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Role of Landscape Elements in Enhancing Microclimate Comfort for Students: A Case Study of Jinnah Hall, University of Agriculture Faisalabad

Mirza Abdul Saboor[1*], Adnan Younis[1], Irfan Yaseen[2], Ahmed Faiz Akbar[1], Muzamil Ijaz[5], Faisal Rafiq[1], Abida Parveen[3] and Hafiz Muhammad Kashif[4]

[1]Institute of Horticulture Sciences, University of Agriculture, Faisalabad
[2]Senior Engineer- Landscape and Irrigation, Royal Garden, Abu Dhabi, Emirate
[3]Department Of Botany, University of Agriculture, Faisalabad
[4]Collage of Horticulture and Forestry Sciences, Huazhong Agricultural University, Wuhan, 430070, Hubei, China;
[5]Directorate of Floriculture Training and Research, Punjab, Lahore
Corresponding author: mirzasaboor1999@gmail.com

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ABSTRACT

This case study was conducted to investigate students' perception of the surrounding residential landscape at Jinnah Hall, University of Agriculture, Faisalabad. The study was conducted to evaluate students' perceptions of the effectiveness of landscape design on their academic and social lives; determine the association between students' preferences for particular plants and their ages; and showcase the role of campus landscape in students' physical and mental health. The research methodology combines qualitative and quantitative approaches, including surveys and interviews. A total of 200 students participated in this study by completing the questionnaire, and interviews were conducted to supplement the quantitative data. The collected data were analyzed using SPSS (Statistical Package for the Social Sciences) and the Chi-square test at the 5% significance level. The findings showed that a large portion of the students were within the age bracket of 20-21 years, with 46.3% belong to rural areas. The results showed that about 60% of respondents prefer flowering plants. In terms of color, most respondents preferred red and white flowers. The result of the Chi-square test showed that students' color preferences are independent of their ages. Regarding satisfaction, about half of the respondents were satisfied with the current hall landscaping. Similarly, 56% of the students are aware of the therapeutic Effect of horticulture on mental health. The provision of more footpaths, red flowers, and ornamental plants is hereby recommended.

***Keywords*:** Landscape element, Microclimate.

INTRODUCTION

The landscape encompasses outdoor spaces. Greenery and architectural design play a pivotal role in shaping the educational environment. The realization that the surroundings in which knowledge is produced can profoundly affect the cognitive, social, and emotional aspects of students and teachers has sparked growing interest in the role of landscapes within educational frameworks (Souter-Brown, 2014). The landscape of an educational institute contributes to the overall learning atmosphere. Beyond traditional considerations of aesthetics, the synthesis of research in this field reveals a dynamic interplay between environmental psychology, academic performance, social dynamics, health and well-being, creativity, sustainability, and cultural identity (Masterson et al., 2019). Studies (Crow et al., 2006; Swanwick, 2009; Ayeni et al., 2011; Aretano et al., 2013) have shown that a good landscape creates a conducive atmosphere that calms students' minds and increases concentration. In addition, it provides spaces for leisure, interaction with landscape components, and outdoor lessons and revisions.

Campus is a place for knowledge, a place where leaders are made and behavior is shaped; hence, it has a strong potential to promote sustainable practices. In this regard, a sustainable campus environment creates opportunities for higher education institutions to experiment, teach, practice, and demonstrate a model of sustainable community to the larger society (Alshuwaikhat and Abubakar, 2008). Well-designed educational institutes help improve university's

