

Encouraging Factors of Walkability Among Students in the Tropical Campus

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Abstract. Recent studies on campus walkability have focused on understanding the factors that contribute to walkability and the impact it has on student life, health, and overall campus sustainability. This study explores the factors encouraging walkability among students at the Universiti Malaysia Kelantan (UMK) campus in Bachok, Kelantan. The research employs both quantitative and qualitative methods to gain comprehensive insights into the determinants of pedestrian activity. Quantitative data were collected through a survey distributed to 300 students at UMK Bachok Campus using purposive sampling. The data collection period spanned from May 2024 to June 2024 and were analysed by using SPSS 28.0. Findings from exploratory factor analysis indicate that there are three main factors that encourage the walkability among students in the campus, i) Pedestrian Safety and Comfort, ii) Pedestrian and Cyclist Infrastructure, and iii) Amenities and Environmental Factors. These factors collectively promote a secure, pleasant, and inclusive environment that motivates students to walk more. The study concludes with recommendations for campus planners and policymakers to further enhance walkability, thereby fostering a healthier, more sustainable, and connected campus environment in Bachok, Kelantan.

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1 Introduction

The concept of walkability on campuses in Malaysia is gaining traction as educational institutions recognize the numerous benefits of creating pedestrian-friendly environments. As universities and colleges strive to improve the overall student experience, health outcomes, and sustainability [1], enhancing walkability has become a key focus. Many Malaysian campuses face infrastructural challenges, including insufficient or poorly maintained walkways, inadequate lighting, and lack of pedestrian crossings. They have invested in upgrading their pedestrian infrastructure; a new and improved walkway, pedestrian bridges, and dedicated pedestrian zones have been introduced. Notable examples include the Universiti Malaya (UM) and Universiti Kebangsaan Malaysia (UKM), which have significantly enhanced their campus walkways and green spaces [2, 3]. Safety improvements have been a focal point, with better lighting, more CCTV cameras, and safer pedestrian crossings implemented across various campuses. For instance, Universiti Sains Malaysia (USM) has installed additional streetlights and security measures to ensure safer walking environments, particularly during night-time. Addressing Malaysia's tropical climate, universities have created shaded walkways and installed covered pathways to encourage walking despite the heat and rain. Universiti Putra Malaysia (UPM) has made strides in this area by incorporating more covered walkways and shaded areas. This paper discusses the identification of factors that encouraging walkability in the campus in UMK Bachok Campus and the current conditions of the campus whether it support the walkability of students.

2 Literature Review

2.1 Safety factors

Safety factors in campus walkability are essential for creating a secure and enjoyable environment. Good lighting along pathways makes it easier to see and feel safe at night [4], while regular maintenance keeps walkways smooth and free from hazards like cracks or debris. Traffic management, with features like speed bumps and clear crosswalks [5], helps keep pedestrians safe from vehicles [6]. Emergency infrastructure, such as call stations and surveillance cameras, ensures quick help and monitors campus activity. For cyclists, dedicated bike lanes and well-marked paths keep them separate from pedestrians and vehicles [7], reducing the risk of accidents. Clear signage and regular bike path maintenance, along with ample parking, make cycling safer and more convenient on campus.

2.2 Comfort factors

Comfort factors in campus walkability are all about making the campus experience pleasant and enjoyable [2]. Shade from trees, awnings, or other structures keeps pedestrians cool and protected from intense sun or rain [8, 9]. Smooth, well-maintained pathways ensure a comfortable walk and help prevent injuries [10]. Adding seating areas and rest spots along routes lets people take breaks and enhances their overall comfort [2]. Clear and intuitive signage makes it easy to navigate and reduces any frustration. Beautiful landscaping and green spaces not only make the campus look appealing but also provide relaxing spots [11, 12, 13, 14]. Open spaces and strategic stops are vital for enhancing campus walkability. Open spaces like parks and plazas provide relaxation and social areas, breaking up long pathways and improving campus aesthetics [15, 16]. For cyclists, having plenty of bike racks and

secure storage makes parking a breeze. Shaded bike routes protect riders from extreme weather, and clear signage helps them find their way easily [17].

