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Effects of Visual Environment on Students' Adjustment to Stress

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Abstract

The impact of stress on visual landscape perception was assessed in a photo-based survey. The survey was first performed when the student participants were expected to be stressed just prior to an important examination. The same students were asked to respond to the same questionnaire a month after the examination when they were expected to have a lower level of stress. Then respondents answered some daily activities, personal study habits, and feelings before an exam. They also provided ratings of how much a selection of environmental factors generally influence their ability to study and their academic success. In the main perceptual survey reactions to a selection of 22 landscape scenes photos were reported by ratings (1–5) of the extent to which each of six emotions was associated with each scene. Differences in emotions ratings for the represented landscapes during high-stress and low-stress periods were analyzed by multiple comparison and Pearson correlational methods using the SPSS 17.00 package. Stress tests confirmed higher stress in the first versus second survey and perceptual ratings showed significant statistical differences in emotion ratings between landscape scenes, as well as both main effects and interactions between high stress and low stress conditions. Scene ratings for each emotion were strongly positively correlated between high stress and lower stress conditions. At the same time, respondents generally gave slightly higher ratings for positive emotions -excited, relaxing, happiness-when in the high stress condition and moderately higher ratings for negative emotions -stressed, irritating, scary-, compared to their ratings when tested later under lower stress conditions. This study indicated that stress conditions affect perception, and stressed conditions gave higher emotionality overall than the unstressed condition. In general, in both stressed and unstressed conditions, the students gave the highest scores (>3.4) to convenience and the lowest score (<2) to scary. The main limitations of this study are the large number of environmental factors that influence people's perception. The strongest determiner of emotion ratings was the landscape scenes themselves. Inspection of outliers in the scatter plots and multiple comparisons articulating higher order interactions with stress conditions revealed clear differences in the patterns of emotions ratings, especially for scenes representing water surfaces, open green spaces, and seasonal plant scenes.

Keywords:
Stress, visual quality, environmental psychology, psychological restoration

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INTRODUCTION

The rapid growth of population in urban centers during the last decade has resulted in creating cities with a lot of concrete buildings and little greenery. Such developments negatively affect city dwellers. They feel psychological pressure during their daily lives. To overcome these difficulties and to relax a little, they visit recreational areas, shopping centers, and small parks existing in the cities (Ulrich 1999; Parsons and Daniel 2002; Grahn and Stigsdotter 2003; Velarde et al 2007; Hartig et al., 2014, WHO 2016; Byrne et al., 2016; Jahani et al., 2021).

Under current living conditions, especially the COVID-19 pandemic conditions, people spend most of their time building their environments. This might start creating psychological situations for them. People now live in isolated living spaces without much exposure to the natural environment. Research by Zube et al. (1975) indicated that natural landscapes reduced stress. Moreover, it is suggested that natural landscapes are superior to artificial landscaping. The existence of natural elements in the buildings improves the quality of the scenery (Real et al., 2000; Cerwén et al., 2016; Vert et al., 2020; Jahani et al., 2021; Ha et al., 2022). Also, the aesthetic environment positively affects a human to boost morale (Carlson 2010). Attempts have been made to define landscaping since the beginning of the 1990s. It is more than just what is seen or perceived. In other words, landscaping includes all areas that humans live in how they perceive scenery and their psychological make up at the time. The evaluation of participants in landscape visual quality assessment studies is a widely used and accepted method based on image presentation (Clay and Daniel, 2000; de Val et al., 2006; Özhanci et al. 2014; Devlin et al., 2014; Wang et al., 2021).

Since the European Landscaping Agreement views landscaping as "the key for individual and societal wellness". The World Health Organization (WHO) defines health as "not only the lack of diseases or injuries, but a complete status of physical, mental, and social wellness." The belief that natural factors reduce stress and help the sick can be found in the design of many great ancient cities in Iran, China, and Greece (Velarde et al., 2007).

The literature review conducted reveals that there is a great deal of scholarly research on visual quality. However, a limited number of studies investigate the relationship between visual quality perception and stress level. Finding whether stress affects people's perceptions of the visual environment will guide future landscape projects. Understanding where stressed people find themselves more comfortable will be helpful to landscape planners. As well known, stress affects the performance of students. Thus, removing factors that increase stress and planning educational environments to help with this will be very important in assisting the students in succeeding (Thompson 2011; Beil and Hanes 2013; Tyrväinen et al., 2014; Gidlow et al. 2016).