academic, activity, and service operations through their learning services and increase educational performance. Students spend a lot of time on the university campus with various activities that require constant attention. They gain significant benefits from campus landscapes, such as restoration opportunities, which help them engage in mental activity and scientific work (Hami and Abdi, 2021). Landscaping is known to relieve students' stress, anxiety, and mental fatigue (Li and William, 2016). Human mental capacity could be improved after connection with nature. Green Care is health-promoting, as green spaces can contribute to mental, physical, and social health. Studies on restorative environments have shown that green spaces are more likely to relieve stress than indoor spaces and urban areas, even though urban residents have better access to health care than rural residents. Further studies have shown that natural environments lead to reduced pulse and stress hormone levels, as well as improved mood (Douglas et al., 2017). Gardening is reported to be meaningful and restful. It has been shown that even a view of nature can improve postoperative convalescence. Students' perceptions of the university landscape are particularly valuable, as they are the primary stakeholders in the university. Their opinions and contributions not only support the physical development of the university but also stimulate conceptual, social, and intellectual growth for effective learning. Keeping in mind the significance of landscape in enhancing learning and its impact on students' cognitive development and overall academic performance; this study is designed to;

1. Evaluate a student's perception of the effectiveness of landscape design on students' academic and social life.
2. determine the association between students' preference for a particular plant and their ages; understand the role of campus landscape in students' lifestyles to promote their physical and mental health.

MATERIAL and METHODS

Study Area

The University of Agriculture (UAF) is a public research university in Faisalabad, Pakistan. It is the largest university in Pakistan by area, covering 2,550 acres. It is ranked as a top university of Pakistan for Agriculture/Veterinary and is ranked among the top ten Pakistani universities in the general category. The university was established in 1906 as the first major institution of higher agricultural education in the undivided Punjab. Currently, the university has seven faculties, more than 30 departments and about 5 institutes. The University of Agriculture Faisalabad is a major centre for research; as of 2017, it was the largest agricultural research university in Pakistan.

The study was conducted at Jinnah Hall, University of Agriculture, Faisalabad (Fig 1). This selection was made possessively because the hostel was newly established and has a large capacity, accommodating a total of 1800 students, divided into Block A and Block B, each with a capacity of 900 students (Fig 2).

Sampling Procedure/ Method of Data Collection

The study used Yemane's formula to select 200 respondents, 100 students from each block. 7% error margin was used. According to the formula, 186 respondents are sufficient; however, 200 were used. The respondents were selected randomly since they are assumed to be homogeneous.

$$n = \frac{N}{1 + N(e)^2}$$

n= sample size
N=population of the study 343
1=constant
e=error

$$n = \frac{1800}{1+1800(0.07)^2} = 186 \text{ respondents}$$

The data were collected through interviews and questionnaires. A semi-structured questionnaire was developed and administered to the respondents. The data were collected between 1st and 23 rd March 2022. The questionnaire includes information on respondents' demographic characteristics, Perceptions of the importance of landscape, Perceptions based on Student choices (Elements in the surrounding landscape and their plant choices), and the benefits they acquired from different treatments.

Qualitative data

In addition to the 200 samples for quantitative analysis, another sample was randomly selected for qualitative data collection. The aim was to validate the quantitative findings and aid the generalization of the study's findings. Five students from each block A and B, for a total of 10, were used for the qualitative analysis.

Reliability of the research instrument

Before collecting the actual data, the instrument (questionnaire) was pre-tested with 26 respondents to identify any necessary corrections to the final research instrument items. To further validate the reliability of the measurement, an instrument reliability test was conducted using the Statistical Package for the Social Sciences on a computer (Taber, 2018), yielding a Cronbach's alpha of 0.73.

