Wellbeing in an Urban University: Sensory perception for salutogenic landscape design

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Abstract

Enhancing the affiliation with campus green spaces is an intervention of wellbeing promotion in an urban university campus, and beneficial outdoor experience may result from the concept of salutogenic landscape design where the sensory perception plays a vital role. Therefore, this paper aims to propose operative approaches for assessing sensory perception towards the implementation of salutogenic projects in campus green space. Two identified sites at two different faculties were selected as exploratory studies by focusing on the physical environment for defining influential variables to develop comprehensive research methods.

Keywords: sensory perception; open spaces; salutogenic; wellbeing

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1.0 Introduction

Frequent exposure to green space has generally linked with health and wellbeing enhancement of urban population (Thompson, 2014). The lack of outdoor experience in nature due to limited green space may shape urban residents' living habit into an unhealthy lifestyle. As mentioned by Lisa (2005), health patterns established during the transition from adolescence to adulthood are vital for the development of adult health practices. Most young adults who are going through this transition period are currently in colleges and universities (Lisa, 2005; Moy & Atiya, 2005).

Encouraging outdoor activities is as an intervention for avoiding lifestyle diseases associated with obesity and sedentary behaviour. Students who frequently use green space are more likely to have a higher quality of life, better health condition, and lower mental stress (Ratey & Loehr, 2011; Thompson, 2014). Outdoor experience also contributes to satisfaction with social life on campus. A university campus could be a suitable environment for cultivating salutogenic open space in an urban area. According to Ratey & Loehr (2011), salutogenesis is a medical approach focusing on factors that support human health and wellbeing, rather than on factors that cause disease (pathogenesis).

Under the process of salutogenic design, sensory stimulation influences people's perceptions and responses of the physical environment. Components such as hard/soft landscape, colours, textures and scents can provide multi-sensory outdoor experiences (Hussein, 2009). Beyond the five biological senses (hearing, sight, touch, taste, smell), feelings of space, emotion and spirituality are also stimulated during perceiving outdoor environment (Hussein et al., 2016). Based on Cilliers (2011), optimum environmental perception obtained from different senses can facilitate the design strategy of the salutogenic landscape by considering the people's need and comfort. Yet previous investigations have not covered much about how open spaces affect outdoor experience via sensory perception. The approaches for conducting salutogenic design in campus outdoor areas are still developing accordingly. Hence, a systematic methodology is essential to explore the sensations towards spatial variables of green spaces in the context of a university campus, as shown in Figure 1.1.

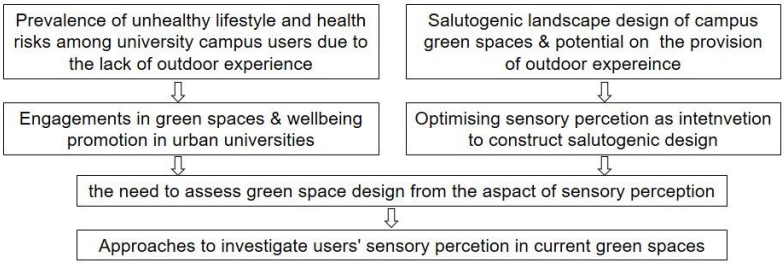

Figure 1.1: The needs of systematic methodology in exploring sensations towards spatial variables of green spaces

Insufficient engagement of outdoor experience in nature may lead to a high rate of sedentary behaviour, physical inactivity, chronic stress and anxiety among university students and staff. Salutogenic landscape design may encourage the affiliation with campus green spaces for physical activities, communication and outdoor learning, which benefits researchers and students' wellbeing even academic achievement in a university campus. Although sensory perception plays an essential role in exploring the motivations and expectations of salutogenic landscape, its assessment process is still inadequately defined. There is a need to examine what are the effective methods to investigate campus users' sensory perception towards open green spaces, specifically in a university campus located in an urban area. Hence, this paper aims to propose operative approaches to assess sensory perception in campus green space for further conduction of salutogenic design in metropolitan universities. There are two objectives developed for achieving this aim. They are to investigate the functional design of campus green spaces and to define the design variables stimulating sensory perception in selected open areas.

