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GREEN SPACES DESIGN IN UNIVERSITY CAMPUS: A REVIEW OF LANDSCAPE PRACTICE OF SUSTAINABILITY AND STUDENTS' WELL-BEING

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ABSTRACT

This study explores the design characteristics of green spaces in Malaysian universities and their influence on students' well-being. The research aims to identify key landscape features that contribute to sustainability and user satisfaction within higher education campuses. A systematic literature review was conducted, covering 50 peer-reviewed studies published between 2000 and 2024 across major academic databases. The analysis revealed that integrating both softscape and hardscape elements, such as vegetation, water features, pathways, and seating, plays a vital role in enhancing environmental quality and psychological restoration. The findings highlight the importance of accessibility, diversity, and the aesthetic balance of green spaces in shaping sustainable and student-centred campus environments. The study provides practical insights for university planners and architects to improve campus liveability and promote well-being through evidence-based landscape design.

Keywords: *Green spaces, Universities, Design, Characteristics, Well-being*

INTRODUCTION

Recently, the integration of green spaces into university planning has emerged as a critical dimension of sustainable campus development and student well-being. In Malaysia, universities increasingly recognise the importance of integrating green spaces into campus planning to enhance student well-being and environmental quality. Previous studies have emphasised the psychological and social benefits of green spaces, including stress reduction, social interaction, and cognitive restoration (Muhiddin et al., 2023; Zhao & Patuano, 2022). However, despite these benefits, Malaysian universities continue to face challenges related to space constraints, limited funding, and insufficient awareness of sustainable design practices (Nor & Sahrir, 2024; Hashim et al., 2023).

While global research on campus green space design is expanding, there remains a clear gap in understanding how design characteristics, particularly the balance between softscape and hardscape elements, can be effectively adapted to the Malaysian context. Existing studies often focus on environmental performance rather than the integration of design principles that directly influence students' well-being. Consequently, there is a need for a comprehensive review that identifies and synthesises these design characteristics to guide future sustainable campus planning.

This study aims to analyse the essential characteristics of green space design in Malaysian universities, focusing on how landscape elements contribute to sustainability and student well-being. Specifically, it seeks to 1) examine the relationship between green space design and student well-being in university settings; 2) identify the key landscape design elements (softscape and hardscape) that promote sustainable campus environments; and 3) provide recommendations for designers and planners to enhance green space integration within Malaysian universities. Through this review, the study contributes to bridging the gap between sustainability practices and the experiential quality of campus landscapes, offering a foundation for evidence-based design strategies in higher education institutions.

LITERATURE REVIEW

A comprehensive understanding of the existing literature on green space design is essential to establish the conceptual foundation for this study. Previous research has explored the multidimensional role of campus landscapes in enhancing sustainability, aesthetics, and psychological restoration. However, the findings remain fragmented across studies, with varying emphases on spatial accessibility, landscape composition, and user experience. This review, therefore, synthesises the perspectives of scholars to identify the main themes influencing the design and effectiveness of university green spaces. In doing so, it highlights three key dimensions: accessibility and usability, softscape and hardscape integration, and design for student well-being, which collectively form the conceptual basis for understanding sustainable campus environments in Malaysian universities.

Characteristics of Green Space Design in Universities

The design of green spaces in universities plays a crucial role in enhancing student well-being, promoting sustainability, and fostering educational opportunities. Effective green space design incorporates various elements that contribute to both environmental and psychological benefits (Aghabozorgi et al., 2024). Effective design considers accessibility, usability, and the integration of natural elements to enhance user experience and promote health benefits (Nor & Sahrir, 2024). Research indicates a strong positive correlation between the presence of green areas and the mental well-being of students, suggesting that well-designed green spaces can serve as restorative environments (Mansor & Harun, 2018). Open spaces should be designed to accommodate various activities and provide restorative effects, enhancing the overall learning environment (Puhakka, 2021). Students prefer well-designed green spaces with seating and active recreation areas, as they promote relaxation and focus (Craig et al., 2025). The integration of natural environments into campus design is essential for creating restorative spaces that support mental health initiatives (Puhakka, 2021). In Nassar (2021), the author summarised some characteristics of green spaces at universities that help students achieve their well-being, as shown in Figure 1. Furthermore, in Craig et al. (2025) the authors stated that the diversity and accessibility of green spaces would meet the different needs of students, from relaxation to active entertainment.

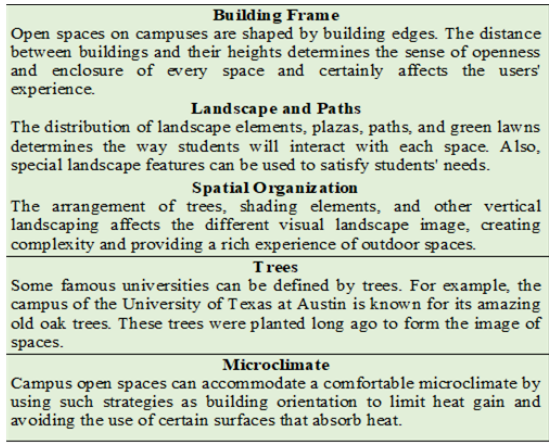

Figure 1. Characteristics of Green Spaces for Universities
Source: Nassar, (2021)

Characteristics of Landscape Design in Universities

Effective campus landscapes can significantly impact mental health and learning outcomes, as evidenced by various studies (Aksoy et al., 2024). Therefore, effective campus design refers to the strategic planning and architectural development of university environments that foster innovation, collaboration, and adaptability to meet the evolving needs of students and faculty.

