...::KENT AKADEMİSİ | URBAN ACADEMY

Volume: 17 Issue: 1 - 2024 | Cilt: 17 Sayı 1 - 2024

ARTICLE INFO | MAKALE KÜNYESİ
Research Article | Araştırma Makalesi
Submission Date | Gönderilme Tarihi: 27.09.2023
Admission Date | Kabul Tarihi: 14.01.2024

CITATION INFO | ATIF KÜNYESİ
Dogmusoz, B.B., Vardi Topal, H. (2024). Visual Preferences of College Students for an Ecological Design Project in a Campus Environment. Kent Akademisi Dergisi, 17(1):88-108, https://doi.org/10.35674/kent.1366742

Visual Preferences of College Students for an Ecological Design Project in a Campus Environment

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Öz

Son yıllarda, ekolojik tasarımın kentsel peyzajlara entegrasyonu, çevresel zorlukları ele alma ve yaşam kalitesini artırma potansiyeli nedeniyle araştırmacıların, uygulayıcıların ve yöneticilerin büyük ilgisini çekmiştir. Ekolojik tasarımı kentsel peyzajlara entegre etmenin çevre koruma ve farkındalık gibi pek çok faydası olsa da, estetik kritik ancak çoğu zaman gözden kaçırılan bir unsur olmaya devam ediyor. Bu makale, İzmir Katip Çelebi Üniversitesi'ndeki bir yağmur bahçesi projesi üzerinden üniversite öğrencilerinin ekolojik tasarıma yönelik görsel tercihlerini incelemektedir. Ekolojik tasarım, sürdürülebilir kentsel alanların yaratılmasında önemli rol oynayan yağmur bahçeleri gibi yeşil altyapı stratejilerini içerir. Bu çalışmada İzmir Katip Çelebi Üniversitesi öğrencileri arasında kampüste hayata geçirilecek yağmur bahçesi projesine yönelik anketler yaptık. Ankette her biri çeşitli görsel nitelikleri temsil eden altı adet yağmur bahçesi tasarım görseli sunulmuştur.. Ankette ayrıca estetik çekicilik, ekolojik önem, tercih edilen tasarım seçimi ve demografik bilgilerle ilgili sorular da yer almaktadır. Çalışma içerisinde 120 katılımcıdan veri toplanmıştır ve betimleyici istatistik yöntemi kullanılarak analiz yapılmıştır. Sonuç olarak çalışma bulguları renkli bitki seçimlerinin yer aldığı Resim 6(renk çeşitliliğinin olduğu tasarım)'nın en yüksek estetik puanı aldığını, gölgelik ağaçların yer aldığı Resim 4 (yüksek boylu ağaçların olduğu tasarım)'ün ise ekolojik açıdan en önemli tasarım olarak öne çıktığını ortaya koymaktadır.

Anahtar Kelimeler: ekolojik tasarım, Estetik, sürdürülebilir tasarım, yeşil altyapı, yağmur bahçesi

ABSTRACT

In the last few decades, the integration of ecological design in urban landscapes has gained significant attention from researchers, practitioners, and administrators because of its potential to address environmental challenges and enhance the quality of life. While there are many benefits of integrating ecological design in urban landscapes such as environmental conservation and awareness, its aesthetics have remained a critical, yet often overlooked, aspect. This paper examines the visual preferences of college students for ecological design through a rain garden project at Izmir Katip Celebi University. Ecological design includes green infrastructure strategies like rain gardens that play a major role in creating sustainable urban areas. In this study, we conducted surveys among students at Izmir Katip Celebi University regarding a rain garden project that would be implemented on campus. We provided six rain garden design images, each representing various visual attributes in the survey. The survey also included questions about aesthetic appeal, ecological significance, preferred design choice, and demographic information. We collected the data from 120 respondents and analyzed responses using descriptive statistics. The study findings presented that Image 6 (design with colorful plant selections) received the highest aesthetic rating, while Image 4 (design with canopy trees) stood out as the most ecologically significant design.

Keywords: ecological design, aesthetics, sustainable design, green infrastructure, rain garden

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INTRODUCTION

In the face of rapid urbanization and the evident challenges posed by climate change, ecological design in urban settings has emerged as a critical focus of the current environmental discourse. Ecological design, also known as sustainable design or green design, offers several benefits, including environmental conservation, climate change mitigation, biodiversity preservation, improved air and water quality, reduced infrastructure costs, environmental education, and awareness, and more. Several studies have been conducted to investigate the benefits of ecological design in the built environment (Gobster, 1999; Monzingo, 1997;). Acknowledging that ecological design has certain environmental, social, and economic benefits in urban settings, another critical aspect of ecological design involves considering visual preferences to enhance the human experience and promote a sense of well-being within these spaces.

The aesthetic value of ecological design practices has long been a prominent topic for environmentalists. In his seminal book "Design with Nature," published in 1969, Ian McHarg proposed a landscape suitability model that prioritizes ecological considerations, with aesthetics being the last to be applied. McHarg's model provoked ecological design discourse, emphasizing ecology and the value of aesthetics in design. Even though McHarg seemingly overshadowed aesthetics, Thayer (1976) argued for the necessity of recognizing the legitimacy of aesthetics in ecological design. As opposed to the conventional viewpoint that the ecological function of a landscape is a priority regardless of whether it is aesthetically pleasant or not, both Monzingo (1997) and Meyer (2008) suggest that aesthetically pleasing or eye-catching features in the landscape convey ecological messages more efficiently than landscapes that are dull and ordinary. This theory relies on the fact that landscapes intensely associated with ecological elements are not visually preferable.

