Empowering Student Well-Being with Sustainable Innovations at Perdana Botanical Garden

*[1]Nur Idzhainee Hashim, [2]Mohammad Irfan Alif Abdul Rahman, [3]Nor Hanisah Mohd Hashim, [4]Suzana Ahmad

[1]Faculty of Built Environment, Universiti Teknologi MARA 40450 Shah Alam, Selangor Darul Ehsan

[2]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA 40450 Shah Alam, Selangor Darul Ehsan

*Corresponding Author

DOI: https://doi.org/10.47772/IJRISS.2025.925ILEIID000075

Received: 23 September 2025; Accepted: 30 September 2025; Published: 07 November 2025

ABSTRACT

This study explores smart and sustainable innovations aimed at enhancing the well-being and learning experiences of university students at Perdana Botanical Garden (PBG). The research focuses on two primary objectives: first, to deliver engaging and accessible information about PBG through smart digital platforms and second, to promote student well-being and learning by implementing sustainable, student-friendly initiatives within the garden. The idea of this innovation addresses the existing information gap by delivering accessible, real-time, and engaging content that enhances the overall visitor experience throughout the PBG. A structured questionnaire was developed to gather student perspectives on awareness, perception, and preferences regarding this innovation. The findings collectively highlight significant insights supporting the various ways in which PBG promotes overall well-being through emotional, social, and physical health thereby positioning it as a dynamic hub for student innovation. The implications of this research suggest that integrating smart innovation and sustainability within urban green spaces can significantly improve student engagement, environmental awareness, and overall quality of life through nature based and technology driven solutions.

Keywords: Botanical Garden, Innovation, University Students, Sustainability, Well – Being and Learning

INTRODUCTION

Academic, social, and technological pressures affect university students more than ever which may impact both their well-being and academic performance (Misra, 2000; Bayram & Bilgel, 2008). Stress and anxiety with technology use and not engaging in person social connections can greatly limit students from outdoor recreation or social interactions even more, showing that access to green space is give the potential to include all students. A greater understanding of natural environments can lead to reduced stress, increased cognitive function, and better emotional balance, supporting Attention Restoration Theory (Kaplan & Kaplan, 1989) and Stress Reduction Theory (Ulrich *et al*., 1991).

Perdana Botanical Garden (PBG) as the oldest urban green space in Malaysia, offers opportunities for mental restoration, physical activity and socialization. Gardens such as PBG, have been associated with decreased loneliness, improved concentration, and a greater sense of community belonging among students (Roe *et al.,* 2013; Maas et al., 2008). However, several barriers including a lack of knowledge, issues relating to getting to the park and no programs designed for students, contribute to students not realizing the full potential of PBG (Goh & Mahmood, 2016). To address these gaps, innovative ideas that are smart and sustainable digital engagement, mindfulness programs and eco-innovation, could all play a role to help transform PBG into a living laboratory focused on students. This study introduces ways to think differently about PBG and transform it into an innovation hub, that enhances wellbeing, learning opportunities for students while promoting sustainable urban living.

METHODOLOGY

This study used a quantitative research design and cross-sectional survey method to understand how smart and sustainable innovations can improve student well-being and learning at (PBG). The target population for this study was 384 university students from Kuala Lumpur and Selangor as they are important users' group of urban green spaces. Respondents were selected using convenience sampling based on their availability and willingness to engage. This method provided direct, quantifiable insights into the extent to which digital engagement and sustainability-related programs can be actively utilized in supporting the role of PBG in enhancing student well-being and their learning.

RESULTS AND DISCUSSION

Table 1 Distribution of Survey Respondents by University

University	Frequency (n)	Percentage (%)
Universiti Teknologi Mara	45	11.9
Universiti Kebangsaan Malaysia	37	9.6
Universiti Malaya	46	11.6
Universiti Putra Malaysia	35	9.1
University Of Manipal	1	3
Perdana University	30	7.8
UUM Kampus Kuala Lumpur	31	8
UNITAR University College	36	9.3
Universiti Kuala Lumpur	27	7
BERJAYA University College	29	7.5
SEGi College Kuala Lumpur	47	12.2
City University Malaysia	21	5.4

The composition of the university showed a wide-ranging, consisting of representation of students from different university institutions in Kuala Lumpur and Selangor, through both private and public universities. The survey responded to the diversity of students that the representation can provide, since the largest grouping of students responding came from SEGi College Kuala Lumpur at 12.2% of the sample of the total 386 students. This was closely followed by Universiti Teknologi Mara (UiTM) at 11.9 %, Universiti Malaya (UM) at 11.6 %, and UNITAR University College at 9.3 percent. Other significant contributors included Universiti Kebangsaan Malaysia (9.6 %), Universiti Putra Malaysia (9.1 %), Universiti Utara Malaysia Kampus Kuala Lumpur (8.0 %), Perdana University (7.8 %), Universiti Kuala Lumpur (7.0 %), BERJAYA University College (7.5 %), and finally, City University Malaysia (5.4 %).