This concept encompasses various elements, including spatial optimisation, sustainability, and the promotion of a vibrant educational atmosphere (Million & Castillo Ulloa, 2023). Research indicates that specific landscape sites on campuses can have restorative effects on students, promoting well-being and reducing stress (Nie et al., 2024). Effective campus integration incorporates sustainability, innovation, and advanced management systems to create an environment conducive to student development and community engagement. This multifaceted approach encompasses various strategies that enhance both the educational experience and the campus's ecological footprint (Nie et al., 2024). Frequent visits to diverse landscapes correlate with increased happiness and lower stress levels, suggesting that the strategic placement of green spaces is essential (Nie et al., 2024).

Studies indicate that students prefer coherent planting designs that balance aesthetics and functionality, which can guide future campus landscape projects (Nie et al., 2024). Research by Hami & Abdi in (Hami & Abdi, 2021) stated that landscape is a key variable significantly associated with effective green space design. Landscape design integrates both soft and hard elements, creating a harmonious environment that meets aesthetic and functional needs (Hami & Abdi, 2021). The landscape encompasses both soft and hard elements in its design and composition, as demonstrated in Figure 2.

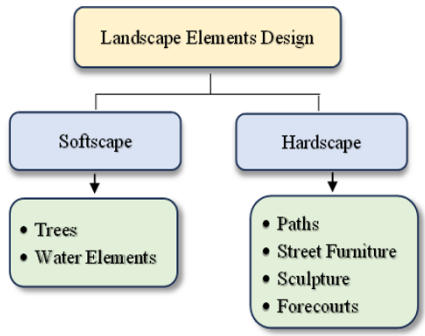

Figure 2. Showing Hardscape and Softscape Landscape Elements
Source:(Allahyar & Kazemi, 2021; Kostanjšek & Golobič, 2023; Nassar, 2021)

The Accessibility and Usability of Green Spaces on Campus

Accessibility and usability are fundamental attributes influencing the effectiveness of campus green spaces. Studies emphasise that the proximity of green areas to students' daily routes encourages frequent usage and restorative engagement (Zhao & Patuano, 2022; Mitchell & Carbone, 2011). However, several scholars note that the lack of connected pathways and shaded resting spots reduces the inclusiveness of these areas (Rahmandari et al., 2018; Muhiddin et al., 2023). The contrasting perspectives reveal that accessibility alone is insufficient unless usability through seating, lighting, and maintenance is considered part of the holistic design. These relationships suggest that future campus planning should combine physical access with experiential comfort to promote continuous interaction between students and green environments (Speake et al., 2013; Li et al., 2019; Mogra & Furlan, 2017); they discussed the factors that influence the accessibility and usability of these spaces. Surveys reveal that students appreciate green spaces, considering them vital for the campus environment and university image

(Speake et al., 2013). However, many students visit these areas infrequently, often limited to specific times, such as afternoons (Li et al., 2019).

Effective landscape design is essential for ensuring that green spaces are accessible to all students, including those with disabilities (Çorbaci et al., 2020). Factors such as seating, lighting, and pathways significantly influence the usability of these areas (Çorbaci et al., 2020). Regional factors, including climate and cultural values, can impact students' perceptions and willingness to use green spaces (Mogra & Furlan, 2017). For instance, in hotter climates, usage may decline during the summer months, despite the spaces being perceived as safe (Mogra & Furlan, 2017). Conversely, while many students recognise the importance of green spaces, some may prioritize academic or social activities over utilising these areas, indicating a need for universities to enhance engagement strategies to promote their use. The following two sections explain the most important characteristics of green space design in universities.

Softscape

The concept of softscape refers to the living elements of landscaping, primarily involving plant materials such as trees, shrubs, flowers, and grass. In university settings, trees serve both aesthetic and functional roles that enhance campus environments (EKİCİ & KORKUT, 2019). Softscape trees contribute significantly to the ecological and social aspects of university landscapes, promoting biodiversity and providing spaces for relaxation and study. Softscape trees enhance the beauty of university campuses, creating inviting spaces for students and faculty (Woźniak & Połap, 2020). These trees support local wildlife, contributing to a balanced ecosystem within urban settings (Villandré et al., 2012). Additionally, softscape trees provide shade, promoting outdoor activities on campus.

The effectiveness of trees in shading varies based on species, arrangement, and location, influencing not only comfort but also ecological factors such as irrigation demand and urban heat mitigation (Schutzki, 2005). Figure 3 demonstrates the dense presence of trees, which play a crucial role in making outdoor areas more comfortable for gatherings and study sessions (Irsoy et al., 2012). Hence, trees play a significant role in improving air quality by absorbing pollutants and producing oxygen (Mahdee et al.,

2022). Previous studies show that the characteristics of trees can improve the well-being of university students (Craig et al., 2025).

Figure 3. Dense Trees at the Massachusetts Institute of Technology
Source: Lau et al., (2014)

Moreover, water features such as ponds and streams enhance the aesthetic quality of university campuses, creating serene environments for students and faculty (Eren & Bulda, 2019). Further, landscape-based designs, including vegetated swales and constructed wetlands, are effective for treating water and can be integrated into campus landscapes for irrigation and other uses (Solomon & Abebe, 2024). The soft revetment method improves the landscape water system by mimicking natural water systems, enhancing both functionality and aesthetic appeal while reducing costs (Yeo et al., 2023). Figure 4 illustrates that water elements act as a bridge between nature and the environment, as they are more likely to enhance the well-being of university students.