Green infrastructure strategies, such as rain gardens, stormwater treatment areas, green roofs, etc., have been selected to address questions related to ecological aesthetics (Haruna et.al, 2018; Veinberma & Zigmunde, 2019) since they are visible to the public. According to Sheppard and Picard (2006), if the public supports an ecological design because of its beauty, then the implementation and maintenance of it are made easier. Additionally, it will increase the likelihood that an ecological design will be accepted and valued by the general public if aesthetic choices and ecological goals are taken into account while designing (Nasar, 1998). In this context, understanding how people perceive and experience them as beautiful and ecologically significant is important. People's aesthetic preferences and perceived ecological significance can be affected by different factors. The purpose of this paper is to present a comprehensive exploration of the intricate interplay between ecological design and visual preferences in the context of a rain garden project. This study will add to the body of literature by investigating whether the look of an ecological design impacts how the public perceives its ecological value and whether visual attributes influence their aesthetic preferences. This study can also inform city planners by suggesting how public aesthetic appreciation can be increased through the inclusion of aesthetically relevant attributes in an ecological design.

In this research, existing theories are used to create a framework in order to explore the visual preferences of students in an ecologically designed project in a campus area. Based on these theories, the study focuses on six different visual attributes: (1) low-dense vegetation, (2) high-dense vegetation, (3) the presence of fences, (4) the presence of canopy trees, (5) the use of structural materials, and (6) colorful plant selection. These attributes were discussed in the literature and will be discussed in detail in the next chapter.

Among the many ecological design projects that have been implemented in cities across the world, rain gardens have become one of the most prominent ecological design implications, allowing for stormwater management and contributing to the overall well-being of urban ecosystems. Therefore, this study involved a rain garden implementation project on the Izmir Katip Celebi University campus. Before implementing the rain garden, students were asked about their visual preferences for the proposed rain garden, using the six visual attributes based on the ecological design literature. The aim

of the study is to identify which visual features of an ecological design students find less/more aesthetic and less/more ecological significance. Additionally, by inquiring about their preference for implementing which design on the campus, the study aims to reveal how perceived aesthetic and ecological preferences influence the acceptance of the design.

1. Ecological Design and Landscape Aesthetics Preferences

Ecological design is a type of design that mimics nature to lessen negative environmental effects (Monzingo, 1997). Based on this, green infrastructure strategies can be defined as an important part of ecological design. The implementation of green infrastructure has gained importance in cities facing significant problems caused by urbanization. However, its implementation is not common. Some studies have discussed the factors affecting its implementation (Baptiste et. al., 2015; Turner et. al., 2015; Dogmusoz et al., 2020). These studies have revealed that public acceptance plays an important role in their installation. Many studies (Nasar, 1998; Gobster, 2007; Sheppard et al., 2004) have been conducted related to public preferences for ecological design, suggesting that if the public perceives a design as aesthetically appealing, then it will be easier to implement and maintain.

There is a large body of studies to understand the public's landscape aesthetics preferences. The concept of 'Landscape visual preference' can be defined as *''a person's level of liking or disliking for the visual appearance of a place*'' (Cheng, 2007, p:10). There are different assumptions in research related to landscape visual preferences. Lothian (1999) states that the aesthetics quality of an item may be discovered in its attributes. Aesthetics are thought of as a collection of physical qualities that might appeal to people in either a positive or negative way. In other words, some landscape qualities will be widely liked or disliked by everyone. A subjective description of aesthetics, however, is dependent on the particular observer.

While not frequently studied in ecological studies, aesthetics has been a constant subject in the field of landscape architecture. However, when ecological design was conveyed and put into practice on a societal level, the appreciation of aesthetics has become an important topic. Then, studies have focused on which visual attributes of an ecological design affected people's perceived beauty.

The most commonly cited elements that influence landscape attractiveness are natural factors (Palmer, 1978; Gobster and Westphal, 2004; Nassauer, 1992). The significance of natural features in an urban setting has been repeatedly shown by several urban planners. All of these hypothetical situations acknowledge that natural aspects reduce urban density and might be essential factors for the quality of life in urban areas. Vegetation and the visibility of water have been the most discussed natural factors in the literature (Arriaza et al., 2004; Nassuer, 1992). However, in the context of this study, only vegetation will be discussed since the study area is not suitable for the inclusion of water features.

The role of vegetated areas in landscape aesthetic studies is supported both in literature and in numerous experimental tests (Nassauer, 2004; Gobster & Westphal, 2004). Natural factors are described as quantitative data to determine their effects, such as the percentage of the vegetated area, the total number of species of vegetation, and other data such as the height of the vegetation (Arriaza et al., 2004; Palmer, 2004; Junker & Buchecker, 2008). Some authors (Howett, 1987; Lyle, 1991; Meyer, 2008) suggest that high-density vegetation, which provides a complex scene, may represent an ecological process that is more effective. Moreover, its complex scene might increase people's desire to investigate its hidden characteristics, making it more attractive (Kaplan and Kaplan, 1982). Some other studies, on the other hand, highlight that low-density vegetation adds favorable aesthetic perceptions to an ecological design (Burgess et al., 1988; Schroeder 1991). In addition to this, the height of the vegetation has also been discussed in the literature. According to Kimberly's study (2007), which was related to visual preferences of stormwater treatment areas, a high vegetated design was the least preferred. Conversely, a study by Junker and Buchecker (2008) found out that a high vegetated design was preferred compared to a mown lawn.