3 Research Methodology

The study site is located at Universiti Malaysia Kelantan Bachok Campus, Malaysia as shown in Figure 1. The study was carried out using quantitative and qualitative methods. This study includes the street network connecting hostels (IBS) and faculties, chosen for their frequent use by students from various disciplines for daily activities. For the quantitative data collection, the survey was distributed to 300 students in the UMK Bachok campus by purposive sampling. The data collection was done from May 2024 to June 2024 and analysed by using SPSS 28.0. Internal item consistency, assessed using Cronbach's alpha ranging from 0.6 to 0.9, determined the reliability of the study instruments. The study focused on analysing campus street walkability factors to identify the most significant aspects affecting walkability and their underlying components. All data were processed and met the assumptions required for factor analysis, based on a minimum sample size of 150 respondents [2].



Fig. 1. Layout Plan of UMK Bachok Campus

The qualitative observational study focuses on factors influencing walkability which involves systematic observations to categorize factors as either present in good condition, present but not in good condition, or not present. Observations were conducted across different campus locations from the main entrance of UMK through administration buildings (Canselor Buliding and Dewan Tunaku Canselor), library (Perpustakaan UMK), faculties (FSE, FTKW, Pusat Bahasa) and other students related buidings such as café, Pusat Kesihatan, Pusat Islam and hostels (IBS) using a structured checklist to document the status of each factor. Data collection involved trained observers who conducted observations at different times to capture varying conditions and user interactions.

4 Results and findings

The demographic profile of the respondents (N=300) as shown in Table 1 consist of 59.0 percent of males and 41.0 percent of females. 96.0 percent of the respondents fall in 20-29

years old of age group, 4.0 percent from 30-39 years old age group and none from age group of 40-49 years old. In terms of nationality, 99.7 percent of the respondents are Malaysian while only 0.3 percent are non-Malaysian. Malay respondents dominated the surveys with 49.3 percent, while compared to Chinese, Indian, Bumiputera and 'others' respondents.

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

Fifty-two items of factors encouraging walkability among students in the campus were analysed by using factor analysis as shown in Table 2. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value for this exploratory analysis is considered good (0.946) with approximate chi-square in Bartlett's Test of Sphericity value is 8764.338 (df= 1326, Sig.= 0.00). From 52 items of factors encouraging walkability among students in the campus, 29 items were removed due to redundancies and were tabulated into 3 components namely i) Pedestrian Safety and Comfort, ii) Pedestrian and Cyclist Infrastructure, and iii) Amenities and Environmental Factors. The Cronbach's Alpha for each group is interpreted as good and acceptable as the value is above 0.7 [19]. The mean of each construct is above 6.0 and the standard deviation range between 1.0 to 2.0 which relatively low suggested that the respondents agreed that these factors are considered important in encouraging them to walk in the campus. The 'important' scale ranges from 6 (somewhat important) to 10 (absolute important) from 10-likert scale in the questionnaire. The first walkability factor is Pedestrian Safety and Comfort which consists of 11 items. Studies consistently highlight the importance of infrastructure such as segregated pedestrian pathways and well-marked crosswalks (Mean: 8.1433 and 8.1867, respectively) for enhancing safety and facilitating efficient movement on university campuses [5]. These elements not only reduce the risk of accidents [6] but also contribute to a more pleasant walking experience. The presence of trees along sidewalks (Mean: 7.9500) and aesthetically pleasing landscape designs (Mean: 8.0867) align with findings that demonstrate how greenery and attractive surroundings positively impact users' perception of environmental quality [14] and contribute to a sense of well-being. Similarly, features like grass or dirt strips separating roads from sidewalks (Mean: 8.0967), parks, and green spaces (Mean: 7.9367) are known to provide opportunities for relaxation and recreation, enhancing overall campus ambiance [15].