Stress is difficult to define, but almost everybody frequently faces this psychological condition (Gadzella, 1991; Devlin et al., 2014). Lazarus and

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Folkman (1984) argue that it is the body's physiology or psychological extreme response to stimuli caused by external or internal factors that the individual perceives as threatening or harmful. Thus, it is not the individual or a particular event that causes the stress. The interaction of the person with a specific event and how s/he interprets it is the case that causes stress (Ulrich et al., 1991; Folkman and Moskowitz 2004; Hartig and Staats 2006; Barton and Pretty 2010; Tyrväinen et al., 2014; Nasar and Bokharaei, 2017).

Perrine and Lisle (1995) suggest that the new living conditions of university students and the resulting adjustment problems as the source of stress. When investigating the sources of stress for university students, Şahin (1998) focused on their long-term worries, the daily pressures they face, and the sadness they suffer in personal life. Folkman and Lazarus (1980) provide two main ways of fighting stress. First, one can focus on problem-solving where s/he directly acts on the problem and collects the necessary information to eliminate the problem that causes the stress. Second, s/he can try to control or eliminate the negative feelings that cause stress. Billings and Moos (1981) proposed a three-factor conceptualization of coping with stress. These included active cognitive, active behavioral, and avoidance approaches in a dynamic cognitive system that may consider several alternatives and focus on the positive options. The active behavioral process tries to find more about the problem by talking to friends and resorting to other information sources while the avoidance approach wants to focus on other things such as sports, eating, and the like so that s/he does not have to think about the problem. Stress conditions may get affected by gender. The stress conditions and levels show a gender variation or not have been the subject of many academic studies. Although many studies have indicated that females face more stress than males on average, the results are not conclusive (Cohen et al. 1983). In one such study conducted with university students, perceived stress did not show a variation among genders (Pedrelli et al., 2008). However, other studies show that perceived stress was higher for females (Hogan et al. 2002; Gentry et al. 2007). Yet, in another reflection of the university students investigating the relationship between eating habits, perceived stress, and depression in Germany, Bulgaria, and Poland, the researchers concluded that the perceived stress was higher for the females (Mikolajczyk et al. 2008). In another study in Sweden, the effects of landscape gardening on stress were investigated by Adevi and Lieberg 2012. The conclusion was that gardening could ease anxiety and benefit mental health (Hawkins et al. 2011; 2013; Cerwén et al., 2016).

Although the quality of landscaping can be measured easily in many ways independent of humans, it is also a fact that human interaction and perceptions play a role in the assessment. These perceptions can be characterized and measured in some ways (Palmer and Hoffman, 2001). Evaluation of landscape quality has become an essential component of

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regional planning and management and hence continues to be active research (Daniel and Meitner, 2001).

Many researchers have investigated this topic from some angles, including studies in urban and rural settings, natural and artificial landscaping, and various landscaping elements and parameters. Many researchers, interested in assessing the visual quality of landscaping, have used photographs of different scenes to obtain respondent input (Dearden 1984; Habron 1998; Bergen et al. 1995; Clay and Daniel 2000; de Val et al. 2006; Howley 2011; Thompson 2011; Özhanci et al. 2014). How humans evaluate and why is an essential interest area in environmental psychology. Researchers have developed various analytical and interpretative models (Hartig and Staats 2006). Studies on healthy environments typically point to the role of natural elements in reducing or curing stress (Parsons et al. 1998; Hartig and Staats 2006; Hartig et al. 2014; Bringslimark et al. 2009; Nordh et al. 2011; Roe et al. 2013). Hartig et al. (2003) have compared natural and rural environments by obtaining psychophysical measurements through repetitive blood pressure measurements in assessing stress reduction. The researchers have observed that respondents sitting in a room with a view had faster blood pressure reduction than other respondents seated in a room without an argument. Similarly, walks in nature provided more stress reduction than walks in urban environments. Moreover, nature walks have resulted in long-lasting stress reduction and anger reduction. Hartig and Staats (2006) studied university student subjects in two different periods, morning hours when students were less tired and afternoon hours when the students were more tired. The students preferred to walk in a wooded area over walking in the city center in both periods. The preference of the more tired students showed a stronger inclination in choosing to walk in the woods. They believed that the wooded area had a stronger refreshing and healing characteristic.

In academic studies, different methods are used to understand and describe the concepts in visual perception. For example; In Brisbane, Australia, digital media and image-sharing platforms such as Instagram have been used to determine which elements in pictures the population associates with happiness in the urban environment by showing photographs (Pringle and Guaralda, 2018). In a study conducted by Yamashita (2002) in Japan, they asked adults and children to take pictures in an area with a river view. Then, they analyzed the water perception of adults and children according to the photographic images taken. The relationship between green spaces and stress in urban areas was analyzed by showing 24 photographs of trees, flowers, birds, and water surfaces (Wang et al., 2019).