The fundamentals of aesthetics were also investigated through concepts such as color, texture, and scale. Studies have suggested that these concepts influence landscape preferences. Among them, color has been discussed as one of the most essential landscape factors in visual perception (Bell, 2004). Different colors might reveal various emotional responses in humans. Landscapes with different colors have received more attention in ecological design studies (Grose, 2012). Plants as the most important part of a landscape express aesthetic impressions through color, texture, and shape (Daniel, 2001). When individuals first view a landscape, color usually captures most of their attention. Plant color is a significant influencing factor in the assessment and estimation of landscape visual quality (Ahas et. al., 2005; Harris et.al.,2018).

Studies have indicated that perceived naturalness is associated with aesthetic preferences (Williams and Cary, 2002). Like vegetation, the usage of natural elements might contribute to the perception of beauty and ecological significance. In this study, stone was used as a natural element to investigate people's aesthetic preferences. Since stone is a natural material found in nature, its contribution to aesthetic preferences is worth investigating. Moreover, according to Gobster and Westphal (2004), using a human-made structure could also positively impact people's aesthetic perception. People's views of a landscape design might be positively impacted by the comfort, identification, and safety that a human structure offers (Buchecker et al., 2003). Fences are most frequently used due to safety concerns. This research will include the "fence" category in the survey.

Some studies have revealed that aesthetic preferences and the perception of ecological significance differ with demographic factors such as age, income level, culture, and social norms (Buchecker et al., 2003; Corner, 1997; Gobster & Westphal, 2004). Differences in perceptions might be attributed to cultural backgrounds, education levels, or environmental attitudes (Yang & Brown, 1992; Hodgson & Thayer, 1980). Since then, empirical studies are constantly needed to show how landscape aesthetic theories may be applied in different regions and social settings.

Aesthetic preferences are commonly recorded using research methods such as questionnaires or online surveys. Different images have been employed to represent different landscapes and ask respondents to pick their favorite ones or score these landscapes. One of the studies that employ questionnaires is Junker and Buchecker's (2006) study. By utilizing questionnaires, that study in Switzerland seeks to determine how individuals perceive the aesthetic appeal of restoration simulations. Several photographic simulations were included in the questionnaire. On a 7-point Likert scale, participants were asked to rate the images for aesthetic, perceived naturalness, and need satisfaction. It demonstrated that perceived naturalness has a significant impact on aesthetic preferences.

Similarly, Chen (2016) investigated the link between aesthetic preferences and urban landscape elements. A questionnaire-based survey was conducted in two cities: Cambridge, UK, and Nanjing, China. In total, 180 responses were collected. This survey is a questionnaire-based interview with photographs demonstrating. A five-point scale, ranging from 1 'Dislike' to 5 'Like', is applied to those questions concerning the evaluation of people's preference for different structures. In the current study, an online questionnaire was also used as a major method to investigate respondents' perceptions.

Overall, according to studies, there are different factors affecting people's aesthetic preferences and the perception of ecological value, such as the location of the research conducted. Studies conducted in different locations may yield different results. These variations suggest that further research is required to identify which factors related to vegetation affect people's perceived beauty and ecological significance on a local scale. Therefore, studies conducted in different locations around the world may further contribute to the ecological design and aesthetics debate.

2. Methodology

2.1. Study Area

Izmir is a rapidly expanding metropolitan area due to immigration. This rapid urbanization has caused several environmental challenges, including urban flooding and water pollution. The city government has recently made several attempts to address these issues. For example, green roofs are required by the government for buildings larger than 60 thousand square meters (Dogmusoz, 2023). Furthermore, Izmir is one of three leading cities in the EU-funded Urban GREENUP project, which aims to decrease the negative effects of climate change and improve air quality and water management (GCAP, 2020). Considering these circumstances at the scale of the city, Izmir emerges as an exceedingly suitable location for a comprehensive inquiry into the suitability of green infrastructure. Izmir Kâtip Çelebi University campus was selected as the pilot area of this study due to its size, location and ease of accessibility to the researchers.

Izmir Kâtip Çelebi University Çiğli Campus is in Çiğli district of Izmir. The Çiğli Campus of Izmir Katip Çelebi University covers 700,000 m² with buildings covering approximately 135,000 m² (IKCU Strategic Plan, 2020-2024). In addition to this, the campus is located in close to one of the city's largest industrial zones, the Ataturk Organized Industrial Zone, which possesses a potential for the release of industrial contaminants in the vicinity (Figure 1). The IKCU campus holds promise in reducing local urban flooding and water pollution issues when green infrastructure systems are designed and constructed in the campus area.