Table 2. Factors Encouraging Walkability Among Students in The Campus

Exploratory Factor Analysis	
KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.946
Bartlett's Test of Sphericity	Approx. Chi-Square
	df
	8764.338
	1326

	Sig.			0.000
Item	Mean	Std. Deviation	F. Loading (n=300)	
<i>Pedestrian Safety and Comfort</i>				
Separation of pedestrian and vehicle routes	8.1433	1.77952	0.671	
Minimizing conflicts between pedestrians	7.6033	2.03136	0.634	
Safe road crossings with crosswalks	8.1867	1.73065	0.598	
Trees along sidewalks to guide the path	7.9500	1.74480	0.587	
Enhancing the aesthetic experience of surrounding landscapes	8.0867	1.76906	0.575	
Strips of grass or dirt separating roads and sidewalks	8.0967	1.74857	0.572	
Visible crosswalk markings at main intersections	7.8067	1.82035	0.569	
Availability of any parks or green spaces on campus	7.9367	1.71146	0.548	
Protection from rain	8.2933	1.75620	0.541	
Noise buffers from vehicles	7.4300	1.85740	0.538	
Seating and waiting areas for pedestrians	7.8800	1.69761	0.447	
Cronbach's Alpha				0.881
<i>Pedestrian and Cyclist Infrastructure</i>				
Dedicated bicycle lanes	7.7333	1.77748	0.600	
Proper placement of pedestrian signals and signage	7.9667	1.80826	0.584	
Clear sidewalks free of obstructions	8.1967	1.62896	0.580	
Shaded walkways with trees or roofs	8.0967	1.61742	0.568	
Close proximity of buildings within the campus	7.9533	1.72076	0.553	
Night-visible crosswalk markings	8.3233	1.58551	0.531	
Cronbach's Alpha				0.781
<i>Amenities and Environmental Factors</i>				
Water dispensers along walkways	7.5500	1.89194	0.684	
Adequate resting places or gazebos	7.9300	1.77641	0.624	
Presence of wild animals	7.6867	1.91154	0.606	
Small stop points or meeting areas	7.9567	1.71988	0.558	
Attractive features like landmarks, murals, and wall paintings	8.1800	1.68634	0.505	
Jogging tracks	7.8233	1.64351	0.415	
Cronbach's Alpha				0.759

The second walkability factor is Pedestrian and Cyclist Infrastructure which consist of six items. The findings regarding infrastructure supporting pedestrian and cyclist movement are consistent with established research on urban planning and transportation studies. Research consistently indicates that well-maintained sidewalks free from obstructions (Mean: 8.1967) are essential for ensuring accessibility and safety, aligning with findings that highlight the importance of unobstructed pathways for pedestrians. Providing shading with tree canopies or roofs along walkways (Mean: 8.0967) is known to improve comfort and protect pedestrians from harsh weather conditions, reinforcing the role of environmental design in enhancing user experience. Moreover, the visibility of crosswalk marks at night (Mean: 8.3233) addresses safety concerns during low-light conditions, underscoring the importance of clear and visible signage for pedestrian safety. These findings underline the importance of integrating robust infrastructure planning and environmental design principles to create safe, accessible, and comfortable campus environments that support sustainable transportation choices and enhance overall user satisfaction [2, 4].

The third walkability factor is Amenities and Environmental Factors. In this study, the amenities and environmental factors was influenced by six items, contributing to campus walkability resonate with broader research on urban design and environmental psychology. Small stops or meeting areas (Mean: 7.9567) are valued for promoting social interaction and relaxation, supporting findings that social and recreational spaces contribute to community

well-being on campuses [7]. The high valuation of beautiful landmarks, murals, and wall paintings (Mean: 8.1800) underscores their role in enhancing the aesthetic appeal and cultural richness of the campus environment, which are known to positively impact user experience and overall satisfaction. These findings collectively emphasize the importance of integrating diverse amenities and environmental enhancements to create vibrant, inclusive, and user-centred campus environments that foster well-being and engagement among students and faculty [2, 5, 7].











Through the observation within the campus as shown in Table 3 and Table 4, the results highlight the condition of infrastructure and amenities related to pedestrian safety, comfort, and overall campus walkability at UMK Bachok. For Pedestrian Safety and Comfort, critical elements such as segregation between pedestrian and vehicle routes, and crosswalks are noted as present but often not in good condition, suggesting maintenance issues that could compromise safety. Trees for navigation and aesthetic landscaping are present but similarly not well-maintained. Grass or dirt strips separating roads from sidewalks are in good condition, indicating successful upkeep in some areas. However, amenities like protection from rainy weather, buffer from vehicle noise, and seating/waiting areas are notably absent, potentially impacting comfort and convenience for pedestrians. For Pedestrian and Cyclist Infrastructure, essential facilities such as bicycle lanes, pedestrian signals, and clear sidewalks are largely absent. Where present, sidewalk clearance from obstructions is noted as in good condition, but other infrastructure like shaded walkways and visible crosswalk marks at night are lacking, posing potential safety concerns for pedestrians and cyclists alike. Regarding Amenities and Environmental Factors, amenities such as water dispensers, wild animal management, and attractive features like landmarks and murals are absent. Adequate resting places and small meeting areas are present but in poor condition, and while jogging tracks are available, their maintenance seems inadequate.