2.0 Literature Review

Various health-promotion opportunities are provided by natural environment: physical activity and fresh air for physical wellbeing; stress reduction and attention restoration for mental wellbeing; social integration, engagement and participation for social welfare. Urban citizens that exercise or relax in green spaces regularly are estimated to have a much lower risk of poor mental health than those who have physical activities in non-natural venues such as the gym or streets. Simultaneously, green space also has the potential for reducing the obesity rate and lower cardiovascular morbidity. The modern urban lifestyle is associated with chronic stress, insufficient physical activity and exposure to anthropogenic environmental hazards (Thompson & Oliveira, 2019). Because of the limited green space, the lack of affiliation with nature may shape urban residents' living habit into a sedentary lifestyle (Thompson, 2013). Along with the expansion of urbanisation, urban green space is diminishing. It cues that prevalence of poor mental and physical health is more likely to occur in economically developed metropolitan regions.

When it comes to overall wellness, university students have been identified as a vulnerable population among urban residents (Quinn, 2015). Besides, higher morbidity caused by sedentary lifestyle is also detected among staff who live or work in university campus (Moy & Atiya, 2005). The increase in outdoor experience is found to be possibly helpful to control morbidity rate, benefit mental wellbeing and promote academic success in university campuses. Considering an abundance of information existing on the relationship between health promotion and physical environment, the quality and function of campus open spaces have become the concern of university administrators in an urban area as well (Lisa, 2005). Physical, educational environment that promotes increased physical activity can potentially improve students' health and performance, which is explained by the theory of salutogenesis, a philosophy that focuses on health promotion (Ratey & Loehr, 2011).

By combining the concept of salutogenic design in the built environment, campus open

spaces could potentially increase outdoor activity and enhance the wellbeing of students. A university campus in an urban area also provides an opportunity for constructing salutogenic outdoor spaces. The affiliation with green spaces is tied by outdoor experience, which premises emotional and physical responses, and ultimately, people's recognition of their environment and their articulation of them reflect on the engagement to outdoor activity (Okoli, 2013). Environment-behaviour studies have developed ecological approaches combining the natural atmosphere with health by studying the transactional features of the person-place relationship (Thompson, 2013). Salutogenic design process explains the mechanism to achieve health enhancement through urban green spaces construction (Cilliers, 2011; Thompson et al., 2014). Under this dynamic mechanism, human senses stimulate the comprehensibility of the external environment, which lead to a pervasive, enduring, though the active feeling of coherence towards spatial perception (Cilliers, 2011).

Optimum sensory stimulation from multi senses can be developed by considering the people's need (Hussein, 2017). Case studies about open spaces in universities have clarified that availability and utility, aesthetic attraction, fluency between inner and outdoor spaces, suitability for the realisation of activities, safety, variety in use and convenience are the spatial variables supporting outdoor activities (Eusuf et al., 2018). Outdoor activities and outdoor learning may potentially lead to institutional commitment, retention, and persistence, which, in turn, promote academic achievement and mental health (Quinn, 2015). By encouraging outdoor experience on campus, a landscape designed multi-sensory learning environment is a practical application to enhance higher education (Pierce, 2017). Previous outcomes have indicated the significance of sensory stimulation in the future construction of salutogenic open space for wellbeing promotion and academic success. However, these investigations have not sufficiently defined the role of sensory perception in the salutogenic design process, and there is limited information on how to evaluate the influence of sensory perception on users' outdoor experience (see Figure 2.1).