Figure 1. Izmir Katip Celebi University Cigli Campus (Image Source: Google Maps,2023) https://www.google.com/maps/@38.5103483,27.0411366,15z/data=!5m1!1e4?entry=ttu

After conducting site surveys across various locations of the IKCU campus, an inner area adjacent to the Science and Engineering Building as the study site was identified as the study site (Figure 2). The selection of this area was based on three significant factors. Firstly, the soil composition and slope of the area were important physical factors that could potentially impact the successful implementation of a rain garden. A thorough soil analysis and slope survey of the study site confirmed its suitability for a rain garden. The soil analysis was done based on observational determination. If the soil is easily crumbled and soft, it indicates that the soil has good drainage capacity and is suitable for the construction of a rain garden. Moreover, the area to be used as a rain garden should have a maximum

slope of 12%. The slope of the area has been calculated and since it is less than 12%, it meets this requirement as well. Secondly, both the physical and visual accessibility of an area played pivotal roles in the selection of the study site. The chosen study site was carefully evaluated to ensure ease of access and visual integration with the adjacent building. Finally, microclimate conditions were another significant factor taken into account when selecting the study site for a rain garden. The area was photographed at different times of the day to assess its suitability for sunlight exposure. Some of the plants intended for the garden require direct sun, while others grow in semi-shaded conditions. Some plants can be easily affected by the prevailing wind on campus. The study site effectively incorporates these prerequisites at an optimum level by affording both sun and shade at different times of the day and protecting from the prevailing wind.

Figure 2. The study site for a rain garden application.

2.2. Sample

This study targeted students who use the building where the rain garden application will be implemented. The building is primarily used by students from the Faculty of Engineering and Architecture. There are 3439 students affiliated with this faculty in the 2022-2023 academic year. Power analysis was conducted to estimate the minimum sample size with a desired statistical power of 0.80, an effect size of 0.20, and alpha level of 0.05. The minimum sample size was determined to be 74. The survey link was sent to students via email, or those who wished to participate voluntarily in person via a QR code. In total, the survey had 149 responses. After eliminating incomplete responses, 120 surveys were suitable for analysis.

2.3. Survey

The "Qualtrics" survey program was employed to construct and disseminate the online survey. The Institutional Review Board of Izmir Katip Celebi University reviewed and approved the survey for research involving human participants. The initial page of the survey explicitly stated that hitting the "next" button signified authorization to take part in the survey for the study. Before moving on to the next page of questions in the survey, participants were not required to respond to any of the questions. The survey allowed participants to leave at any point without finishing all of the items, which resulted in their replies being marked as "partial".

Before organizing the survey questions, six sample pictures of a rain garden design were generated using Photoshop. These images were created based on six factors that were discussed in the literature: the presence of fences, the presence of canopy trees, high dense vegetation, medium dense vegetation, the use of structural material, and colorful plant selection. All images shared the same background.

The survey consisted of different parts. Part 1 contained questions to assess their perception of beauty and ecological significance: ‘How aesthetically appealing is this design?’ and ‘How ecologically significant is this design?’. Responses were measured by a 5-point Likert scale, where 1= not aesthetically pleasing/ ecologically significant at all to where 5=very aesthetically pleasing/ecologically

significant. In Part 2, respondents were asked to choose the design they would most prefer to see implemented on campus. After making their choice, respondents were asked to explain why they favored that particular design. A list of reasons was also provided, along with open-ended questions if participants wished to add their own reasons. Part 3 required respondents to choose the design they would least prefer to see implemented on campus. Following their selection, respondents were asked to clarify why they did not want that design to be implemented. A list of reasons was also provided for this selection and open-ended questions were added if they wanted to add another reason of their choice. The final part of the survey comprised demographic questions such as gender, education level, and level of income.

2.4. Analysis

Descriptive statistics were calculated to concisely describe the sample data. Through quantitative data, descriptive statistics provide a summary and a basic description of the sample data. Data are often reported in one of two ways when performing descriptive statistical analysis. In the current study, the properties of our data were summarized using mean values, standard deviations, and percentages. All statistical analyses were conducted using SPSS software.

3. Results

3.1. Demographics

Demographic characteristics were examined for 120 respondents, and the results are presented in Table 1. The study comprised a higher percentage of females (65%) than males (35%). Among the participants, master's degree (1.6%) and Ph.D. (1.6%) students represented the smallest proportions. Students in their junior year (58.2) contributed more to the study compared to other groups. The demographic data revealed that the majority of respondents (70%) had an income level lower than 5000 TL. Regarding age, 95% of participants fell into the youngest group, aged 18-29 years. Since the participants were university students, there was little variation in age and income levels among them. Furthermore, students were asked whether they had taken any classes related to environmental science. The results showed that 69.2% of participants had not taken any classes on this topic prior to the study.