Interestingly, students from Manipal University College Malaysia, situated outside of Kuala Lumpur and Selangor, were also present in the sample. This finding serves to emphasize that PBG is an attractive factor of students outside of the current geographical target area, therefore, it can be considered as significant globally as an urban green space, not only as a local attraction.

The results in Table 2 indicate that students tend to agree with high mean scores regarding how much they get impact from PBG, especially in relation to mental health. From the findings, the highest mean was 4.21 for the statement, "I feel that visiting PBG" really helps to reduce my stress." This demonstrates how beneficial it is for university students to have a resource like this garden available, especially since stress is an issue for them. It has been demonstrated in the literature that access to green space such as walking through a botanical garden provide a restorative environment that can reduce stress, mental fatigue and some of the signs often have negative outcome on our psychological well-being (Van Den Berg *et al.,* 2010). Related to this, students with the pressures

of university life, study deadlines, or some other personal challenge can often be stuck in a feeling of ongoing pressures, and many will have numerous personal challenges impacting them simultaneously. They need a place that they can escape, get lost in nature, feel refreshed, and not worry for a short while.

Thus, when students can go for a walk through the gardens and feel safe and have access to peaceful experiences, that were just passionate displays of nature expressing itself, they were able to feel relaxed again or balance their mental health. This was especially important if they are studying after a time that they left their homes. Again, even tending to their own psychological health, knowing that such access to a diverse range of calming experiences helped to improve their emotional strength and for them to process their immediate journeys, or day-to-day experiences that unintentionally contributed to their anxious states. So, access to the gardens is not only a passive pleasure but also getting students closer to development of psychological well-being in a meaningful way so they can either get back to the academic success or personal challenges they faced.

The second highest mean of 4.19 relates to the statement, "One time in the garden helps me focus on my studies better," pointing to the mental abilities related to being in and around natural environments. A wide range of research findings supports the idea that interaction with green space is associated with improved attention restoration and reduced mental fatigue resulting in both of which are important for learning and academic performance (Berman *et al.,* 2008). Botanical gardens provide calm and visually complex settings that give students the opportunity to take a mental break, refresh their cognitive reserve, and assume their academic work with more focused intent and clarity. As a theory, attention restoration model suggests that natural settings allow students to recover the brain's capacity to focus through a reduced scope of the gentle stimulation from a space where they do not have to focus intensely as students do when study (Kaplan & Kaplan, 1989). Given the large mental load of university students, access to green space in locations such as PBG provides direct access to improved academic performance in terms of levels of focus, to learn more efficiently, and sustained mental effort, thus highlighting the educational as well as recreational advantages of the garden.

Furthermore, the lowest mean scores of 4.16 represent three statements regarding two general well-being categories ranging from emotional, social cohesion and being physically active, but students expressed agree that they felt the garden positively contributed to their well-being. The emotional well-being item, "spending time in PBG improves my overall emotional well-being," is aligned with research indicating natural green spaces enhance emotional resilience and contribute to diminishing anxiety and buffering the symptoms of depression (Hartig *et al.,* 2014). Natural green spaces promote relaxation and mindfulness, which offer a buffer to reducing psychological distress. Regarding the students' social benefits of the garden, the students agree that "visiting PBG increases my sense of belonging to a community," clarifying the garden provides students with a social space for relationships to develop, and social interaction and social support, where both are distinct yet important facets of mental health (Jennings & Gaither, 2015). Lastly, the statement "I am more likely to walk or jog when I go to PBG" highlights the promotion of activity through access to green space, which is linked to positive physical health outcomes and decreased risk for lifestyle-related diseases (Lee & Maheswaran, 2011). These findings collectively support the numerous ways that PBG promotes general health through emotional, social, and physical health which is necessary for university students' continued development and learning.