Figure 4. Water Features in Cairo University and Tanner Fountain, Harvard University
Source: (Farid & Mohamed, 2023; Lau et al., 2014)

Hardscape

Hardscape consists of non-plant materials, including stone, wood, and concrete structures (Zhang et al., 2023). The integration of hardscape elements, which includes non-living features like pathways and structures, contributes to the overall liveability and environmental quality of university spaces (Marzuki et al., 2023). Hardscape surfaces significantly affect urban hydrology, influencing water flow and potentially reducing flooding risks (Butt et al., 2018). In addition, aesthetic quality is enhanced through well-designed pathways that incorporate ecological elements, such as trees, which improve visual appeal and support wildlife movement (Butt et al., 2018).

As such, the design of hardscape paths is essential for student mobility and safety, impacting their overall university experience (Kostanjšek & Golobič, 2023). Effective signage and accessibility features are vital for navigating these spaces, promoting a positive perception of the campus environment (Kostanjšek & Golobič, 2023). Figure 5 exhibits some of the paths on campus. While hardscape paths are essential for functionality and aesthetics, they must be designed with sustainable methods to mitigate environmental impacts and enhance the campus's ecological footprint, which is likely to improve the well-being of students (Aghabozorgi et al., 2024).

Figure 5. Shaded Path at Cairo University and Vibrant Path at Harvard University

Source: (Farid & Mohamed, 2023; Lau et al., 2014)

Moreover, research highlights various aspects of street furniture design and its impact on university spaces (Aghabozorgi et al., 2024). As such, the relationship between users and street furniture is vital (Kostanjšek & Golobič, 2023). The relationship between users and street furniture on campus is multifaceted, significantly influencing student engagement and comfort in public spaces (Butt et al., 2018). Students prefer street furniture

that is circular or face-to-face, promoting social interaction. Preferred materials include natural elements, and colours should be bright and inviting, enhancing the aesthetic appeal of the campus (Kurdoglu, 2016).

Overall, a study conducted in Kurdoglu (2016) found that several pieces of furniture were disharmonious with their surroundings, indicating a need for better alignment with user activities and preferences. Additionally, research preferences revealed that ideal furniture should be comfortable, aesthetically pleasing, and functional, incorporating elements like power sources and shading (Butt et al., 2018). Thus, the design process for campus furniture must consider user needs and community input. Figure 6 illustrates some street furniture at Ain Shams University in Egypt.

Likewise, a study utilising quality function deployment emphasised the importance of aligning design with user feedback to enhance functionality and satisfaction (Yeo et al., 2023). Therefore, the focus on hardscape street furniture is essential, as it significantly influences student engagement and comfort in public spaces (Wirdelöv, 2020). Further, it is equally important to consider the integration of softscape elements, such as greenery, to create a balanced and inviting campus atmosphere that promotes the well-being of university students (Solomon & Abebe, 2024).

Figure 6. Street Furniture at Ain Shams University

Source: Farid & Mohamed, (2023)

By and large, hardscape sculptures in universities serve not only as aesthetic enhancements but also as functional elements that contribute to campus identity and environmental sustainability (Wirdelöv, 2020). The integration of hardscape sculptures can significantly influence the university atmosphere and community engagement (Sart, 2023).

As such, campus sculptures are perceived as appealing and functional, enhancing the aesthetic experience for students and faculty (Gálvez-Nieto et al., 2023). They play a crucial role in placemaking, helping to establish a unique identity for the university (Gálvez-Nieto et al., 2023). Figure 7 shows sculptures on campus. Hence, the use of sustainable materials, such as eco-bricks made from recycled plastics, can mitigate waste and promote environmental responsibility (Gálvez-Nieto et al., 2023).

In addition, outdoor sculptures face biodeterioration from microbial activity, necessitating the use of environmentally friendly preservation methods (Woźniak & Połap, 2020). Therefore, hardscape sculptures enhance university campuses, and their maintenance and environmental impact should be carefully managed to ensure long- term benefits (Hasan et al., 2018).

Figure 7. Sculptures at the Massachusetts Institute of Technology and at the Islamic University of Malaysia

Source: (Lau et al., 2014; Roslan et al., 2020)

Furthermore, according to previous research, forecourts in university campuses can significantly enhance the educational environment by fostering informal learning and community engagement (Allahyar & Kazemi, 2021). The design of these spaces should prioritize flexibility and accessibility, reflecting the evolving needs of students (Allahyar & Kazemi, 2021). Overall, the authors in Sefton (2018) argued that forecourts are crucial for informal learning, providing areas that encourage collaboration and creativity among students. Hence, the integration of open educational spaces can transform the campus experience, making it more conducive to social interaction and innovation (Estacio et al., 2018).

In addition, the authors in Zhang et al. (2023) emphasises the role of public landscapes, such as forecourts, in creating vibrant urban campuses that stimulate creativity and collaboration (Zhang et al., 2023), Figure 8 shows a courtyard at the University of Hong Kong and Cairo University, which is a meeting place for students.

As such, the design of these forecourts should consider their function as part of an innovation district, enhancing the university's role in the urban fabric. Besides, Gálvez-Nieto et al. (2023) highlighted the necessity for comprehensive planning of public spaces to meet the diverse needs of the university community, which means that these areas support both academic and social life. Accordingly, effective design can elevate student life, promoting a sense of belonging and community engagement.