Table 1. Demographic Characteristics of the Survey Respondents

		Count (n)	Percentage (n)
Gender	Male	42	35
	Female	78	65
Education level	Freshman year	2	10.8
	Sophomore year	13	10.7
	Junior year	30	24.6
	Senior year	71	58.2
	Master’s degree	2	1.6
	Ph.D.	2	1.6
Income level	< 5000 TL	84	70
	5001-10000 TL	19	15.8

	10001-15000 TL	5	4.2
	15001-20000 TL	4	3.3
	20001-25000 TL	3	2,5
	>25000 TL	4	4,2
Age	18-29	114	95
	30-39	4	3,3
	40-49	2	1,7
Ever taken a Class related to the Environment	Yes	37	30.8
	No	83	69.2

3.2. Descriptive statistics of images

The acceptance of ecological design depends on the perception and cognition of individuals, which can be investigated through studies related to aesthetics. Because of the prominent visibility of the rain garden within the context of this project, users' engagement and acceptance of the rain garden are significant. Several studies indicated that people are more receptive to an ecological design with a high aesthetic value and aesthetics play an important role in shaping the perceived ecological significance of a design (Baptiste, 2014; Bryne et al., 2015). While various factors contribute to aesthetic preferences, it was necessary to consider the contextual limitations inherent in the application of the rain garden within the context of this project (i.e., adjacent to a building in a campus environment). Natural elements such as vegetation, water, and stone are acknowledged in the literature as important factors elevating the aesthetic value of landscapes. In this project, however, adding water to the scene was not appropriate since the area was not physically suitable for water features. Consequently, the current study focused on evaluating vegetation and stone as natural elements. The selection of rain garden plants was done considering rain garden design considerations and local conditions and concluded with only a handful of certain types. Even though factors such as plant form and texture, recognized in the literature for increasing aesthetic appeal, were not taken into consideration in this study. Instead, plants were evaluated according to their density, size, and color. The presence of fences is barely discussed in landscape aesthetics studies but is discussed in ecological aesthetics (Zhang, 2013) and ecology studies (Hoole and Berkes, 2010; McInturff et al., 2020). Since the study area was suitable for the usage of fences, it was evaluated in the current study. As a result of a comprehensive examination of the literature and the condition of the project site, six variables were established to use in the images of the survey. While creating the images based on the six variables, a frame for the sample image was built. The background was the same in all images.

Image 1- low dense vegetation

Image 1 was created based on the criteria of low-density vegetation (Figure 3). Several studies related to the landscape aesthetics preferences have examined connections between plant density and preference from an ecological perspective (Yang et al., 2013; McMorran et al., 2008). Since density is generally examined under two topics, namely low density and high density, these topics were investigated separately in this study. According to numerous studies, low-density vegetation emphasizes the positive visual elements of ecological design whereas high-density vegetated ecological design might appear more complex for users (Burgess et al., 1988; Schroeder 1991). Table 2 displays the frequencies, mean scores, and standard deviations of the image, as rated on a five-point

Likert scale for the perceived aesthetics value and ecological importance. In this context, students did not find this design to be aesthetically pleasing (M=2.73, SD=1.26). However, respondents believed that this design was ecologically significant (M=3.46, SD=1.20).

Figure 3. Design of the "Image 1: low-dense vegetation"

Table 2. The Frequencies, Mean Scores and Standard Deviations of the "Image 1: low-dense vegetation"

	Count (n)	Percent (%)		Count(n)	Percent (%)
1- not aesthetically pleasing at all	25	20.8	**1- not ecologically significant at all**	8	6.7
2	27	22.5	**2**	18	15
3	37	30.8	**3**	35	29.2
4	17	14.2	**4**	29	24.2
5-very aesthetically pleasing	14	11.7	**5- very ecologically significant**	30	25
Total	120	100	**Total**	120	100
	Mean	**SD**		**Mean**	**SD**
	2.73	1.26		3.46	1.20

Image 2- presence of fences

Image 2 was created based on the presence of fence criteria (Figure 4). Several studies have revealed that fences are becoming an increasingly common design element in the constructed environment (Bandauko et al., 2021; Zuirainah et al., 2020). There are only a few studies (Zhang, 2013) related to

the relationship between the presence of fences and the aesthetics of a landscape, especially in ecological aesthetics studies. Since the use of fences could be practicable in the project area, this criterion was also included in the survey. Table 3 summarizes the frequencies, mean scores and standard deviations of the image as rated on a five-point Likert scale for the perceived aesthetic value and ecological importance. Based on the mean values calculated, this design was not found aesthetically pleasing by respondents (M=1.88, SD=1.14). However, students indicated that the rain garden had a high ecological value (M=3.14, SD= 1.28).

Figure 4. The Design of the "Image 2- presence of fences"

Table 3. The Frequencies, Mean Scores and Standard Deviations of the "Image 2- presence of fences"

	Frequency (n)	Percent (%)		Frequency(n)	Percent (%)
1- not aesthetically pleasing at all	61	50.8	**1- not ecologically significant at all**	15	12.7
2	30	25	**2**	20	16.9
3	18	14.8	**3**	40	33.9
4	4	3.3	**4**	20	16.1
5-very aesthetically pleasing	7	5.7	**5- very ecologically significant**	25	20.3
Total	120	100	**Total**	120	100
	Mean	**SD**		**Mean**	**SD**
	1.88	1.14		3.14	1.28

Image 3- the use of structural material

Image 3 was created based on the use of structural material criteria (Figure 5). Stones were used as a structural material because it reflects naturalness (Zhang, 2013). Previous studies indicated that landscapes that are perceived as natural are also seen as more aesthetically interesting by people (Williams and Cary, 2002). Table 4 represents the frequencies, mean scores and standard deviations of the design for its perceived aesthetic and ecological value ratings. The results indicated that participants had high mean scores for the image. This shows that participants found this design both aesthetic (M=3.10, SD=1.22) and thought it had high ecological value (M=3.41, SD=1.18).