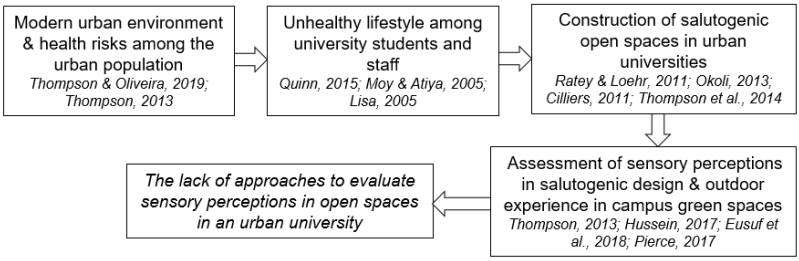

Figure 2.1: The role of sensory perception in salutogenic design

Among all types of campus green spaces, open spaces surrounding buildings can function as important activity area due to the indoor-outdoor distance and accessibility (Cindel et al., 2018; Jamaludin et al., 2014). Many scholars have claimed that the adjacent open spaces establish a sense of attachment to occupants via different approaches and criteria of plan and design. For keeping pace with the growing awareness about the impact

of an urban neighbourhood, the necessity of interactive open space has been realised. The educational buildings are the most critical component of university physical environment. Therefore, the salutogenic design of the physical environment in learning zones are becoming increasingly essential goals for the sustainable development of the physical campus.

Moreover, the spatial configuration and landscape of open spaces in the built environment ought to be climate-responsive. Based on Cindel et al. (2018), the classifications include centralised, linear, semi-enclosed or attached open spaces. An optimum form, orientation and envelope configuration can promote a natural, comfortable environment and enhance overall outdoor thermal performance (Cindel et al., 2018). In tropical regions, the role of open spaces surrounding buildings is of prime importance to contribute to the success of passive building design (Jamaludin et al., 2017). Adjunct outdoor spaces, such as envelopes and courtyards, are commonly applied in architecture layouts for adapting the hot-humid climate. It is because the existence of these open space facilitates natural ventilation and adjust the indoor light condition to achieve environmental satisfaction (Jamaludin et al., 2014).

In Malaysia, passive design strategies of the built environment are popular academic focuses that are highly supported by local policies. One of the critical aspirations outlines of National Landscape Policy (NLP) is to produce a quality, unique, and sustainable landscape to accomplish the Beautiful Garden Nation vision (Malek et al., 2016). Kuala Lumpur, the capital and largest city of Malaysia, it has an estimated population of 1.6 million in 2006 (Zahri, 2017). There are several other public and private universities located in Kuala Lumpur. This metropolis situated 21 meters above the mean sea level has the climatic characteristics of near-uniform monthly mean temperature (26.8 to 27 °C) and high mean relative humidity (63 to 68%). University of Malaya (UM) is the first generation of universities in Kuala Lumpur. The UM campus is in the typical urban neighbourhood where students are likely to suffer from a higher level of obesity and stress (Moy & Atiya, 2005). Besides, the campus sited at the current address in the year 1962, which ensures the stability of campus green spaces on vegetation development and the capability of holding participation (Jamaludin et al., 2017). Thus, two open areas surrounding educational buildings in UM campus were taken as case study sites for testing the possible research methods to find out the practical approach for surveying users' sensory perception (see Figure 2.2).

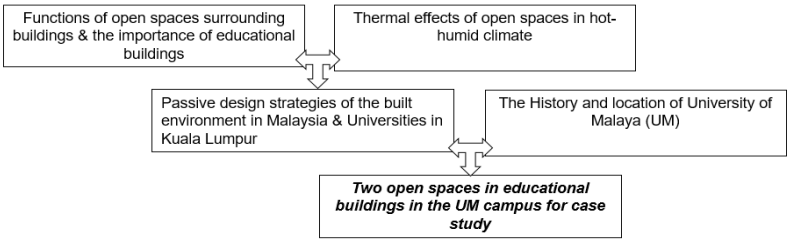

Figure2.2: Justification of case study selection

3.0 Methodology

A preliminary study was implemented as an initial exploration for the quality review of current open space design. After an investigation of educational buildings in several university campuses in the urban area of Kuala Lumpur, the educational blocks are estimated to be related to the assessment of surrounding open spaces from the aspects of both physical environment and educational activities. Environmental contexts and architecture design of educational buildings may affect the outdoor settings in its adjacent environment. Meanwhile, the research fields and professional training may bring various requirement on the physical education settings and the arrangement of surrounding green spaces. Therefore, the investigation of faculty building shall cover the information of location, external environment, façade design, building layout and academic specialities.