Figure 8. Forecourts at Hong Kong University and Cairo University
Source: (Farid & Mohamed, 2023; Lau et al., 2014)

Softscape and Hardscape Integration

The literature collectively highlights that successful green space design depends on the balanced integration of softscape and hardscape elements (Hami & Abdi, 2021; Butt et al., 2018). While softscape features such as vegetation and water bodies enhance ecological quality and sensory comfort, hardscape structures like pathways, seating, and sculptures shape movement and social interaction. Some scholars emphasise the ecological dimension (Villandré et al., 2012), whereas others focus on social liveability (Kurdoglu, 2016; Gálvez-Nieto et al., 2023). Planting designs in campus landscapes significantly shape students' outdoor study preferences and use patterns (Norizan & Siti Rasidah, 2017). This synthesis indicates that design integration, rather than isolated components, defines the experiential quality of campus landscapes.

Additionally, various studies highlight the multifaceted characteristics of these landscapes, emphasising their restorative effects, ecological integration, and aesthetic qualities (Si et al., 2024). In addition, research indicates that specific landscape sites on campuses can significantly improve student well-being. For instance, a study found that frequent visits to diverse landscape areas correlated with increased happiness and reduced stress levels among students (Nie et al., 2024). Table 1 summarises the most important characteristics of landscape and its significant design principles based on previous literature.

Table 1: Summary of the Characteristics of Landscape in Universities and the Principle for Designing Green Spaces on Campus

Characteristics of Landscape Green Space Design	Campus Green Spaces Design Principle
Trees	Variety of tree species, compact trees that enhance the path, evergreen trees with low maintenance
Water Elements	Connect with green space, attractive unconventional designs
Paths	Clear, accessible, durable non-slip floors, levels, and ramps; separate roads for vehicles
Street Furniture	Provide shaded seating, low-energy and solar-powered lights, signage
Sculpture	Site is visually suitable, its harmony with the green spaces, design reflects value, materials used adapt to future conditions
Forecourts	Accessibility, contains attractive green designs

Source: (Dober & Richard, 2000; Lau et al, 2017; Şentürk & Hakan, 2018; Nassar, 2021; Hami & Abdi, 2021; Farid & Mohamed, 2023)

Design for Student Well-Being

Understanding how the integrated characteristics of softscape and hardscape elements influence students' perceptions and experiences is essential for achieving genuine well-being within university campuses. Biophilic campus landscapes provide demonstrable restorative effects that mitigate students' stress (Thani & Salleh, 2024). Trees, water features, and seating areas serve aesthetic and ecological purposes and shape students' psychological comfort, sense of safety, and opportunities for social interaction (Nie et al., 2024; Mansor & Harun, 2018). Therefore, these design components are harmoniously balanced; they can transform outdoor spaces into restorative environments that foster calmness, concentration,

and belonging. Research indicates that exposure to natural elements, shade, and organised spatial patterns enhances emotional regulation and attention recovery (Aghabozorgi et al., 2024; Puhakka, 2021). Similarly, incorporating restorative landscape principles within campus design is associated with improved satisfaction and a stronger sense of place among university communities (Brown & Corry, 2020; Si et al., 2024).

Synthesizing these perspectives suggests that well-being outcomes are maximised when design strategies address sensory engagement, social inclusion, and accessibility simultaneously. Therefore, integrating well-being indicators into landscape design evaluation frameworks could provide universities with measurable evidence of the benefits of green campuses. The following figure 9 shows the conceptual framework for the research paper.

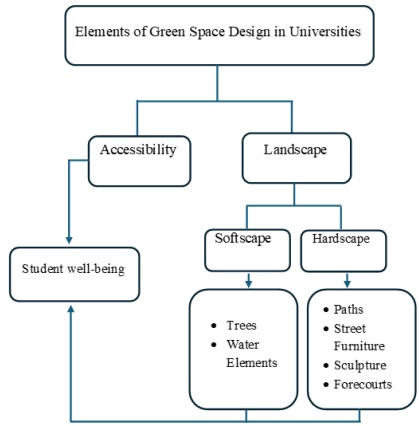

Figure 9. Conceptual Framework

Source: Author, (2025)

METHODOLOGY

This study adopted a Systematic Literature Review (SLR) approach to examine the characteristics of green space design in universities and its relationship to student well-being. The review process was guided by the PRISMA 2020 framework to ensure methodological transparency and replicability. Three academic databases, Scopus, Web of Science, and ScienceDirect, were systematically searched for peer-reviewed articles published between 2000 and 2024. Overall, scientific articles, book

references, and reports were included in the search process. Hence, an advanced search process was implemented to improve the number of selected articles. The search process employed keywords from the abstract, the title, and the data that were carefully collected. Moreover, to limit the number of search results, the search was filtered by subject area to include only articles related to the field of landscape in universities. Based on Francis- Baldessari, the study was organized into the following six stages, as shown in Figure 10. For the timeline, the search criteria included articles published from 2000 to 2024.

The process of including and excluding articles was carried out through careful readings of the title, abstract, and full text. The study first filtered the acquired articles based on the title and relevance to the research questions, then filtered the included articles based on the abstract, and finally filtered the articles based on full-text readings and their relevance to the problems raised in the research questions.