Table 2 Descriptive Statistic of the impact on Botanical Garden in Enhancing University Student Well-Being and Learning

Statement		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	**Mean**
		1	**2**	**3**	**4**	**5**	
Enhanced Mental Health							
I feel that visiting Perdana Botanical Garden really helps to reduce my stress.	*f*	9	16	22	176	163	4.21
	%	2.3	4.1	5.7	45.6	42.2	
I believe that spending time in Perdana Botanical Garden	*f*	14	16	22	176	158	4.16
	%	3.6	4.1	5.7	45.6	40.9	

improves my overall emotional well-being.							
Improved Academic Performance							
Being in the garden helps me focus better on my studies.	*f*	8	16	30	171	161	4.19
	%	2.1	4.1	7.8	44.3	41.7	
I think that the Perdana Botanical Garden helps me feel less tired in my mind, which makes my studying better.	*f*	7	23	24	173	159	4.18
	%	1.8	6	6.2	44.8	41.2	
Increased Social Well-Being							
I feel that Perdana Botanical Garden provides me with opportunities to connect with other people.	*f*	9	26	16	175	160	4.17
	%	2.3	6.7	4.1	45.3	41.5	
I believe that visiting Perdana Botanical Garden increases my sense of belonging to a community.	*f*	11	20	28	166	161	4.16
	%	2.8	5.2	7.3	43	161	
Better Physical Health							
I am more likely to walk or jog when I go to Perdana Botanical Garden.	*f*	8	22	28	170	158	4.16
	%	2.1	5.7	7.3	44	40.9	
I feel that Perdana Botanical Garden encourages me to maintain a healthier lifestyle.	*f*	11	23	12	177	163	4.19
	%	2.8	6	3.1	45.9	42.2	

The findings in Table 3 show that many students noticed that social and transportation barriers prevented them from visiting PBG, with the highest mean score of 4.15 caused by lack of friends to attend with is an important social constraint. This is an example of how companionship can be an important reason for students to participate in leisure activities. Many students may be less strongly encouraged to go to the garden alone and may feel lonely or rely on their friends for emotional support. Association with friends, often makes the outdoor experience richer, enjoyable, and rewarding. These social functions are extremely important to university students, who depend on their friends in both emotional and psychological functions.

This is combined by using the same mean for the lack of public transportation or parking and highlights the lack of practical access to the garden. Transportation is important for students who may not own cars or are faced with time constraints. When considered overall together, these two constraints reveal the primary importance of social connection and access to social connection in helping to determine participation. The social and therapeutic advantages of the garden will be maximally realized by addressing these issues (Smith & Jones, 2018; Chen *et al.,* 2018).

In addition, the item mean score of 4.13 showed how much pressure students experience, in terms of their studies, and is one of the barriers to engaging in the garden. Students can often be extremely occupied with studies, due or heavy course loads, assignments, and tests to the point where they can spend all their time and mental space into just getting their coursework done and engaging in leisure activities becomes nearly impossible. This situation shows every often physically restrictive reality of university life where the demands of studying take first place over the simple act of recharging. A lack of ability to search for good leisure time to visit such place, as PBG, can impact student's mental wellness negatively, as breaks that involve access to nature are widely known to decrease stress and have a positive impact on their moods. Therefore, academic workload not only presents an intellectual challenge, but it may also reduce balanced living. Getting breaks and scheduled recreational conduct can alleviate this constraint, allowing students to add leisure back into their daily lives (Lee & Kim, 2019).

In a different way, statement "It was difficult for me to get to Perdana Botanical Garden", which received the lowest mean rating of 3.46, suggests that while there are some concerns regarding way finding or access, these are seen as being less of an issue than the academic and social constraints. In other words, while some students may face physical access issues such as public transport options or distance, these are not considered to be the biggest concerns. Still, even the slightest discomfort or barrier of getting to the garden, can limit students' freedom and frequency of visits. Thus, improvements to access such as public transport route, shuttle services, parking options which can still serve to help students engage with the garden. As access is an essential requirement of participation, it is a valid concern when looking to overcome other barriers. Therefore, if the student community thinks that improved logistics are significant concerns to address, it is also an important idea to ensure students can fully know the educational and restorative qualities of the garden (Chen *et al*., 2018).

