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# e-Proceeding

# v-GOGREEN2020

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"SUSTAINABLE ENVIRONMENT, RESILIENCE AND SOCIAL WELL-BEING"

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# RANKING OF PLANTING COMPOSITION ATTRIBUTES IN CAMPUS WELL-BEING

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## Abstract

Planting composition is the art of arranging individual plants using similar or different species with a distinctive element of size, colour, texture or form. These composition attributes may influence viewers' preferences. Theoretically, people always respond to beautiful and well-planted surroundings rather than mysterious and complicated planting design. The research aims to rank the planting composition attributes which are able to enhance the campus environment and community well-being. Therefore, the collection of planting composition images are grouped accordingly, and the mean results recorded to achieve the aim of attributes ranking objectively. The descriptive analysis was used as a method to quantify the mean results. The ranking is significant to determine the quality of green needed by the community on campus for their life and well-being. As a result, the research findings are able to guide the designers to sensibly setting the planting design, particularly in the campus environment.

**Keywords:** *Planting composition; attributes; campus; well-being; preferences*

## 1.0 INTRODUCTION

The world is experiencing the progressive green environment, and now is increasingly seen in many developments such as green infrastructure, green index, greenway network, green corridor and others to upgrade the demand for healthy living in the green environment. Currently, scholars have studied the relationship between planting and reflection on preference and well-being. For example, Akhir et al. (2019) studied planting design as an influencing factor to visual landscape quality and well-being. Liu and Schroth (2019) assessed the aesthetic preferences concerning vegetation in enclosure urban parks. Hoyle, Hitchmough and Jorgensen (2017) explored the wow factor in urban planting correlated with restorative effect and perceived biodiversity. These emphasize that landscape planting attributes have significant impacts on visual quality (Polat and Akay, 2015), healing process or even help preventing mental illness as well as community well-being (Gerstenberg and Hofmann, 2016). This research will discuss planting composition in the campus context to determine the ranking of planting attributes which are able to increase students' well-being. It becomes increasingly important to understand the criteria of planting to construct the campus landscape possessing high aesthetic quality and efficiency of stress relief simultaneously.

## 2.0 PLANTING COMPOSITION ATTRIBUTES

The purpose of this research is to explore how the attributes of planting composition and landscape preference can be brought together. Plants have visual quality as an extremely powerful attribute in comparison to other variables, and the relationship between plants and visual quality is emphasized. (De La Fuente De Val & Mühlhauser, 2014; Ulrich, 1986). Jiang et al. (2014) determined that the amount or density of trees was a positive predictor of mental restoration or aesthetic preference. People feel calmer and happier when being around plants (Kaplan and Kaplan, 1989). Planting trees in a barren residential area (without trees) results in a dramatic increase in preference and stress recovery (Jiang et al., 2014). Still, too dense planting can undermine regeneration by evoking feelings of insecurity (Van den Berg et al., 2014). Flowers, especially brightly colored flowers, can improve aesthetic preference (Hoyle et al., 2017) and positively contribute to the psychological well-being of a human. For example, vegetation with flower cover of 27% or above is significantly more attractive than those with lower percentage flower cover (Hoyle et al., 2017). Overall, people prefer areas with clumps of trees and shrubs. Nowadays, brightly colored flowers are grown in many parks. Whether or not bright flowers are more fitting for the production of visual appreciation and mental well-being rather than a more naturalistic atmosphere is a topic that needs to be addressed.

Therefore, the planting composition attributes should be measured for reliability and identify its influences on the visual quality of the landscape planting area. The features selected in this study are based on the plant properties such as size, colour, shape or form, texture, density, arrangement, vividness and naturalness. These eight attributes will be analysed to determine the ranking as mostly influencer of landscape aesthetic planting scenes. Aesthetic qualities of planting design directly affect the scenic beauty of landscapes, and this has recently been an essential component of landscape planning and management strategies (Daniel, 2001). Visual pleasure, derived from landscapes of high aesthetic quality and scenic beauty, directly affects perceptions, preferences, and uses (Daniel, 2001; Daniel & Vining, 1983). Therefore, aesthetic pleasure is a broadly important objective of planting design, and plants offer enjoyable sensory experiences and creative opportunities for art and design.