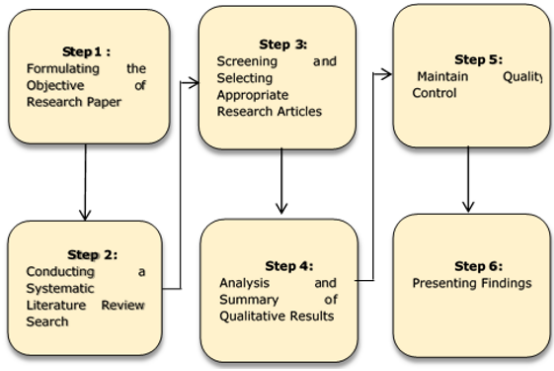

Figure 10. Phases of Qualitative Systematic

Source: (Mohammed et al., 2022; Sugiarto et al., 2022; Researcher, 2024)

The search strategy combined the keywords "green space," "university campus," "landscape design," and "student well-being" using Boolean operators (AND, OR). Only studies written in English and directly related to the physical or landscape design of higher education institutions were included. Exclusion criteria involved conference papers, non-academic reports, and studies focusing solely on urban public parks. The screening procedure involved three stages: (1) title review, (2) abstract review, and (3) full-text evaluation. Duplicates were removed, and relevance was confirmed

based on thematic alignment with the research objectives. A total of 50 studies were retained for final analysis.

Data were extracted and organized in a spreadsheet according to author, year, geographic context, and design focus. Thematic synthesis was then employed to identify recurring patterns related to accessibility, softscape–hardscape integration, and design for well-being. This structured approach ensured that the findings accurately reflected the collective evidence of previous research.

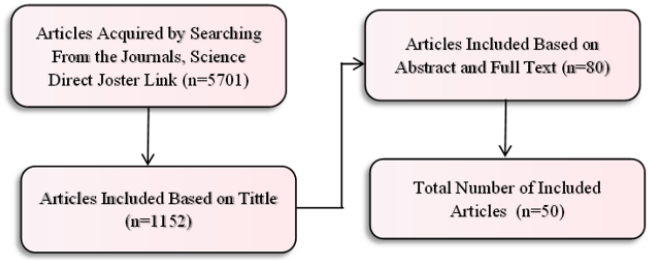

Figure 11. Flowchart of the Inclusion and Exclusion Criteria Used in the Articles Selection Process, n Number Articles

Source: (Sugiarto et al., 2022; Researcher, 2024)

FINDINGS

The synthesis of 50 reviewed studies reveals that research on campus green spaces has primarily emphasised environmental and aesthetic dimensions rather than practical implementation within Malaysian universities. A substantial portion of the literature focuses on softscape features, such as plant density, tree placement, and water elements, which are consistently linked to relaxation, sensory comfort, and ecological value (Aghabozorgi et al., 2024; Mansor & Harun, 2018). Similarly, hardscape components, including pathways, furniture, and sculptures, have been analyzed for their influence on user movement, accessibility, and social interaction (Butt et al., 2018; Kurdoglu, 2016). However, despite this growing body of knowledge, most studies stop at the descriptive level and lack an explicit framework for applying these design principles in Malaysian higher education campuses (Hashim et al., 2023; Nor & Sahrir, 2024). Moreover, only a limited number of studies have directly investigated how these design attributes contribute to

students' psychological well-being, leaving a critical gap between theoretical design benefits and their measurable outcomes (Nie et al., 2024; Si et al., 2024). While international research increasingly integrates well-being indicators into campus planning and landscape performance evaluations (Brown & Corry, 2020), Malaysian universities continue to emphasise sustainability certifications and environmental goals over experiential and restorative dimensions. This imbalance calls attention to the need for future empirical research to translate design characteristics into applicable models that enhance both sustainability and student well-being within Malaysian university environments. The following Table 2 shows a summary of the number of studies covered in the research paper on design campus elements.

Table 2. Summary of the Main Themes from the Reviewed Studies (n = 50)

Design Element	Number of Studies	Notes on Findings
Accessibility & Usability	14	Studies highlighted the importance of proximity, safety, and ease of movement in encouraging student use of green spaces.
Softscape Elements (trees, water)	16	Most research emphasised greenery and water elements as key to environmental comfort, biodiversity, and relaxation.
Hardscape Elements (paths, furniture, sculptures)	9	Findings showed their contribution to navigation, shading, and social interaction; yet design integration remains underdeveloped.
Integrated Design Approaches	7	Several studies recommended combining ecological and social functions but provided limited guidance on implementation in campus contexts.
Student Well-Being	4	While a few studies conceptually linked green space design to well-being, there were no practical strategies or frameworks proposed for implementing these outcomes in Malaysian universities.
Total	50	-

Source: Author, (2025)

When comparing Malaysian universities to international contexts, notable differences emerge. Studies from Europe and East Asia often emphasise user comfort, accessibility, and the use of data-driven design evaluation frameworks (Aghabozorgi et al., 2024; Nie et al., 2024). In contrast, Malaysian campuses, while demonstrating a strong commitment to sustainability and green certification, still face spatial and maintenance

constraints that limit the usability and continuity of their green areas (Hashim et al., 2023; Nor & Sahrir, 2024). These distinctions suggest that Malaysian universities are progressing toward sustainable campus models but would benefit from adopting international best practices that integrate both ecological and experiential dimensions of landscape design. This comparison indicates that while Malaysian universities have made significant progress in sustainability-oriented planning, the translation of these principles into student-centered landscape applications remains limited. Future studies should therefore explore how design models tested internationally can be contextualized to meet the unique cultural and spatial needs of Malaysian campuses.

PRACTICAL IMPLICATIONS

The findings of this study provide several practical insights that can guide campus planners, landscape designers, and university administrators in creating more sustainable and student-centerer environments. First, by identifying the most influential design characteristics, particularly the balance between softscape and hardscape elements, the study offers a framework that can be directly integrated into future campus master plans. Designers may apply these insights by ensuring that green areas incorporate sufficient plant density, shaded seating, and accessible pathways that encourage regular student use and restorative engagement. Second, the results highlight the importance of usability and connectivity in linking fragmented green spaces into a coherent network across the campus. This can assist planners in prioritising walkability, microclimate comfort, and visual continuity during design and renovation processes. Third, the inclusion of well-being indicators in design evaluation provides an evidence-based approach for decision-makers to assess whether new campus developments contribute to students' psychological restoration and social interaction.