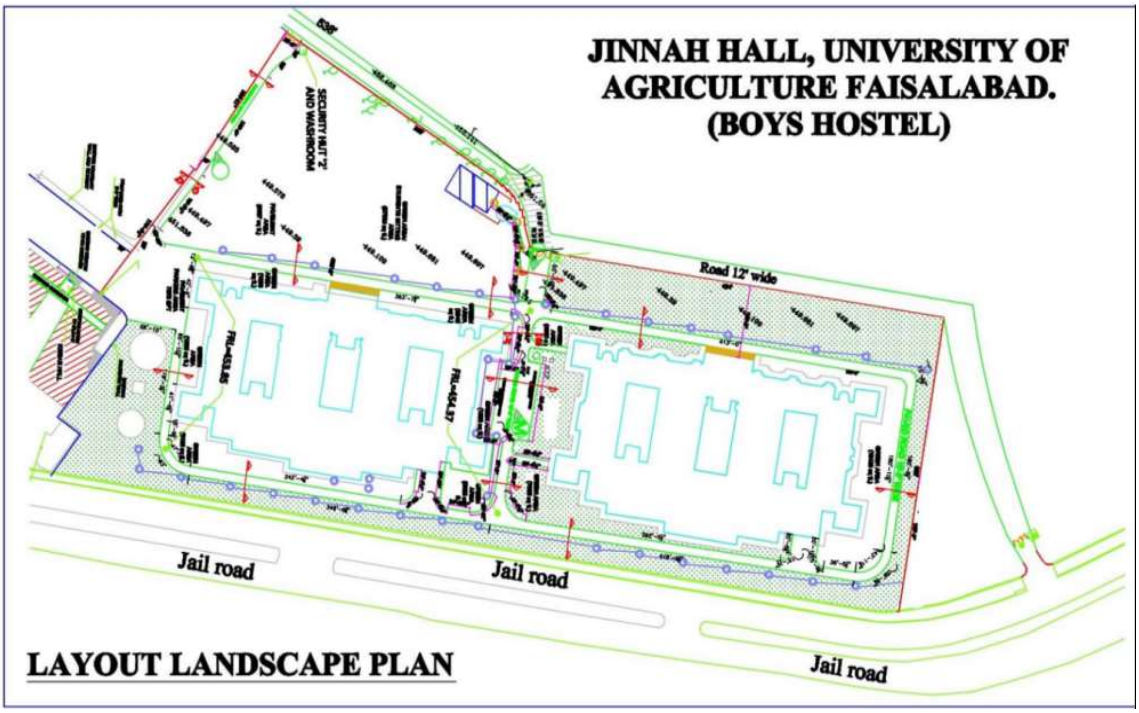

Fig 1: Map of the study Area

Design of the study area using AutoCAD

Plate 1:Front view on Real-time **Plate 2: Back side view**

Fig 2: Design of the study area using AutoCAD.

Data analysis

The collected data were coded, decoded, and statistically arranged for analysis. Data after tabulation were analyzed using SPSS (Statistical Package for the Social Sciences; data analysis tool). Descriptive statistics and the Chi-square test were used for the analysis. The Chi-square test was used for nonparametric populations and nominal variables. The data was analyzed at 5% significance level (Steel et al., 1997). For the quantitative responses, the respondents' views were reported in their original form.

The Chi-square formula is calculated as $\chi^2 = \sum\left(\frac{O-E}{E}\right)^2$

Where: χ^2 = chi-square,
O= Observed Frequency
E= Expected Frequency

RESULT AND DISCUSSIONS

Demographic Characteristics of the Respondents

The participants in this study had different ages and backgrounds. From the analysis, respondents aged 16–18 are 26, representing 13%; those aged 19–21 are 97, representing 48.5%; and those aged 21-23 are 65, representing 32.5%. Lastly, those aged 24 and above are only 12, representing 6% of the participants. The majority of participants were between 19 and 21 years old (Table 1). This question examines how respondents' long-term residential backgrounds influence their perceptions. The results in Table 1 further showed that a notable 37% of respondents have primarily resided in urban areas, in contrast, only 6.0% are from suburban areas. Moreover, 11% have predominantly lived in peri-urban areas, offering insights from environments that blend urban and rural characteristics. The largest cohort, comprising 46 % of respondents, originates from rural areas.