## 3.0 METHODOLOGY

### 3.1 Research Design

Assessment of the visual quality of the campus landscape planting areas used in this study was the psychophysical method (Zube et al., 1982). The study was carried out based on the photograph-based method used by most scholars in this research field. The technique in question consists of taking photographs of the area in phases, using a photo-questionnaire design, and applying statistical analysis.

### 3.2 Study Area

The campus landscape is the context of this research, whereby areas in Universiti Putra Malaysia (UPM) main campus located in Serdang, Selangor became selected areas of study (Figure 1). The factors taken into consideration for the site chosen were sizes, function, and distribution within the faculties in the campus. UPM has 1245.056 hectares, consists of 15 faculties and has about 25,000 number of students. The survey areas have taken only green spaces with passable landscape planting scenes in each of faculties were the places that can be assessed by students physically and visually.

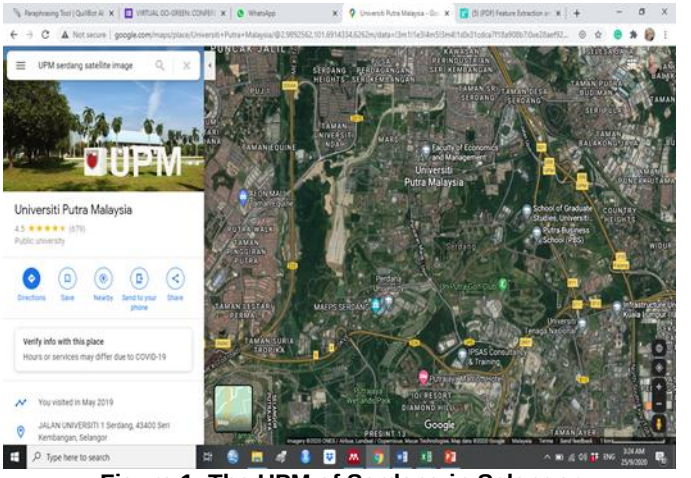


**Figure 1: The UPM of Serdang in Selangor**

(Source: Google satellite image)

### 3.3 Photography

For photography, the researchers used a digital single-lens reflex (DSLR) camera with a 12.3-megapixel resolution, 18x optical zoom lens and panoramic shooting mode. Photographs were taken in May 2019 during weekends so that human factors are not included in the photographs. The time photographs taken between 08:00 in the morning until 11.00. The ideal time for photos taken is in bright conditions (sunny conditions) and to avoid taking pictures too early in the morning or afternoon (Firmansyah et al., 2017). Photographs shot in different angles of panoramas in a manner that reflect all of the characteristics of planting design areas. Approximately 94 landscape planting scenes in total taken in all of the faculties' areas. The panoramic photograph field method, used in Sevenant and Antrop's (2009) study, was also employed. Following this, 51 photographs were selected with the aid of subject experts from academicians in the landscape architecture field. The selection performed such that the main planting design elements of each image is accurately reflected. Each selected photograph was then grouped into seven criteria which were defined accordingly in Table 1.

### 3.4 Photo-Questionnaire

The total of 51 number of landscape planting photographs were placed on A4 size paper. The photo-questionnaire contains the questions on the demographic profile of respondents such as gender, age, race, level of education, semester, and faculties of the respondents. Second, the respondents were asked to evaluate the visual quality of each landscape planting photograph on a Likert scale with scores between 1 (strongly dislike) to 5 (strongly like) (Kaplan and Kaplan, 1989). The third question is about the planting composition attributes affecting the respondents' preference.