Table 3 Descriptive Statistic of the Barriers on Botanical Garden in Enhancing University Student Well-Being and Learning

Statement		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	**Mean**
		1	**2**	**3**	**4**	**5**	
Time Constraints and Academic Pressure							
My heavy study schedule stops me from visiting Perdana Botanical Garden.	*f*	10	22	35	163	156	4.12
	%	2.5	5.7	9.1	42.2	40.4	
Having many assignments and tests makes it hard for me to find time to go to Perdana Botanical Garden.	*f*	12	18	34	157	155	4.13
	%	3.1	4.7	8.8	43.3	40.2	
Social Isolation and Loneliness							
Feeling lonely makes me less likely to visit Perdana Botanical Garden.	*f*	14	25	28	171	148	4.07
	%	3.6	6.5	7.3	44.3	38.3	
Not having friends to go with stops me from visiting Perdana Botanical Garden.	*f*	11	20	27	172	156	4.15
	%	2.8	5.2	7	44.6	40.4	
Digital Overload and Technology Addiction							
Spending too much time on my phone or computer makes me not want to visit Perdana Botanical Garden.	*f*	18	23	27	168	160	4.06
	%	4.7	6	7	43.5	38.9	
I like using my phone or computer more than spending time in places like Perdana Botanical Garden.	*f*	15	19	27	174	151	4.11
	%	3.9	4.9	7	45.1	39.1	
Accessibility and Transportation							
It is difficult for me to get to Perdana Botanical Garden.	*f*	12	21	166	153	34	3.46
	%	3.1	5.4	43	39.6	8.8	

Not having good public transport or parking stops me from visiting Perdana Botanical Garden.	*f*	14	21	20	171	160	4.15
	%	3.6	5.4	5.2	44.3	41.5	

Enhancing Visitor Engagement through Smart Information Delivery

One key recommendation for PBG is the use of smart or digital information delivery systems to improve accessibility and engagement with students. One of the most common barriers highlighted in findings collected throughout the study was the lack of awareness of the garden's facilities, programs, and activities. To solve this, PBG could consider developing a mobile application that could provide interactive mapping, information about facilities, direct notifications about future events and programs specifically aimed at university students. Through these features visitors can use mobile app or digital kioks to select routes based on difficulty or mood. Moreover, information from real – time environmental data such as air quality temperature, biodiversity can show along the trail at PBG to encourage environmental awareness. Research shows that digital platforms can increase visitor and user engagement and awareness in public spaces with real-time, user-centred information (Nguyen *et al*., 2021). Additionally, Augmented Reality (AR) options can be developed in the app, enabling students to identify plants, follow trails, and educate themselves through interactive content which will enhance their educational and leisure experiences. Research indicates that AR messaging in parks is effective for increasing visitor satisfaction and stimulating learning outcomes, especially considering groups of visitors who are younger and made up of students (Zhang *et al*., 2024). In addition, increasing PBG's social media reach is crucial to reaching students where they spend most of their time. Specialized campaigns, reinforced by student challenge, engagement polls, and informative content, can increase reach and encourage habitual revisiting. All these changes would collectively impact the way students interact with PBG, making it easier, more informative, and perhaps a little more relevant in students' everyday lives.

Integrating Student-Centred Programs for Well-Being and Learning

The second recommendation is to develop student-centred programs that are recreational, educational, and health or wellness-based within PBG. Many university students experience stress from academic pressures, as well as social pressures, often leaving them overwhelmed and anxious, even depressed. It is known that exposure to natural environments is connected to improvements to psychological well-being and decreased stress (Ulrich *et al,* 1991; Roe *et al.,* 2013). The creation of Mindfulness Trails with QR codes for guided meditation and audio relaxation resources could allow for self-care for students while they are exploring with their friends. The garden can also incorporate the Living Classroom concept which creates opportunities for experiential learning in fields like botany, psychology, and environmental studies. This adds more interactive elements to education and may encourage students to consider the garden as an extension of their formal education. Previous research has documented the need to integrate outdoor environments into formal education to facilitate improvement with focus and creativity and learning (Olszewska-Guizzo et al., 2022). PBG can also enhance student creativity and leadership through eco-art exhibitions, cultural programs, student-organized hackathons and the promotion of student collaboration, community building and invention while also creating knowledge (Kingsley & Townsend, 2006). By challenging PBG to integrate program possibilities where it relates to students' academic and personal needs, PBG can become an inspiration for student development that embraces all aspects of student life.