Finally, for Malaysian universities, these implications suggest a shift from focusing solely on sustainability metrics toward a more student-centred design paradigm, aligning landscape policies with both environmental and experiential outcomes. By operationalizing the principles identified in this review, future campus projects can move beyond aesthetic improvements toward measurable impacts on students' well-being and satisfaction.

CONCLUSION

The review identifies three key design dimensions: accessibility and usability, softscape and hardscape integration, and design for student well-being that collectively define the effectiveness of campus landscapes. This study highlights the interdependence between physical design elements and students' psychological restoration, offering a more holistic perspective on sustainable campus environments.

The findings demonstrate that Malaysian universities have made significant progress in implementing sustainability-orientated landscape planning. However, the integration of student-centered design principles remains limited, especially regarding the measurable incorporation of well-being indicators in design evaluation. This review thus introduces a conceptual framework that links design attributes to environmental quality, social interaction, and student well-being, providing a foundation for evidence-based campus planning. From a practical standpoint, the study offers actionable guidance for planners, landscape designers, and university administrators. The recommendations can inform future campus master plans and serve as a reference for universities seeking to improve both ecological performance and the lived experience of students in Malaysian higher education settings.

While this study provides a comprehensive synthesis of existing research, future studies should adopt empirical and mixed-method approaches to validate the proposed conceptual framework within real university contexts. Longitudinal or case-based investigations on Malaysian campuses could generate measurable evidence of how green space design influences students' psychological well-being, academic engagement, and sense of belonging.

LIMITATIONS AND FUTURE RESEARCH

The research was limited to the variables whose characteristics were studied to enhance the design process. Future research could expand to take more variables for the university campus that would help in the design process. The research is limited to one methodology that would produce more

accurate results. Future research could add a new methodology that would increase students' opinions to help in achieving the desired well-being.

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AUTHOR CONTRIBUTIONS

All authors contributed to the research design and questionnaire. Aya wrote the entire research, reviewed the relevant literature, and selected the best one to achieve the article's objectives. Wan proofread the manuscript to ensure that the methodology employed served and achieved the article's objectives. Azhani reviewed the academic formatting and ensured that the article was consistent with the journal in terms of content and format. All authors reviewed and approved the final manuscript.

CONFLICT OF INTEREST

The authors have no conflicts of interest on this article to declare.

DATA AVAILABILITY

The data analysis for this project is still underway; therefore, this article does not include it, focusing instead on a review of previous work concerning sustainable green landscape practices and students' well-being in Malaysian universities.

DECLARATION OF AI-GENERATED CONTENT

I, the author of this manuscript titled "Green Space Design in University Campuses: Enhancing Student Well-Being through Landscape Characteristics," declare that artificial intelligence (AI) tools, including

ChatGPT (OpenAI), were used solely to improve the language clarity, academic tone, and structural coherence of the text. The use of AI was limited to linguistic refinement and formatting assistance and did not influence the study's conceptualisation, data analysis, interpretation, or conclusions. All ideas, arguments, and analytical insights presented in this paper are entirely the result of my own intellectual effort and academic judgment.

REFERENCES

Aghabozorgi, K., van der Jagt, A., Bell, S., & Smith, H. (2024). How university blue and green space affect students' mental health: A scoping review. *Urban Forestry & Urban Greening, 97*, 128394. https://doi.org/10.1016/j.ufug.2024.128394.

Aksoy, O., Demir, S., Ersoz, N. D., & Gokkaya, M. D. (2024). Assessment of an effective quantitative model with multi-criteria decision-making method for sustainable campus. *Environmental Science and Pollution Research, 31*(9), 13230–13245. https://doi.org/10.1007/s11356-024-32040-7.

Allahyar, M., & Kazemi, F. (2021). Effect of landscape design elements on promoting neuropsychological health of children. *Urban Forestry & Urban Greening, 65*, 127333. https://doi.org/10.1016/j.ufug.2021.127333.

Boyd, F. (2022). Between the library and lectures: How can nature be integrated into university infrastructure to improve students' mental health. *Frontiers in Psychology, 13,* 865422. https://doi.org/10.3389/fpsyg.2022.865422.

Brown, R. D., & Corry, R. C. (2020). Evidence-based landscape architecture for human health and well-being. *Sustainability, 12*(4), 1360. https://doi.org/10.3390/su12041360.

Butt, A. A., Harvey, J. T., Kendall, A., Li, H., & Zhu, Y. (2018). *Framework for urban metabolism and life cycle assessment of hardscape.* In J. T. Harvey & A. Kendall (Eds.), The National Center for Sustainable Transportation (NCST): Methods and applications (p. 52). University of California Press. https://escholarship.org/uc/item/77g742tq.

Çorbacı, Ö. L., Turna, T., & Oğuztürk, G. E. (2020). Kamusal alanların peyzaj düzenlemesi açısından erişilebilirliğinin incelenmesi: Dicle Üniversitesi kampüsü örneği [Examining accessibility of public spaces in terms of landscape arrangement: A sample on Dicle University Campus]. *Düzce Üniversitesi Orman Fakültesi Ormancılık Dergisi, 16*(1), 105–127.