### 3.5 Respondents

The respondents for this photo-questionnaire survey are only students. The total number of respondents were 319 students. They were considered for each of the faculties in UPM selected into the evaluation. This purposive sampling is useful to ensure all of the students with different knowledge background on landscape design can accurately represent the entire population of students in UPM.

The survey questionnaire was equally distributed to almost 20 to 23 students from each of the 15 faculties of this campus with regard to this location.

### 3.6 Statistical Analysis

Then, the collected data was analysed by using the SPSS software version 23.0. Average scores of the visual quality score of each photograph and attributes of the planting composition were then calculated. Spearman's rho correlation analysis was used to analyze the significant relationship between landscape planting preference and factors or attributes that influence respondents' preferences.

## 4.0 RESULTS

### 4.1 Visual Quality Scores of Photographs and Attributes

The average participant scores of the visual quality of each photograph in the photo-questionnaire were calculated. Beforehand, the 51 number of photographs have been grouped using factor analysis in SPSS. There were seven groups divided with criteria explained in Table 1 provided together with the mean values for the landscape planting preferences. An examination of the table reveals that the characteristics of visual quality preferences were higher for B1 (balance with plant species diversity) that most liked and appreciated photographs with scores of 4.18. The B7 group of photographs were the least appreciated photograph, with a score of 3.26.

**Table 1: The criteria from landscape planting photographs**

| Code | Criteria | Number of photos | Mean score |
|---|---|---|---|
| B1 | Balance with plant species diversity | 6 | 4.18 |
| B2 | Street planting with coherence design | 7 | 3.94 |
| B3 | Complexity with coherence composition | 7 | 3.85 |
| B4 | Dense tree form with clean base | 7 | 3.73 |
| B5 | Planting with variety of forms | 8 | 3.61 |
| B6 | Planting with texture intensity | 8 | 3.45 |
| B7 | Different plants species arrangement | 8 | 3.26 |

(Source: Authors, 2020)

The results for planting composition attributes which represent the most influential factor in landscape planting preference is reflected in Table 2. The ranking of planting composition attributes mostly considered during selected photographs is A1 (Arrangement) with a score 4.34 while A3 (Texture) score is 3.71, which is the less considered factor while choosing the photographs.

**Table 2: The planting composition attributes ranking score**

| Code | Attributes/ Factors influence preferences | Mean score |
|---|---|---|
| A1 | Size | 4.02 |
| A2 | Colour | 4.15 |
| A3 | Texture | 3.71 |
| A4 | Shape | 4.10 |
| A5 | Density | 4.19 |
| A6 | Arrangement | 4.34 |
| A7 | Vividness | 4.01 |
| A8 | Naturalness | 4.18 |

(Source: Authors, 2020)

### 4.2 Relationship between the Visual Quality of Photographs and Attributes

Tables 3 shows the results of the Spearman's rho correlation analysis, which was performed to determine the relationship between the visual quality of photographs and planting composition attributes. Based on the results, it was determined that most of the attributes are significant but certain attributes are not significant for photographs grouped in B5, B6 and B7. B5 is a group of photographs reflecting planting design with a variety of forms. However, this

B5 group of photographs are not significant with attribute A4 (shape). B6 and B7 also are not correlated with A4 (shape) and A2 (colour). Moreover, B7 was identified as not correlated with A6 (arrangement).