The following questions guide this research: * What is the effect does stress and unstress have on visual quality? *Which is the relationship between environmental psychology and stress? *What is the effect of visual perception on emotions in case of stress and unstress. *Which

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landscape features are stronger in the coexistence of stress-unstress and emotion?

Landscape architectures have considerable responsibility in planning and creating environments that enable people to live comfortably and less stressed. This study aims to determine what types of landscapes relax people when they are stressed. This is very important for the improvement of urban design.

RESEARCH METHODS

The effect of stress on visual perception was tried to be determined with photographs. It was explicitly preferred to use photographs because the "human brain constitutes cognitive models for various conditions and events to be able to adapt to the environment and lead a life based on experiences. Photographs seen in the information guide books and postcards are attractive points for citizens and visitors of the cities" (Bostancı and Oral, 2017). The selection of photographs taken by the researcher was by Prof. Dr. Terry Daniel (Emeritus Professor of Psychology and Renewable Natural Resources, University of Arizona). Full color photos were used by the author as a proxy for real landscapes. All photographs were taken on different dates. Previously, we interviewed this expert by e-mail, and the things which we should do about the visual perception of this study were informed. Accordingly, we requested similar photographs with the same photographic frame in the designed research. Images of natural, artificial, and cultural areas affecting the landscape design were preferred. In addition, we preferred the use of natural, artificial areas, crowded, quiet regions, urban and rural landscapes only in the environmental perception of students under exam stress. Mountains, lakes, sea, and forests were preferred for natural areas. In the water surface photograph, a natural still water surface is preferred. Other photographs have been selected as belonging to cultural-artificial places. It aims to transfer the obtained results to the physical plan decisions and guide the landscape design. The 22 landscape photos used in this study and the visual quality questions were prepared using a representation and rating scale judgment method (Daniel and Meitner 2001; Özhanci et al. 2014; Jiang et al. 2014; Polat and Akay, 2015; Wang et al., 2021). Using two different photos for the similar landscape character was due to increased perception and recovery memory. The 22 landscape scenes (Figure 1) are briefly described below:

In order to determine the stress status of the students, a stress test was conducted first. The stress test was repeated before each questionnaire application. The stress-related questions were related to the 14-question stress questionnaire developed by Cohen and Williamson in 1988. This instrument was translated into Turkish by Professor Zuhal Baltas, and together with Ercument, Yerlikaya has used it for a survey in 2006 (Baltas-Baltas 1997). Data for the stress assessment were used to calculate stress indices for each respondent at

the time of the first session, just prior to taking an exam, and one month later when all exams had been completed.