Stated by Bedimo-Rung et al. (2006), the conceptual model for direct observation should consist of the following domains: features, condition, access, esthetics, and safety. Based on the previous strategies of conducting observation and the need for this study, guideline forms were adopted for investigating the layout, environmental contexts and sensory design of case-study open spaces. Subsequently, observation record in types of photos, videos and notes are required to observe the participants' activities or users' behaviours. Due to the delicate design of adjacent green spaces, the green spaces in the Faculty of Built Environment and the Faculty of Medicine were taken as case-study sites to conduct a direct observation.

In this investigation, the author obtained insufficient data on tracking behaviours and activities. Because time-sensitive items may need to be measured on multiple occasions, while things asking for subjective responses may require more supervised practice (Bedimo-Rung et al., 2006). Besides, the motivations or causes for a specific behaviour and activity is unclearly related to the sensory and spatial variables.

4.0 Results

Faculty of Built Environment and Faculty of Medicine has been selected as case studies. The findings of both faculties and identified green spaces are able to facilitate the development of guideline form and strategies for applying other research methods.

4.1 The description of educational buildings

The description of the building is an essential section that may influence the landscape design and outdoor experience in its adjunct open spaces. Table 4.1 and Table 4.2 demonstrate the relevant information of the two faculties and the location of selected open spaces.

Table 4.1: Description of the Faculty of Built Environment

Name of faculty	Faculty of Built Environment
Location, the layout of main educational buildings and attached green space	The position is higher than its surroundings and half-open structure provide sufficient possibility to overlook The faculty is a 10-floor single building locating in the southern part of campus opposite of Examination Hall. It is adjacent to the Faculty of Engineering and the Faculty of Medicine. There is a sunken yard beside the main entrance (see Figure 4.1).

Architecture design	Façade	As shown in Figure 4.2
	Inner structure	It is a single building with ten floors. The open lobby takes a large proportion of the ground floor area. The arrangements of open corridors and open stairs are applied from the ground until the second floor. Yet the semi-open hallway on the third floor next to the café is in a relatively small area.
	Enclosure	The ground floor is a semi-closed space with the canopy at the gate. Outdoor stairs and platforms link with the office zone.
Regular lecture hours	Monday - Thursday	9.00am-1.00pm, 2.00pm-5.00pm
	Friday	9.00am-12.00am, 2.15pm-5.00pm
Professional majors and academic areas	The academic specialities are urban and planning, architecture, quantity survey, building survey, real estate, project management, facility and maintenance.	
Requirements for physical settings	There shall be classrooms for making models and displaying, as well as labs with computers for lectures or using any software.	

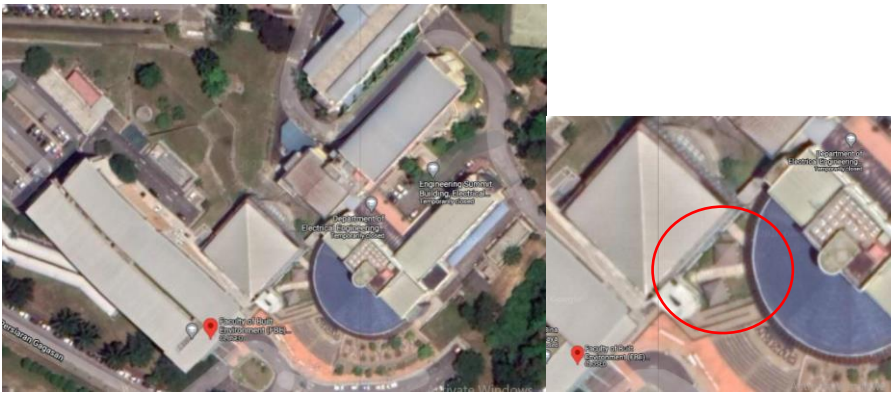

Figure 4.1: Location and layout of main educational buildings and attached green space of the Faculty of Built Environment
(Source: Google map)