**Table 3: The relationship between the visual quality of photographs and attributes**

| Spearman's rho | Correlation coefficient sig. (2-tailed) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
| A1 | . | | | | | | | | | | | | | | |
| A2 | .350** | | | | | | | | | | | | | | |
| | 0.00 | . | | | | | | | | | | | | | |
| A3 | .165** | .308** | | | | | | | | | | | | | |
| | 0.003 | 0.00 | . | | | | | | | | | | | | |
| A4 | .155** | .213** | .326** | | | | | | | | | | | | |
| | 0.005 | 0.00 | 0.00 | . | | | | | | | | | | | |
| A5 | .341** | .167** | .171** | .317** | | | | | | | | | | | |
| | 0.00 | 0.003 | 0.002 | 0.00 | . | | | | | | | | | | |
| A6 | .244** | .326** | .145** | .410** | .414** | | | | | | | | | | |
| | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | . | | | | | | | | | |
| A7 | 0.091 | .231** | 0.107 | .277** | .199** | .377** | | | | | | | | | |
| | 0.103 | 0.00 | 0.055 | 0.00 | 0.00 | 0.00 | . | | | | | | | | |
| A8 | .257** | .350** | .173** | .273** | .275** | .324** | .327** | | | | | | | | |
| | 0.00 | 0.00 | 0.002 | 0.00 | 0.00 | 0.00 | 0.00 | . | | | | | | | |
| B1 | .197** | .234** | .202** | .165** | .240** | .255** | .156** | .289** | | | | | | | |
| | 0.00 | 0.00 | 0.00 | 0.003 | 0.00 | 0.00 | 0.005 | 0.00 | . | | | | | | |
| B2 | .251** | .220** | .159** | .135* | .215** | .259** | .207** | .272** | .696** | | | | | | |
| | 0.00 | 0.00 | 0.005 | 0.016 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | . | | | | | |
| B3 | .210** | .235** | .176** | .146** | .224** | .217** | .237** | .287** | .693** | .735** | | | | | |
| | 0.00 | 0.00 | 0.002 | 0.009 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | . | | | | |
| B4 | .203** | .196** | .178** | .143* | .250** | .259** | .181** | .239** | .681** | .791** | .793** | | | | |
| | 0.00 | 0.00 | 0.001 | 0.011 | 0.00 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | . | | | |
| B5 | .179** | .184** | .178** | 0.106 | .182** | .175** | .232** | .242** | .683** | .812** | .813** | .835** | | | |
| | 0.001 | 0.001 | 0.001 | 0.059 | 0.001 | 0.002 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | . | | |
| B6 | .130* | 0.065 | .143* | 0.06 | .168** | .116* | .185** | .197** | .617** | .702** | .802** | .788** | .778** | | |
| | 0.02 | 0.248 | 0.011 | 0.288 | 0.003 | 0.039 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | . | |
| B7 | .114* | 0.044 | .189** | 0.073 | .136* | 0.094 | .153** | .151** | .581** | .671** | .703** | .728** | .795** | .764** | |
| | 0.041 | 0.438 | 0.001 | 0.191 | 0.015 | 0.094 | 0.006 | 0.007 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | . |

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

## 5.0 DISCUSSION

Factors that affect aesthetic preferences are the features of the landscape (Sevenant and Antrop, 2009). Thus, it was ensured that the characteristics of the planting displayed a distribution that was representative of the landscape planting on the campus. Among various planting composition attributes are plant arrangement, plant density and naturalness of plant were all related to visual quality in planting design. Besides that, plant species diversity is among the main elements of the visual quality of landscape areas, but if the arrangement, density and naturalness of the plants are not carefully composed, it will reduce the visual appearance of landscape quality. The significant contributions of vegetation elements to the visual quality of landscapes have been mentioned in numerous previous studies. Landscapes that maintain a proper balance of vegetation have very high appreciation ratios. In parallel with findings, it was previously stated that the vegetation structures of the landscapes with beautiful scenery include a large diversity of plants with good arrangement.

## 6.0 CONCLUSION

The results of this study can potentially be used for the planning, design and management of campus landscape. These findings should especially be taken into consideration in landscape campus projects that focus on increasing the visual quality of landscape areas. When designing green space areas on campus, further emphasis and attention should be accorded to the plant designs arrangement, density, naturalness and plant diversity. Further studies on landscape management, especially concerning planting, should be conducted with consideration of the above-mentioned data.

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