Figure 5. The Design of "Image 3- the use of structural material"

Table 4. The Frequencies, Mean Scores and Standard Deviations of the "Image 3- the use of structural material"

	Frequency (n)	Percent (%)		Frequency(n)	Percent(%)
1- not aesthetically pleasing at all	15	12.9	**1- not ecologically significant at all**	7	6
2	18	15.5	**2**	19	16.4
3	41	35.3	**3**	37	31.9
4	27	20.7	**4**	29	22.4
5-very aesthetically pleasing	21	15.5	**5- very ecologically significant**	30	23.3
Total	120	100	**Total**	120	100
	Mean	**SD**		**Mean**	**SD**
	3.10	1.22		3.41	1.18

Image 4- presence of canopy trees

Image 4 was created based on the presence of canopy trees criteria (Figure 6). The size of plants has been discussed in landscape aesthetics studies (Austin, 2002; Ryan, 2011) and revealed that the usage

of various sizes of plants draws people's attention. Since the plants used in this project met a certain criterion, the aesthetic effect of plant size was measured by adding canopy trees. Table 5 represents the frequencies, mean scores and standard deviations of the design for its perceived aesthetic and ecological value ratings. This design also had high mean scores. The respondents gave the image higher ratings both for its aesthetic value (M=3.80, SD=1.23) and its ecological significance (M=3.97, SD=1.02).

Figure 6. The Design of the "Image 4- presence of canopy trees"

Table 5. The Frequencies, Mean Scores and Standard Deviations of the "Image 4- presence of canopy trees"

	Frequency (n)	Percent (%)		Frequency(n)	Percent (%)
1- not aesthetically pleasing at all	9	7.6	**1= not ecologically significant at all**	3	2.6
2	9	7.6	**2**	6	5.1
3	22	18.6	**3**	27	22.2
4	37	29.7	**4**	39	32.5
5-very aesthetically pleasing	45	36.4	**5=very ecologically significant**	45	37.6
Total	120	100	**Total**	120	100
	Mean	**SD**		**Mean**	**SD**
	3.80	1.23		3.97	1.02

Image 5- high dense vegetation

As was mentioned in Image 1, the density of vegetation was examined in two ways: high-dense and low-dense vegetation. Studies of Burgess et al. (1998) and Meyer (2008) revealed that both low and high dense vegetation can be perceived as aesthetically pleasing by people. Therefore, it was essential

to investigate both in this study. Image 5 was created based on the high dense vegetation criteria (Figure 7). Table 6 represents the frequencies, mean scores and standard deviations of the design for its perceived aesthetic and ecological value ratings. According to the results, although participants gave the image a high rating (M=3.40, SD= 1.22), they gave the image a lower rating (M=2.93, SD=1.18) for its aesthetic value than its ecological significance for its ecological value.

Figure 7. The Design of the "Image 5- high dense vegetation"

Table 6. The Frequencies, Mean Scores and Standard Deviations of the "Image 5- high dense vegetation"

	Frequency (n)	Percent (%)		Frequency(n)	Percent (%)
1- not aesthetically pleasing at all	17	13.9	**1= not ecologically significant at all**	7	6
2	28	23.0	**2**	18	15.4
3	35	28.7	**3**	43	35.9
4	26	21.3	**4**	22	17.9
5-very aesthetically pleasing	14	11.5	**5=very ecologically significant**	30	24.8
Total	120	100	**Total**	120	100
	Mean	**SD**		**Mean**	**SD**
	2.93	1.22		3.40	1.18

Image 6- colorful plant selection

Image 6 was created based on the colorful plant selection criteria (Figure 8). Recent studies have shown that people's aesthetic preferences are more influenced by color diversity (Hoyle et al., 2018; Tomitaka et al., 2021). Since the literature indicates that having color diversity enhances aesthetics,

the study focused on this aspect, and a design without color diversity was not examined separately, as was done with density. Table 7 represents the frequencies, mean scores and standard deviations of the design for its perceived aesthetic and ecological value ratings. For Image 6, survey participants gave higher ratings both for its aesthetic (M=3.92, SD=1.22) and ecological value (M=3.78, SD=1.16).

Figure 8. The Design of the "Image 6- colorful plant selection"

Table 7. The Frequencies, Mean Scores and Standard Deviations of the "Image 6- colorful plant selection"

	Frequency (n)	Percent (%)		Frequency(n)	Percent (%)
1- not aesthetically pleasing at all	10	13.9	**1= not ecologically significant at all**	4	3.4
2	4	23.0	**2**	14	11.9
3	22	28.7	**3**	29	24.6
4	32	21.3	**4**	28	23.7
5-very aesthetically pleasing	52	11.5	**5=very ecologically significant**	43	36.4
Total	120	100	**Total**	120	100
	Mean	**SD**		**Mean**	**SD**
	3.92	1.22		3.78	1.16

Overall, when comparing the mean values of images, Image 6 (colorful plant selection) received the highest ranking in terms of perceived beauty. Furthermore, participants rated Image 4 (the presence of canopy trees) the highest rating in terms of ecological significance. Image 2 (the presence of the fence) was found to be both the least aesthetically pleasing and the least ecologically important compared to others.