Figure 4.2: Façade design of the Faculty of Built Environment
(Source: Author)

Table 4.2: Description of Faculty of Medicine

Name of faculty	Faculty of Medicine	
Location, the layout of main educational buildings and attached green space	This faculty locates at the Southeast part of the campus next to Faculty of Built Environment. Open corridors are well connecting with the outside environment. There is a courtyard with limited accessibility providing a green view for the covered café nearby (see Figure 4.3).	
Architecture design	Façade	As shown in Figure 4.4
	Inner structure	The educational building is 3 to 4 floors with few attached constructions. There are several blocks connected internally. The layout is in a large area with differences in heights.
	Enclosure	There are attached open corridor beside the main entrance. Open hallways and stairs take a large part. The rotating sun shields on both sides of the semi-open halls are to adjust microclimate.
Regular lecture hours	Monday - Thursday	8.30am-5.pm
	Friday	9.00am-12.00am, 2.00pm-5.00pm
Professional majors and academic areas	The academic specialities are Medicine and surgery, biomedical science, pharmacy, nursing science.	
Requirements for physical settings	There are many laboratories together with lecture rooms in the educational buildings, and the clinical practice departments have connections with the public.	

Figure 4.1: Location and layout of the main educational buildings and attached green space of the Faculty of Medicine
(Source: Google map)

Figure 4.2: Façade design of the Faculty of Medicine
(Source: Author)

4.2 The investigations in selected green spaces

The chosen green space in the Faculty of Built Environment is a sunken yard beside the entrance of the educational building. It is a relatively enclosed space in the middle of the stairs and walls of buildings. The vertical position is lower than its surroundings, which creates a feeling of isolation and safety. The physical settings include two pavilions for resting, steps made of concrete boards and cobblestones, clay flowerpots. The two pathways leading to pavilions make this tiny green space accessible for the regular users, and the users can enjoy the green view when they pass by the semi-open sections of the building (see Figure 4.5). Yet most of the students pass by but hardly stop to get into this space, and they prefer the open lobby where they can wait for the lift and having their lunch. Some of them may enjoy the view when they walk beside corridors and stairs or make phone calls. The landscape design in the limited space is in details that create an intensive green space to attract much visual attention.

A wide range of plants species with mixed texture are arranged, and the palms with broad leaves is an outstanding feature to a certain extent. Hard surfaces of stone make the seats either too cold or too hot for sitting. But the stone steps have supported the participation of outdoor activities via a provision of accessibility. The unpleasant odour from gutters is noticeable sometimes. Flowers of plants may attract butterflies. There are many mosquitoes during the early morning and sunset time. As for the microclimate, this spaces is stuffy and humid during the daytime, especially in the afternoon when there is much solar radiation, the layout and vegetation species are shown in Figure 4.6 and Table 4.3.

Table 4.3: Plants' species at the Faculty of Built Environment

No.	Scientific Name	Common Name	Amount (number or area)	Remarks
1	Manihot esculenta	Tapioca	7	1.2/0.7*0.7
2	Rhapis excelsa	Lady`s palm	3	potted
3	Jasminum officinale	Common jasmine	1	potted
4	Asplenium nidus	Bird's nest fern	1	potted
5	Cordyline fruticosa 'Chili Pepper'	Chili Pepper Ti Plant	2	potted
6	Dieffenbachia amoena 'Tropic Snow'	Tropical topaz	1	potted
7	Pedilanthus tithymaloides "Variegatus"	Japanese poinsettia	1	potted
8	Bougainvillea "Mrs Eva Mauve Variegata"	Bougainvillea, Paper flower	1	potted
9	Dieffenbachia	Dumb canes	1	potted
10	Washingtonia robusta	Mexican fan palm	3	potted
11	Pandanus amaryllifolius	Pandan	1	potted
12	Cuphea hyssopifolia	False Heather	1	potted
13	Kalanchoe hildebrantii	Silver teaspoons	1	potted
14	Carica papaya	Papaya	1	potted
15	Curcuma longa	Turmerics	2	potted
16	Asplenium nidus	Bird`s nest fern	1	potted
17	Dypsis lutescens	Yellow cane palm	1	potted

