysis for PCS and PCI items suggest that students perceive these features as satisfactory, which could explain the lack of significant relationships in the structural model. This finding resonates with Wali & Frank (2024), who argued that infrastructure and safety features, although essential, may not actively encourage walking unless combined with emotionally and sensorially engaging environments.

Moreover, the results are consistent with those of Demdoum et al. (2024), who emphasised the need to move beyond assessments focused solely on infrastructure and toward frameworks that incorporate behavioural understanding and environmental comfort. This study affirms that while safety and infrastructure provide an essential base, the factors that truly encourage walking include comfort, visual appeal, and opportunities for social interaction. These experiential elements transform walking from a necessity into a preferred and enjoyable activity. As a result, campus planners are encouraged to adopt a comprehensive approach that integrates both functional requirements and enhancements to sensory and social dimensions. Creating environments that are not only safe and connected but also engaging and pleasant can promote sustainable walking behaviours among students. Such strategies contribute to broader sustainability and wellbeing goals by aligning daily mobility choices with campus users' lived experiences and preferences.

4. CONCLUSION

This study provides strong empirical evidence that Amenities and Environmental Factors significantly influence students' walking behaviours on campus. The findings highlight the importance of environmental quality, visual appeal, and functional amenities such as shaded walkways, resting spots, and aesthetically pleasing surroundings. These elements contribute positively to students' decisions to walk, suggesting that mobility on campus is shaped not only by practical needs but also by the emotional and experiential aspects of the environment. In contrast, Pedestrian Safety and Comfort and Pedestrian and Cyclist Infrastructure did not exhibit significant effects in the structural model, despite receiving high mean scores in the descriptive analysis. The result may indicate that students regard these features as basic standards rather than influential variables in their daily mobility decisions. The study emphasises the importance of designing campus environments beyond structural adequacy to support visually engaging, socially interactive, and thermally comfortable walking experiences. A limitation of the study is the possibility of response bias due to overlapping questionnaire items and the survey length, which may have influenced how respondents interpreted certain elements. Future research should improve questionnaire clarity and explore qualitative feedback to understand the behavioural implications of walkability factors better.

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