Which one should be implemented/not implemented on campus?

Participants were asked to rate their preferences for the implementation of a rain garden on campus (Figure 9). Table 8 presents that 59.2% of them prefer Image 4 to be implemented in campus environments. Then, respondents were asked to explain their choice for this design. The chart illustrates the reasons behind the selection of Image 4. Accordingly, 38.3% of participants believed that this design had high ecological value, making it a preferred choice for implementation. Another 18.3% of students favored this design due to its plant selection (Figure 10).

Figure 9. Images of the designs that were presented to respondents to choose one to implement on the campus

Table 8. The Frequencies and Percentages of Each Image

	Frequency(n)	Percent (%)
Image 1	N	N
Image 2	2	1.7
Image 3	4	3.3
Image 4	71	59.2

Image 5	3	2.5
Image 6	40	33.3
Total	120	100

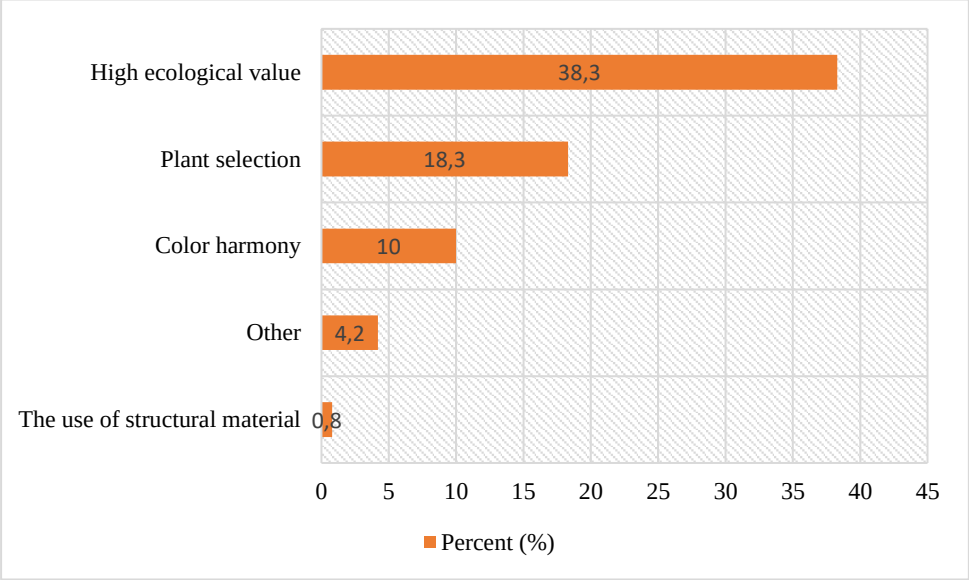

Figure 10. Reasons of the respondents for selecting Image 4 as the Most Wanted Design to Implement

Participants were also asked to rate the least favored design (Table 9). A significant majority, 78.3% of them, voted for Image 2 (presence of fence) as the least favored design for application on the campus. Participants cited aesthetics as their primary reason for their preference, rating it significantly lower than other options. A substantial portion of the respondents found this design to be aesthetically not pleasing (Figure 11).

Table 9. Frequencies and Percentages of Least Wanted Designs

	Frequency(n)	Percent (%)
Image 1	3	2.5
Image 2	94	78.3
Image 3	3	2.5
Image 4	7	5.7
Image 5	8	6.6
Image 6	5	4.1
Total	120	100

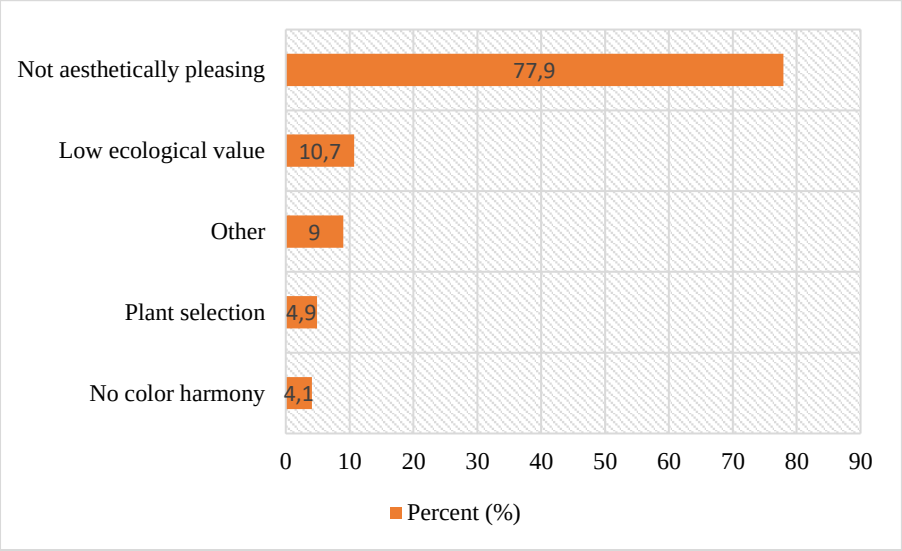

Figure 11. Reasons of the respondents for selecting Image 2 as Least Wanted Design to Implement