18	Pereskia sacharosa/saecnarosa	Needle Seven Blade / Tree Cancer	1	potted
19	Dracaena surculosa var. maculata	Japanese bamboo	2	potted
20	Sansevieria trifasciata	Mother in-law's tongue	2	potted
21	Donax canniformis	Bemban / Bamban	1	potted
22	Rhaphiolepis indica	Indian hawthorne	1	Potted
23	Phoenix roebelenii	Pygmy date palm	2	Potted

(Source: Author)

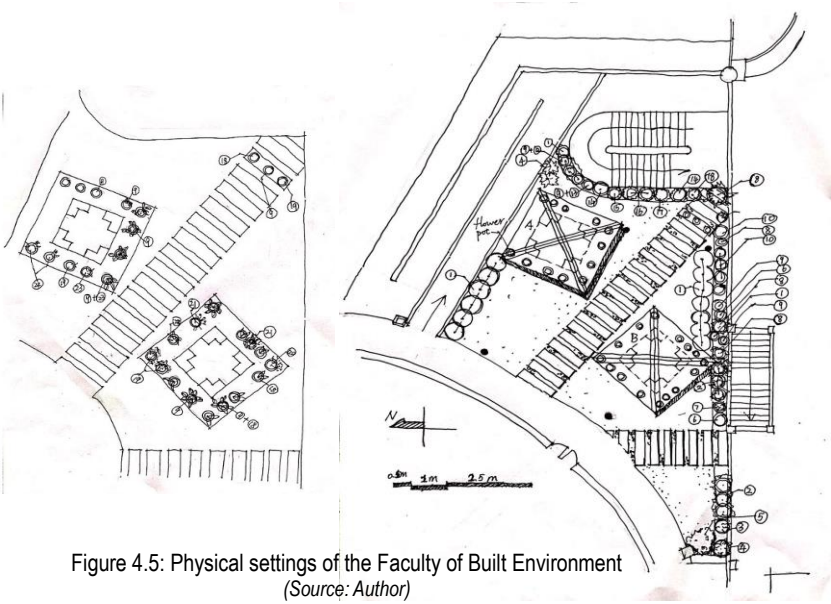

Figure 4.5: Physical settings of the Faculty of Built Environment
(Source: Author)

Figure 4.6: Layout and vegetation of the Faculty of Built Environment
(Source: Author)

Table 4.4: Plants' species at the Faculty of Medicine

No.	Scientific name	Common name	Amount (number or area)	Approximate Size: height(m)/crown breadth(m*m)

1	Cinnamomum camphora	Camphor tree	1	20/18*15
2	Ptychosperma macarthurii	Macarthur palm	4 6	2.2/1*1 1.5/0.8*0.8
3	Bentinckia nicobarica	Bentinck palm	3	20/1.5*1.5
4	Salix babylonica	Weeping willow tree	5	4.5/4*4
5	Ficus microcarpa 'golden'	Indian laurel fig	4	1.2/2*2
6	Latania loddigesii	Blue latan palm	2	2/3.5*3.5
7	Asplenium nidus	Bird's nest fern	1	0.6/0.5*0.5
8	-	-	30m*28m	0.15/---

(Source: Author)

Figure 4.7: Physical settings of the Faculty of Medicine
(Source: Author)

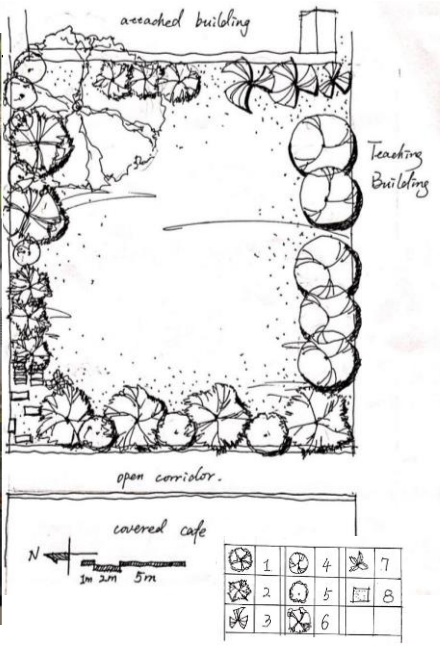

Figure 4.8: Layout and vegetation of the Faculty of Medicine
(Source: Author)