EKİCİ, B., & Korkut, A. B. (2019). Investigation of the existing use of campus plants: The case of Namık Kemal University (N.K.U.). *Bartın Orman Fakültesi Dergisi, 21*(2), 292–304. https://doi.org/10.24011/barofd.521977.

Eren, G. H., & Bulda, M. (2019). Kampüs alanı içinde su öğesi kullanımının işlevsel ve estetik niteliklerinin değerlendirilmesi: Anadolu Üniversitesi Yunus Emre kampüsü örneği [Evaluation of the functional and aesthetic qualities of water elements within campus area: The case of Anadolu University Yunus Emre Campus]. IDA: *International Design and Art Journal, 1*(1), 109–123.

Farid, M., & Sara, M. S. N. (2023). Designing academic open spaces. *International Journal of Engineering Research and Technology, 12*(1), 223–232. https://doi.org/10.17577/IJERTV12IS010112.

Gálvez-Nieto, J. L., Polanco-Levicán, K., Navarro-Aburto, B., & Béltran-Véliz, J. C. (2023). Explanatory factors of school climate and school identification: An analysis of multilevel latent profiles. *Sustainability, 15*(19), 14064. https://doi.org/10.3390/su151914064.

Hami, A., & Abdi, B. (2021). Students' landscaping preferences for open spaces in their campus environment. *Indoor and Built Environment, 30*(1), 87–98. https://doi.org/10.1177/1420326X19887207.

Hasan, R., Aziz, N. D., Nawawi, A. H., & Mohd Amin, G. (2018). Theoretical framework for tree management in landscape design: Case study at UiTM Campus Shah Alam. *Environment-Behaviour Proceedings Journal, 3*(7). https://doi.org/10.21834/e-bpj.v3i7.1284.

Hashim, N. I., Tutong, F. A., Hashim, N. H. M., Nasir, N. A. M., & Ahmad, C. B. (2023). Valuing green space in university environment: Benefits and challenges. *IOP Conference Series: Earth and Environmental*

Science, 1217(1). https://doi.org/10.1088/1755-1315/1217/1/012007.

Irsoy, O., Yildiz, O. T., & Alpaydin, E. (2012). Design and analysis of classifier learning experiments in bioinformatics: Survey and case studies. *IEEE/ACM Transactions on Computational Biology and Bioinformatics, 9*(6), 1663–1675. https://doi.org/10.1109/TCBB.2012.117.

Isa, H. M., Sedhu, D. S., Lop, N. S., Rashid, K., Nor, O. M., & Iffahd, M. (2021). Strategies, challenges and solutions towards the implementation of green campus in UiTM Perak. *Journal of the Malaysian Institute of Planners, 19*(2), 60–71.

Kostanjšek, B., & Golobič, M. (2023). Cultural ecosystem services of landscape elements and their contribution to landscape identity: The case of Slovenia. *Ecological Indicators, 157,* 111224. https://doi.org/10.1016/j.ecolind.2023.111224.

Kurdoglu, O. (2016). Expert-based evaluation of the impacts of hydropower plant construction on natural systems in Turkey. *Energy and Environment, 27*(6–7), 690–703. https://doi.org/10.1177/0958305X16667186.

Lau, S. S. Y., Gou, Z., & Liu, Y. (2014). Healthy campus by open space design: Approaches and guidelines. *Frontiers of Architectural Research, 3*(4), 452–467. https://doi.org/10.1016/j.foar.2014.06.006.

Li, X., Ni, G., & Dewancker, B. (2019). Improving the attractiveness and accessibility of campus green space for developing a sustainable university environment. *Environmental Science and Pollution Research, 26*(32), 33399–33415. https://doi.org/10.1007/s11356-019-06735-3.

Mansor, M., & Harun, N. Z. (2018). Health issues and green space as reinforcement for a healthy lifestyle in Malaysia. *Journal of Asian Behavioural Studies, 3*(9), 69–77. https://doi.org/10.21834/jabs.v5i18.87.

Marzuki, A., Bagheri, M., Ahmad, A., Masron, T., & Akhir, M. F. (2023). Establishing a GIS-SMCDA model of sustainable eco-tourism development in Pahang, Malaysia. *Episodes Journal of International Geoscience, 46*(3), 375–387. https://doi.org/10.18814/epiiugs/2022/022037.

Million, A., & Castillo Ulloa, I. (2023). *Paisajes educativos: Los entornos socioespaciales educativos como recursos para la arquitectura y la planificación urbana* [Educational landscapes: Socio-spatial learning environments as resources for architecture and urban planning]. Dearq, 35, 62–73. https://doi.org/10.18389/dearq35.2023.06.

Mitchell, I., & Carbone, A. (2011). A typology of task characteristics and their effects on student engagement. *International Journal of Educational Research, 50*(5–6), 257–270. https://doi.org/10.1016/j.ijer.2011.05.001.

Mogra, S., & Furlan, R. (2017). Public realm at Qatar University campus: Perception and sustainability of open green spaces. *Architecture Research, 7*(3), 95–107.

Mohammed, A. M. S., Ukai, T., & Hall, M. (2022). Towards a sustainable campus-city relationship: A systematic review of the literature. *Regional Sustainability, 3*(1), 53–67. https://doi.org/10.1016/j.regsus.2022.03.004.

Muhiddin, A. A. M., Isa, H. M., Sakip, S. R. M., Nor, O. M., & Sedhu, D. S. (2023). Green campus implementation in Malaysian public universities: Challenges and solutions. *Planning Malaysia, 21*(1), 274–298. https://doi.org/10.21837/PM.V21I25.1239.