4. Discussion

The study findings indicate that Image 6, with its colorful plant selection, received the highest aesthetic rating. This result supports some studies (Ahas et. al.,2005; Bell, 2004; Harris et.al.,2018) which indicated that plant color was an important factor in landscape visual preferences studies. Image 4 stands out as the most ecologically significant design, featuring the presence of canopy trees. The participants' preferences in case of the implementation of a rain garden on campus align with these findings, with a majority favoring Image 4 (59.2%) and Image 6 which was the second most preferable design with a rating of 33.3%. The reasons for this choice illustrate that the majority of the study participants consider ecological significance and plant selection in the design of a rain garden. Image 2, which includes a fence, was the least preferred design, primarily due to aesthetic considerations. This result contradicts with Buchecker et. al., (2003) and Zhang's (2013) study. The difference might be because of (1) the usage of fences in different ways (2) the type of fences (high, low etc.) in the image, or (3) the color of the fences. For instance, the use of a decorative fence might be perceived as more aesthetically appealing compared to the use of a chain link fence (Zhang, 2013)

The reason for the selection of Image 4 and Image 6 aligns with prior research that underscores the importance of visual attractiveness in landscape perception (Nasar, 1998). The participants' higher ratings for the presence of canopy trees in Image 4 and vivid and colorful plant selection in Image 6 emphasizes the link between ecological significance and aesthetics. Both of these designs included the highest density of plants; the overwhelming majority of the participants considered them as their preferences for the implementation on campus. This result resonates with the literature on the perception of natural landscape, which assumes that incorporating natural elements, such as trees, into urban landscapes can enhance both the ecological value and aesthetic appeal of a space (Williams & Cary, 2002; Junker, 2007). It can be concluded that people would like to see a natural background in rain garden design, which can be provided with high trees.

The study's results also reflect a specific demographic group's preferences in rain garden design. For instance, the participants presented a strong preference for colorful plant selections (Image 6) and canopy trees (Image 4) while they preferred the designs with low dense vegetation (Image 1) and the presence of a fence (Image 2). This situation may represent a generational trend toward aesthetic design principles that emphasize vibrant greenery and natural aesthetics. When Image 1 and Image 2 are carefully examined, it could be seen that they present poor greenery or some sort of visual and physical obstacle to the proposed garden. Accordingly, these designs were probably considered ordinary or ecologically invaluable by the students. Parallel to this finding, both Monzingo (1997) and

Meyer (2008) emphasize that aesthetically pleasing landscapes are more powerful in conveying ecological messages than landscapes rather dull and ordinary.

However, it is crucial to acknowledge that demographic factors, such as age and cultural background, can influence the aesthetic preferences of people (Nasar, 1998). Since the study participants were relatively younger (between 20-30 years old), the sample may not necessarily represent the preferences of older generations or individuals from diverse cultural backgrounds, which may limit the generalizability of the findings. Future research of this study aims to consider other factors such as age, cultural background, and geographic location. Overall, the differences between these studies may be related to images used to introduce different ecological designs. The background of the picture, color, or other factors might affect participants' aesthetic evaluation.

In addition to this, the current study exclusively focused on the concepts of aesthetic and ecological preferences for a specific location and left out the reasons behind these preferences. Incorporating qualitative methods, such as interviews or focus groups, could provide a richer understanding of the motivations driving participants' choices, aligning with the subjectivist model of aesthetics (Lothian, 1999).

CONCLUSION:

The study's findings have practical implications for a rain garden project in Izmir Katip Celebi University. The majority of the participants considered Image 4 most applicable to the proposed study site because the design has more ecological value. Following Image 4, the second most desirable design was the Image 6 which was rated high scores both for aesthetic and ecological quality by the study participants. Therefore, the design of the proposed rain garden will include the design characteristics of Image 4 as well as the integration of colorful and visually appealing plant selections, as demonstrated in Image 6. These design choices can have broader implications for the acceptance and success of ecological projects on the scale of the IKC campus, as they align with the idea that people are more likely to support initiatives that they find visually pleasing (Sheppard et al., 2004). By integrating aesthetic preferences into ecological designs based on the preferences of the campus users, the rain garden project on the IKC campus may increase community support and engagement in other sustainability projects of the university.

Etik Standart ile Uyumluluk

Çıkar Çatışması: *Yazar / yazarlar, kendileri ve / veya diğer üçüncü kişi ve kurumlarla çıkar çatışmasının olmadığını veya varsa bu çıkar çatışmasının nasıl oluştuğuna ve çözüleceğine ilişkin beyanlar ile yazar katkısı beyan formları makale süreç dosyalarına ıslak imzalı olarak eklenmiştir.*

Etik Kurul İzni: *Bu çalışma için etik kurul iznine gerek vardır.*

Finansal Destek: *Bu proje İzmir Katip Çelebi Üniversitesi Bilimsel Araştırma Projeleri Koordinatorlüğü tarafından desteklenmiştir (Proje no: 2022-GAP-MÜMF-0025).*

Teşekkür: *İzmir Katip Çelebi Üniversitesi Bilimsel Araştırma Projeleri Koordinatorlüğü'ne projemize olan desteklerinden ötürü teşekkür ederiz (Proje no: 2022-GAP-MÜMF-0025).*

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