Promoting Sustainability and Eco-Innovation in Botanical Garden Management

These eco-innovations provide a direct benefit to students and promote PBG as a national model for urban green space and sustainable urban green space development. Even better, when these innovations exist within sustainability, many concerned youths will find sufficient reasons to continue visiting public green spaces while meeting Malaysia's sustainability objectives.

CONCLUSION

As a conclusion, these findings offer a major impact for university administrators, PBG staff and DBKL to optimize the potential of the garden to promote and help students' social, mental and physical well-being. As Delbert *et al*. (2024) concluded, addressing mental health in university populations requires proactive approaches that promote physical activity and social connection. This study also identified key barriers that restrict students' ability to utilise PBG, such as access challenges, lack of social connection, and limited mental stamina for extra-curricular engagement. Addressing these barriers will require purposeful innovation that connects digital action plans, student-centred programming, and sustainable architecture.

This study suggested three important areas for innovation. Firstly, smart information delivery via mobile applications, augmented reality, and social media campaigns can help improve accessibility and knowledge of PBG. Secondly, student-centred programming could improve student wellbeing and academic engagement through mindfulness trails, living classrooms, and student-led eco-art projects, which build student capacity as well. Thirdly, ecological innovation and environmental sustainability can advance green pedagogies while also representing sustainable solutions to PBG to support students. These innovations tie in with global trends in nature-based approaches to therapy and therapeutic spaces which have become increasingly prevalent in campus level well-being strategy (Ribeiro *et al.,* 2024).

In the end, this research demonstrates that by strategically engaging in botanical gardens, students can practice self-care, develop resilience, and enhance cognitive functioning. By utilizing smart technologies, developing sustainable practice and implementing inclusive programming, PBG might transform into a living laboratory for student learning and well-being and a template for urban universities globally to follow and grow.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the contributions of the respondents, who were among the visitors, for their valuable insights and perspectives, which significantly contributed to the success of this research and its findings.

REFERENCES

1. Bayram, N., & Bilgel, N. (2008). The prevalence and socio-demographic correlations of depression, anxiety and stress among a group of university students. Social Psychiatry and Psychiatric Epidemiology, 43(8), 667–672.
2. Chen, G., & Sun, W. (2018). The role of botanical gardens in scientific research, conservation, and citizen science. Plant Diversity, 40(4), 181–188.
3. Delbert, T., Stepansky, K., Bucey, J. C., & Goodman-Schiller, D. (2024). Growing sustainable therapeutic third spaces – a therapeutic sensory garden's impact on university student self-reported quality of life and affect. International Journal of Sustainability in Higher Education.
4. Goh, H. C., & Mahmood, N. (2016). The user's perceptions of Perdana Botanical Garden in Kuala Lumpur. Journal of Design and Built Environment, 16–16(1), 27–28.
5. Hartig, T., Mitchell, R., De Vries, S., Frumkin, H., & Annual Reviews. (2014). Nature and Health. Sci. Adv.
6. Lee, A. C. K., & Maheswaran, R. (2010). The health benefits of urban green spaces: a review of the evidence. Journal of Public Health, 33(2), 212–222.
7. Maas, J., Van Dillen, S. M., Verheij, R. A., & Groenewegen, P. P. (2008). Social contacts as a possible mechanism behind the relation between green space and health. Health & Place, 15(2), 586–595.
8. Misra, R. & West Virginia University. (2000). College students' academic stress and its relation to their anxiety, time management, and leisure satisfaction. American Journal of Health Studies.
9. Nguyen, P.-Y., 1, Astell-Burt, T., 2, Rahimi-Ardabili, H., 1, & Feng, X., 1. (2021). Green Space Quality and Health: A Systematic review. International Journal of Environmental Research and Public Health.
10. Ribeiro, H., Valente De Souza Santana, K., Lizarralde Oliver, S., & Preprints.org. (2024). Natural Environments in University Campuses and Students' Well-being. International Journal of Environmental Research and Public Health.
11. Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. Journal of Environmental Psychology, 201–230.

12. Van Den Berg, A. E., Maas, J., Verheij, R. A., & Groenewegen, P. P. (2010). Green space as a buffer between stressful life events and health. Social Science & Medicine, 70(8), 1203–1210.
13. Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough.' Landscape and Urban Planning, 125, 234–244.
14. Zhang, J., Jin, J., & Liang, Y. (2024). The impact of green space on university students' mental health: the mediating roles of solitude competence and perceptual restoration. Sustainability, 16(2), 707.