Respondents from urban areas are likely to prioritize modern, well-maintained landscapes featuring amenities aligned with their urban lifestyle expectations. These may include well-paved pathways, seating areas, and decorative plantings. Suburban respondents may value landscapes that strike a balance between urban conveniences and natural elements, seeking a harmonious landscape design. Those from peri-urban backgrounds, familiar with both urban and rural settings, may prefer versatile landscapes that combine aesthetic appeal with practical spaces for various activities. Respondents hailing from rural areas may have distinct preferences, favoring more naturalistic landscapes that resonate with their rural surroundings. They may appreciate green spaces that offer tranquility and a deep connection to nature (Ojobo et al., 2024).

Table 1: Demographic characteristics (n=200)

Participant	Frequency	Percentage
Age		
16-18	26	13.0
19-21	97	48.5
21-23	65	32.5
24 and Above	12	06.0
Students residency		
Urban Areas	74	37.0
Sub-Urban	12	6.0
Peri-Urban	22	11.0
Rural	92	46.0

Source: Author's computation

Respondents' Preference for the Plant

This question examines the types of plants students prefer on campus, offering insights into their appreciation for different plant categories. Understanding these preferences can inform the selection of plants for landscaping in educational settings, enhancing the aesthetic and psychological benefits of green spaces.

Table 2: Respondents' Preference for the Plant

Plant Types	Frequency	Percentage	Cumulative Frequency
Flowering Plants	119	59.5	59.5
Fruit Plants	65	32.5	92
Cacti and Succulents	1	0.5	82.5
Indoor Plants	15	7.5	100
Total	200	100	

The result showed that more than half of the respondents (119) representing 59.5% preferred flowering plants. This indicates a strong attraction to plants that offer visual and sensory appeal through their blooms. 32.5% of students favored fruit plants, reflecting a significant interest in plants that provide edible benefits alongside their aesthetic value. Only 0.5% of respondents preferred cacti and succulents, suggesting limited interest in these low-maintenance, drought-resistant plants. 7.5% of students preferred indoor plants, indicating some appreciation for plants that can thrive indoors and enhance interior spaces. The strong preference for flowering plants underscores their visual appeal and the sensory benefits they offer through colorful, often fragrant blooms. This finding is similar to that of Moya et al., (2019), who reported that students prefer flowering plants due to their color attractiveness.

Color and Age Cross Tabulation

This question examines students' preferences for various flower colors. Understanding students' preferences for flower colors can significantly enhance landscape and garden planning in educational institutions. The result of the cross-tabulation between age and plant color preference shows that, out of the 59 respondents (29.5%) within the age bracket of 16-18, the majority (33) prefer red-colored plants. Similarly, students within the age bracket of 19 to 20 also show a strong preference for red plants. The overall result also showed that 44% of respondents (88) preferred

the red-colored plant to any other. This is closely followed by white at 28.5%; yellow and purple represent 14% and 13.5%, respectively. Students' liking of red and yellow flowers is probably due to the belief that Red is often associated with energy, passion, and excitement, making it a popular choice for visually engaging landscapes. And white flowers for calm areas, spaces intended for relaxation and quiet reflection; they can create a serene and elegant atmosphere. White flowers are often associated with tranquility, peace, and elegance.

Table 3: Cross Tabulation between Age and Plant Color Preference.

Color	16-18	19-20	21-23	24 and above	Total
Red	33	40	11	4	88
white	13	26	12	6	57
yellow	7	10	5	6	28
purple	6	15	3	3	27
Total	59	91	31	19	200

Source: Authors's computation

Chi-square test of Association between Age and plant color Preference

To test whether color preference is associated with respondents' age, a Chi-square test was conducted. Based on the hypothesis that color preference depends on the age of the student. The result shows a Pearson Chi-square value of 13.373 with 9 degrees of freedom. This value is lower than the tabulated value 14.68 at 5% significance level. Hence, the null hypothesis is rejected. This result can be interpreted to mean that students' color preferences are independent of their ages.