The green space in Faculty of Medicine is s a courtyard inside of the building layout. This green space is a squared courtyard beside the open corridor across from a covered café on the ground floor, which is a typical enclosed space in the middle of the block. The inaccessible courtyard is next to a semi-closed café and offered a relaxing view for people sitting in there or walking on the neighbouring pathways. It has created a pleasant atmosphere for the users in this educational building (see Figure 4.7). Although there are few steps made of stone boards next to the opens of the corridor, those steps have no practical function on increasing accessibility. The lawn combines with several kinds of trees

to soften the edge next to a hard surface and to provide essential protection for the building. The textures of vegetation, such as the soft grass, willow leaves and branches as well as rough and hard palms, form diversity in the green space. The smell from café and voice from the corridor is not disturbing, and the layout and vegetation species are shown in Figure 4.8 and Table 4.4.

5.0 Discussion

In the investigation of sensory perception, a site observation in advance is necessary. It enables the data collection of how regular campus users (students and staff) respond to the physical settings in the outdoor environment and engage in physical or educational activities in the open air. A preliminary assessment of opportunities for the provision of outdoor experience can clarify the scope and limitations of research. It also sets criteria to analyse what types of green spaces are potential venues for the participation of activities or occurrence of specific behaviours. Furthermore, the development of the methodology of surveys on sensory perceptions shall depend on approaches defined while implementing the investigation and instruments and techniques conducted for processing data collection and analysis. Feasibility analysis achieved in the preliminary site study gave predictions of solutions on possible obstacles by looking into difficulties and challenges for data collection.

Malek et al. (2018) have claimed that utilisation of outdoor recreational space is under the impact of design-related factors such as location, safety, distance, size, accessibility, management and maintenance, comfort, legibility, types of activities and facilities provided. According to the investigation results of two selected faculties in UM campus, the variables of sensory stimulation are divided into two categories which are human senses and landscape elements. The sensory perception of space relies on physical settings because the landscape variables afford various opportunities to affect the perceptual sensibilities in the outdoor experience.

The soft landscape offers a green view facilitating mental wellbeing and comfort microclimate, while the hard landscape provides more opportunities for participation. In the presence of open spaces surrounding buildings, the dimensions of landscape design shall include the colour, texture and fragrance of plants, the material and appearance of facilities and human-made features, the microclimate, spatial ratios, accessibility and provision of outdoor activities. Yet water features are infrequent to apply in the spaces between building due to the difficulty of maintenance and extra humidity caused. In terms of stimulated senses, the physical attributes in an adjacent open area of educational buildings may rise the perception of sight, sound, smell, touch, atmosphere of space and emotions aroused.

The observational study allows the researchers to collect evaluative information without altering the natural environment (Ibrahim & Fadzil, 2013). Bedimo-Rung et al. (2006) have developed a direct observation instrument to assess park characteristics that may be related to physical activity. This study has suggested that direct observation can be considered as an appropriate instrument to explore the environmental settings of open spaces and the opportunities offered for outdoor events. When Hussein (2009) examines some of the design issues associated with sensory gardens, observation is adopted as the

primary research method to evaluate 'sensory function'. Via revealing how users engage their senses, similarly, the same approach is likely to be a path leading to a comprehensive understanding of stimulated senses from the view of campus users. Data recording for direct observation includes historical notes, video or photographs, recording checklist, observation guidelines (printed forms with space to write letters), and combinations of the above.