Table 3. Observation Based on Walkability Factors in The Campus

Item	Presence and in good condition	Presence but not in good condition	Not presence
<i>Pedestrian Safety and Comfort</i>			
Separation of pedestrian and vehicle routes		/	
Minimizing conflicts between pedestrians		/	
Safe road crossings with crosswalks			/
Trees along sidewalks to guide the path		/	
Enhancing the aesthetic experience of surrounding landscapes	/		
Strips of grass or dirt separating roads and sidewalks		/	
Visible crosswalk markings at main intersections		/	
Availability of any parks or green spaces on campus		/	
Protection from rain			/
Noise buffers from vehicles			/
Seating and waiting areas for pedestrians			/
<i>Pedestrian and Cyclist Infrastructure</i>			
Dedicated bicycle lanes			/
Proper placement of pedestrian signals and signage			/
Clear sidewalks free of obstructions	/		
Shaded walkways with trees or roofs			/
Close proximity of buildings within the campus		/	
Night-visible crosswalk markings		/	
<i>Amenities and Environmental Factors</i>			
Water dispensers along walkways			/

Adequate resting places or gazebos	/
Presence of wild animals	/
Small stop points or meeting areas	/
Attractive features like landmarks, murals, and wall paintings	/
Jogging track	/

Table 4. Existing Condition of Pedestrian System in UMK Bachok

No	Condition	
A.	Presence and in good condition	
	 <p>Aesthetics experience of the landscape surrounding the walkways</p>	 <p>Sidewalk clearance from obstruction elements</p>
B.	Presence but not in good condition	
	 <p>Limited small stops point/meeting area.</p>	 <p>Limited resting places or gazebo along the walkways</p>
	 <p>Limited parks, gardens, recreational areas, and green space in the campus</p>	 <p>Trees were planted at the opposite of the sidewalk without properly giving shade to the pedestrian.</p>
C.	Not presence	
	 <p>No cross walks to cross the roads safely</p>	 <p>No protection from rainy weather</p>
		

No pedestrian signals and signage placed at appropriate places



No beautiful landmarks, murals, and wall paintings as attractive factors



No proper lightings in some of the areas.

No seating/waiting area for pedestrian on streets



No proper sidewalks at certain places.



No proper bicycle lane for cyclists

5 Conclusion

This study explores the factors that encourage walkability at Universiti Malaysia Kelantan (UMK) Bachok Campus which include pedestrian safety, comfort, and infrastructure availability. The research, using surveys and observations, highlights the importance of well-maintained pathways, adequate lighting, covered walkways, and green spaces. It identifies challenges such as the lack of weather protection, seating areas, and proper bicycle lanes. The study also notes infrastructure issues like inadequate signage and the absence of essential amenities such as water dispensers. While some areas are well-maintained, others require improvement to enhance walkability. The study calls for further research into the long-term effects of walkability on academic performance and mental health. It also stresses the need for inclusive design that meets diverse needs, including those of people with disabilities. Additionally, the study suggests exploring cultural and behavioural factors, economic impacts, and emerging technologies related to walkability. Environmental assessments, policy evaluations, and user experience studies are recommended to create healthier, more sustainable, and connected campuses in Malaysia.

The authors would like to acknowledge the financial contribution and support from the internal grant award of Universiti Malaysia Kelantan (UMK) Fundamental Research Grant (UMK-FUND) R/FUND/A1200/01841A/002/2024/01310 and Universiti Malaysia Kelantan (UMK) Fundamental Research Grant (UMK-FUND) R/FUND/A1200/01841A/001/2020/00846.

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