Table 4: Chi-square test of Association between Age and plant color Preference

	Value	DF	Asymptotic Significance (2-sided)
Pearson Chi-Square	13.327[a]	9	.148[NS]
Likelihood Ratio	12.696	9	.177
Linear-by-Linear Association	4.932	1	.026
N of Valid Cases	200		

Source: Author's computation

Preference for the 'landscape patterns' of the Hall

This question examines students' preferences for various types of gardens on campus, shedding light on their appreciation for different garden styles and how these preferences might inform landscape planning and development in educational settings. The results in Table 4 showed that nearly half of the students (49.5%) expressed a preference for fruit gardens. This suggests a strong inclination towards gardens that provide edible produce and possibly an interest in sustainable and productive landscapes. A close 47% favored ornamental gardens, indicating a strong appreciation for aesthetically pleasing spaces that enhance the campus's visual appeal. Only 4.0% preferred vegetable gardens, showing a comparatively lower interest in gardens focused on growing vegetables (Table 4).

The preference for fruit gardens by nearly half of the students underscores a significant interest in gardens that provide edible produce. This could reflect a broader trend towards sustainability and self-sufficiency. Community gardens, especially those that produce food, contribute positively to community well-being and sustainability, suggesting that fruit gardens on campus might offer similar benefits (Turner et al., 2022). The high preference for ornamental gardens indicates that students place significant value on visually appealing green spaces that contribute to the beauty of the campus. Kaplan and Kaplan (1989) in "The Experience of Nature: A Psychological Perspective" emphasized the importance of visually pleasing natural environments in enhancing satisfaction and well-being. The relatively low preference for vegetable gardens suggests that while functional, these gardens might not be as attractive to the general student population. Vegetable gardens in urban settings often require higher levels of community engagement and interest, which might be less prevalent on a campus than in other garden types.

Table 4: Distribution of Respondents based on the Preference for the 'landscape patterns' of the Hall

Garden type	Frequency	Percentage	Cumulative Freq
Fruit Garden	99	49.5	49.5
Ornamental Garden	94	47	96.5
Vegetable Garden	7	3.5	100
Total	200	100.0	

Students Satisfaction about hostel landscape

This question examines students' perceptions of their satisfaction with the landscape around their hostels. The result in Table 5 showed that 19.4% of the respondents reported a low level of satisfaction, and 30.8% were moderately satisfied. However, 33.8% of the respondents expressed satisfaction, while 15.9% reported being highly satisfied. This indicates that about 50.2% of the respondents feel that the current landscape does not meet their expectations or needs. This suggests that a substantial portion of students find the landscape somewhat acceptable but believe there is room for improvement. Enhancing green spaces, adding aesthetic features, or improving the

maintenance of existing landscapes could address these students' concerns and boost their satisfaction (Speake et al., 2013).

Table 5: Students' Level of Satisfaction with the current hostel landscaping exercise

Satisfaction level	Frequency	Percentage
Not satisfied	39	19.4
Moderately satisfied	62	30.8
Satisfied	68	33.8
Highly satisfied	32	15.9
Total	200	100

Source: Authors computation

Perception of students about the therapeutic Effect of Horticulture to improve mental health.

Horticulture therapy involves engaging individuals in gardening and plant-based activities to improve their Wellbeing. Analyzing students' engagement in HT can provide insights into its acceptance, benefits, and potential areas for development in educational and therapeutic settings. The results in Table 6 showed that slightly more than half of the students (56 %) have engaged in horticulture therapy. 44% of students have not practiced horticulture therapy. This result indicated that about half of the students do not practice horticultural therapy. However, qualitative data were gathered to understand the reason for not engaging in horticultural therapy. The findings from the qualitative data showed that:

I am not aware of any therapeutic effect of horticulture. Another respondent exclaimed, "Are you sure horticulture has any impact on mental health?" Another respondent also claimed that he is not aware of the usefulness of horticulture towards improving mental health. From this Analysis, we can understand that it is essential to raise students' awareness of the significance of horticulture in enhancing mental health.