However, referring to the limitations of research methodology, the observation has obtained inadequate data on sensory perception of environmental settings and its significances on users' actions. Few researchers have mentioned that a standardised observation schedule can only be conducted when the researcher has specific hypotheses about predicted or categorised behaviours. If the intention to know whether particular actions are related to other variables, observation may lose the advantages. For studying the impacts of sensory perception on users' engagements and environmental satisfaction, there is a need to find out other methods to support the findings of direct observation in selected green spaces.

According to Barker (1969), behaviour settings are ecological units where the physical environment and behaviour are indissolubly connected. Thus, conducting a behaviour setting survey consists of the measurement of crucial descriptive attributes: occurrence, duration, population, occupancy time, penetration, action patterns, behaviour mechanisms, etc. (Barker,1969; Jaeckel et al., 2008). To survey the environmental settings in a particular area, Jaeckel et al. (2008) have claimed that behaviour mapping provides a promising method for objectively measuring relationships between physical behaviour settings and directly associated activity levels. Due to the abundant information obtained about a phenomenon (especially the behaviour of individuals and a group of humans) associated with the spatial system, this research method shares an appealing simplicity while preserving a high degree of ecological validity (Barker,1969). Therefore, the behaviour mapping able to compensate for inadequate data collected via observation. Indirectly fulfil the aim of this study to explore how the current environmental settings support users' behaviours and activities.

In investigations about sensory gardens and open spaces, two main tasks of behaviour mapping are the identification of settings within observation site and definition of those human activities of interest (Jaeckel et al., 2008; Hussein, 2009). The two types of approaches are place-centred mapping and person-centred mapping (the tracking may focus on a particular place or based on individual movements). To define the mechanism of how behaviour settings in surrounding open spaces support for the outdoor experience, a place-centred behaviour mapping is more suitable for further investigations. By using a map of the case-study open space, the positions of participants, the duration of activities in the chosen area, and some characteristics of individuals like gender, age, and level of engagement with others were recorded.

6.0 Conclusions

The practical methods to investigate campus users' sensory perception towards open

green spaces in an urban university are explored and developed in this study. During the investigations of functional design in selected green spaces, the independent and dependent variables stimulating sensory perception are defined (see Table 6.1). This finding may enable the current open spaces to have more potentials for supporting outdoor activities through improving interventions of salutogenic design. For case study selection, the chosen open spaces at the building should play a role as a recreational, instead of traffic organisation, entrance gathering or inaccessible vegetative landscape. Even the accessibility of green spaces become an issue, this should not limit the outdoor experience due to a provision of a pleasant view. Yet they shall not be covered in this research scope because activities cannot occur within the scale. There is a lack of physical settings supporting participation in those places.

Table 6.1: Variables of sensory perception in the presence of campus open space

Independent variables: Elements of landscape design in campus open spaces	**Dependent variables: stimulated human senses**
Colour, texture and fragrance of plants, the material and appearance of facilities and human-made features, the microclimate, size, spatial ratios, accessibility and provision of outdoor activities	*Sight, sound, smell, touch, spatial atmosphere, emotions aroused and spirituality (such as relax, safety, sense of place and belonging).*

(Source: Author)

Both and quantitative methods have been applied in the evaluation of sensory design, assessment of open space quality and behaviour pattern of green space participants. In the direct observation of this study, the qualitative data has associated specific design variables with the stimulation of senses. The layout, vegetation design and utilisations of the selected sites are defined for explaining the occurrence of a behaviour or activity.

The integration with behaviour mapping able to provide more adequate data on the interaction between environmental settings and users' perceptions and behaviours. Furthermore, when researchers intend to come up with design strategies from the aspect of ecological psychology and behaviouristic, place-centred behaviour mapping seems to more efficient. Site observation can afford sufficient data of spatial features for applying this type of behaviour mapping. The goals of combining the two methods are to discover the occurrence of a behaviour, record the duration and frequency of actions, and explore users' responses to a specific design feature. Noticeably, the venues of implementing observation shall have clear borders to avoid confusions in recording an action. In further surveys of interactions between users' behaviours and environmental settings, this finding may cast additional restrictions on the criteria of case study selection.

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