Nassar, U. A. E. H. (2021). Humanizing Taibah University campus open spaces in Madinah: Toward a sustainable environment for walkability and green spaces. *Journal of Sustainability Science and Management, 16*(3), 236–257. https://doi.org/10.46754/JSSM.2021.04.017.

Nie, X., Wang, Y., Zhang, C., Zhao, Y., & Kirkwood, N. (2024). The varied restorative values of campus landscapes to students' well-being: Evidence from a Chinese university. *BMC Public Health, 24*(1), 487. https://doi.org/10.1186/s12889-024-17952-w.

Nor, N. M., & Sahrir, S. (2024). The role of urban green space in promoting sustainable development: A study on Putrajaya, Malaysia. *Journal of the Malaysian Institute of Planners, 22*(5), 111–125. https://doi.org/10.21837/pm.v22i34.1577.

Norizan, M. A., & Siti Rasidah, M. S. (2017). Campus landscape preferences: A favorable planting composition in study area. *Malaysian Journal of Sustainable Environment, 2*(1), 43–57.

Puhakka, R. (2021). University students' participation in outdoor recreation and the perceived well-being effects of nature. *Journal of Outdoor Recreation and Tourism, 36*, 100425. https://doi.org/10.1016/j.jort.2021.100425.

Rahmandari, A. V., Gunawan, A., & Mugnisjah, W. Q. (2018). An evaluation of visual aesthetic quality of pedestrian pathways based on ecological network corridor within campus landscape. *IOP Conference Series: Earth and Environmental Science, 179*(1), 012010. https://doi.org/10.1088/1755-1315/179/1/012010.

Roslan, R., Misnan, N. I., & Musa, D. (2020). The influence of higher learning environment and role model towards entrepreneurial intention among TVET students. *Jurnal Intelek, 15*(1), 133–142. https://doi.org/10.24191/ji.v15i1.276.

Sart, G. (2023). *Sustainable campus design in universities.* In Considerations on education for economic, social, and environmental sustainability (pp. 121–135). IGI Global. https://doi.org/10.4018/978-1-6684-8356-5.ch006.

Schutzki, R. E. (2005). *A guide for the selection and use of plants in the landscape.* Michigan State University Extension.

Sefton, T. (2018). Teaching for creativity and informal learning in liminal spaces. *Action, Criticism, and Theory for Music Education, 17*(3), 79–100. https://doi.org/10.22176/act17.3.79.

Si, B., binti Mohd Noor, A. I., & Wen, K. (2024). Linking university campus green space and students' mental health and well-being: A systematic literature review. *International Journal of Academic Research in Environment and Geography, 10*(1), 31–47. https://doi.org/10.46886/ijareg/v10-i1/9120.

Solomon, T., & Abebe, W. T. (2024). Landscape-based water treatment design elements: A review. *Journal of Korean Society of Environmental*

Engineers, 46(6), 348–356. https://doi.org/10.4491/ksee.2024.46.6.348.

Souter-Brown, G. (2014). *Landscape and urban design for health and well-being*. Routledge. https://doi.org/10.4324/9781315762944.

Speake, J. (2013). Everyday encounters with nature: Students' perceptions and use of university campus green spaces. *Human Geographies – Journal of Studies and Research in Human Geography, 7*(1), 21–31.

Sugiarto, A., Lee, C. W., & Huruta, A. D. (2022). A systematic review of the sustainable campus concept. *Behavioral Sciences, 12*(5), 163. https://doi.org/10.3390/bs12050163.

Thani, S. K. S. O., & Salleh, N. B. (2024). Exploring the restorative spaces of biophilic campus landscapes in mitigating student stress. *Malaysian Journal of Sustainable Environment, 1*1(2), 233–254. https://doi.org/10.24191/myse.v11i2.1666.

Villandré, L., Rich, B., & Ciampi, A. (2012). Soft classification trees. *Communications in Statistics – Theory and Methods, 41*(16–17), 3244–3258. https://doi.org/10.1080/03610926.2011.632103.

Wirdelöv, J. (2020). The trash bin on stage: On the sociomaterial roles of street furniture. *Urban Planning, 5*(4), 121–131. https://doi.org/10.17645/up.v5i4.3310.

Woźniak, M., & Połap, D. (2020). Soft trees with neural components as an image-processing technique for archaeological excavations. *Personal and Ubiquitous Computing, 24*(3), 363–375. https://doi.org/10.1007/s00779-019-01292-3.

Yeo, S. C., Lai, C. K. Y., Tan, J., Lim, S., Chandramoghan, Y., Tan, T. K., & Gooley, J. J. (2023). Early morning university classes are associated with impaired sleep and academic performance. *Nature Human Behaviour, 7*(4), 502–514. https://doi.org/10.1038/s41562-023-01531-x.

Zakaria, Z., Ariff, N. R. M., Noorhani, N. M. A., & Hussain, M. M. (2024). Sustainable green building initiatives in Malaysia: Issues in the implementation practices. *Journal of the Malaysian Institute of Planners, 22*(3), 530–542.

Zhang, P., He, Q., Chen, Z., Li, X., & Ma, J. (2023). An empirical study on the promotion of students' physiological and psychological recovery in green space on campuses in the post-epidemic era. *International Journal of Environmental Research and Public Health, 20*(1), 1–15. https://doi.org/10.3390/ijerph20010151.

Zhao, S., & Patuano, A. (2022). International Chinese students in the UK: Association between use of green spaces and lower stress levels. *Sustainability, 14*(1), 89. https://doi.org/10.3390/su14010089.