Table 6: Perception of students about therapeutic Effect of Horticulture to improve mental health

Responses	Frequency	Percentage
Yes	112	56.0
No	88	44.0
Total	201	100.0

Source: Author's computation

Views of Jinnah Hall After Landscaping

Fig 3: Canteen and Parking of Jinnah Hall After Landscape.

Fig 4: Front and view of A-Block Jinnah Hall After Landscape.

Qualitative Responses

Question: Are there any outdoor amenities or facilities you would like to see added to the hostel's landscape?

General response

The respondents' opinions showed that the students interviewed expressed interest in ornamental plants. One student responded that "You see ornamental plant are critical in beautifying the campus." I also want the management to intensify the planting of Fruit plants, and flowering plants are also very important. They relieved tension and depression. Another respondent says, "I personally like ornamental plants, and I can assure you this is the opinion of vast majority of us." For me, the water features I preferred were the most. I like them because of their r calming effects and ability to enhance the natural ambiance of an environment. The university management should give more emphasis to the additional walking paths. They are inadequate; there are multiple places that do not have them, and you know, when it rains, moving on sand is not comfortable, and our shoes normally get dirty and uncomfortable. The preference for footpaths underscores the importance of designing pedestrian-friendly environments that facilitate easy, safe movement. This could include wide, well-maintained pathways, clearly marked routes, and integration with green spaces.

Conclusion

Green spaces have great value in creating a positive community atmosphere. Several benefits were derived from green spaces, including environmental amelioration, neighborhood satisfaction, economic impacts such as improved residential property values and increased recreational value, and physical and mental health. The research study aimed to investigate students' perceptions of outdoor learning spaces in a sustainable academic environment. The study further examines the adequacy and provision of physical infrastructure in on-campus outdoor spaces for sustainability. The study was conducted at Jinnah Hall, University of Agriculture, Faisalabad. A total of 200 respondents were interviewed for research purposes. Stratification of the respondents was done based on age. The findings showed that a large portion of the students were in the 20-21-year age bracket, with 46.3% belonging to rural areas. The results showed that about 60% of respondents prefer flowering plants. In terms of color,, most respondents preferred red and white flowers. The Chi-square test showed that students' color preferences are independent of age. Regarding satisfaction, about half of the respondents were satisfied with the current hall landscaping. Similarly, 56% of the students are aware of the therapeutic Effect of horticulture on mental health. At the end, it can be concluded that respondents reveal a strong positive perception among students of outdoor green spaces on campus, highlighting their significant role in enhancing physical and mental well-being. Most respondents actively engage with these green spaces and express general satisfaction with their condition. In conclusion, the findings advocate for continued investment in and attention to campus green spaces to foster a more supportive and health-promoting environment for students.

Future research direction

This study is restricted to a single hall (Jannah Hall) at the university. Future studies should focus on the entire university environment. And it should also consider a female hostel. This will allow generalization and comparison of the results. Similarly, it is important for future studies to extend the study to the foreign students' hostel to examine the impact of diversity on students' attitudes towards landscaping in the university.

Declarations

Funding

This study didn't receive funding from any public, commercial, or non-profit agencies.

Conflicts of Interest

Authors have no conflicts of interest.

Data Availability

Data will be available from the corresponding author upon request.

Ethics Statement

This work involved human data. The work was approved by the University of Agriculture, Faisalabad, Pakistan.

Authors' Contribution

Mirza Abdul Saboor; Data Curation, Methodology, Wiring Original draft, Adnan Younis: Conceptualization, Supervision, Editing, Irfan Yaseen: Formal Data Analysis, Ahmed Faiz Akbar; Writing, Review and Editing, Muzamil Ijaz: Data Analysis and Data Collection, writing, Faisal Rafi: Writing, Review and Editing, Faisal Rafiq: Writing, Review and Editing, Abida Parveen: Writing, Review and Editing, Hafiz Muhammad Kashif: Writing, Review and Editing

Generative AI Statements

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