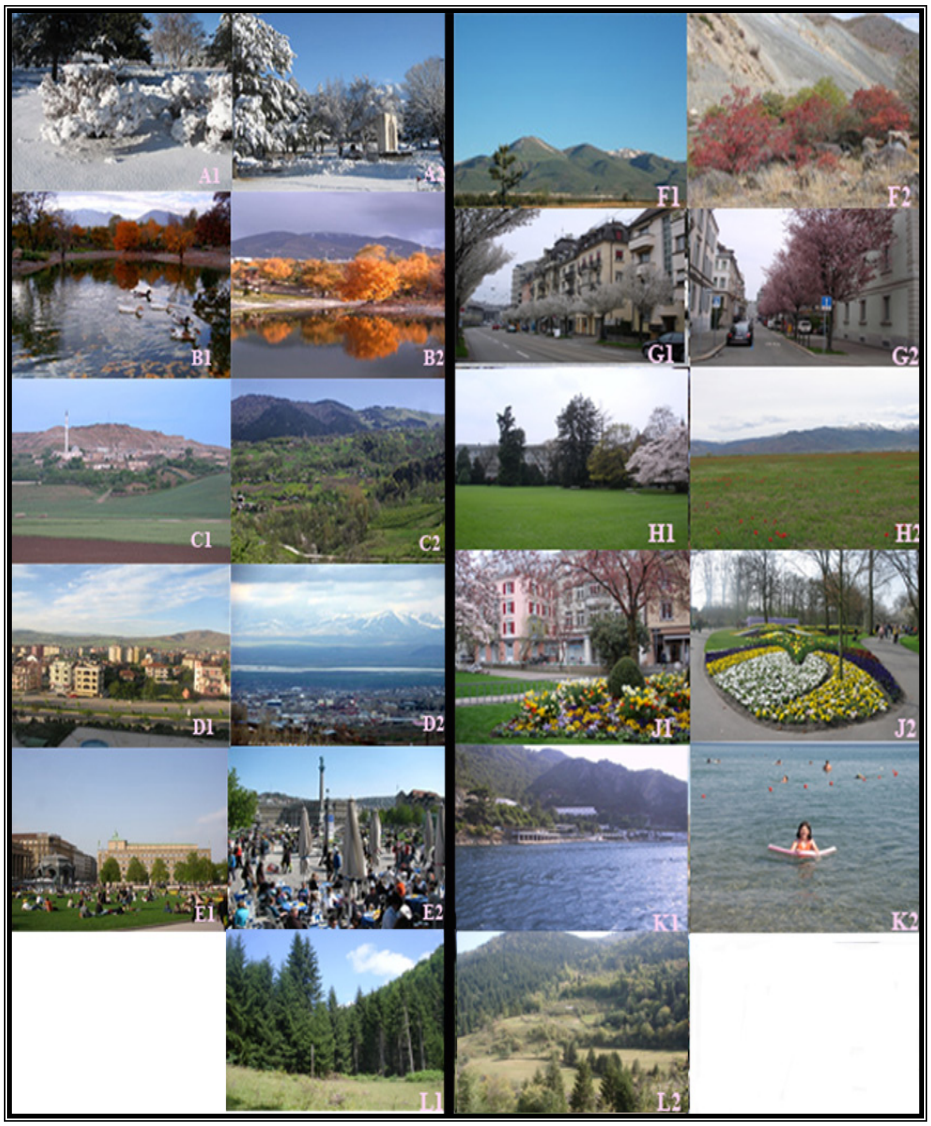

Figure 1. Photos used in visual quality assessment, paired by landscape type

I performed the study in two stages. In the first stage, we asked questions to measure the stress level. In the second stage, without allowing any time, the questions were asked about respondents' characteristics and visual quality perceptions and assessed by some short questions on the reasons affecting them. The respondent sample for this study consists of 34 voluntary Landscape Architecture senior students. As these students entered the classroom to take a difficult final exam, they were first administered a survey that lasted about 45 minutes. The students then went on to take the final exam. The second stage was carried out with the same 34 students. The same students who were preparing for the graduation event without the stress of the exam were collected. The students were seated in several row approximately two

meters in front of the screen. They were informed about the procedure and read through the instructions. I and our assistant chatted with them.

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Afterward, the questionnaire showing the same visuals was applied again.

Statistical analysis: Stress and unstress visual perceptions of 34 students were analyzed. The SPSS 17.00 statistical program was used for all data analyses. Perceptual ratings were analyzed using appropriate T-tests with subsequent multiple comparison procedures, Duncan's multiple comparison tests and Pearson Correlation Analysis. The Pearson analysis method can analyze linear correlation factors better. When studying the environmental factors of ammunition storage, Pearson correlation analysis can be used to find out the environmental factors which have significant linear correlation with ammunition reliability. In statistics, the Pearson correlation coefficient is used to measure the linear correlation between two variables. The closer the absolute value of the coefficient to 0 means that the linear correlation between the two variables is smaller, and the closer the absolute value of the coefficient to 1 means the higher the linear correlation between the two variables (Yang et al., 2021).

Different methods are used in visual quality analysis. Studies on visual perception with the internet include the opinions of many people. Researchers could do more surveys by traveling or with the internet. Also, colored printouts on paper can be shown to people (Polat and Akay, 2015; Bostancı and Oral, 2017; Wang et al., 2021). However, this method was chosen as it would be difficult to find a similar group as its reliability would be questionable. Comparing the answers of the same group will give more accurate results (Professor Terry C. Daniel).

Personal Characteristics of the Respondents

The sample consisted of Landscape Architecture senior students. All have been exposed to visual quality surveys of different objectives in the past. Thus, they have had no problems following instructions during this study. All participating students were in the 23-24 years age category. None had a physical handicap. Of the total respondents 34, 24 were females and 10 were males. The students in the sample relied on their families for financial support. Almost 50 percent of the respondents were satisfied with the allowance they received from the family, and more than 50 percent indicated that their families were financially sound.

Stress and Visual Perception Survey

Two survey instruments were used to determine the role of stress on visual perception. The first one was used to assess the stress level of the respondents. The questionnaire was initially prepared by Cohen (Cohen and Williamson 1988) and contained a 14-item scale with five Likert scale positions. This scale was translated into Turkish and was used for a survey by Baltas-Baltas (1997). After the questionnaire application, the students who experienced stress were interviewed again. It was stated that these students had problems in graduation.

The second questionnaire had three sections. The first section had 13 questions and focused on respondent demographics and other characteristics. The second section included six environmental factors that influence concentration on studies and other daily tasks. Finally, the last area focused on visual perceptions. It contained 22 photographs, two from each of 11 different types of locations, including sea, lake, urban, city center, winter, mountain and rural dwellings, city roads with trees, open green areas, seasonal flowers, and wooded areas. Photographs representing each type of location were selected with input from several knowledgeable people in this area. These 22 photographs were grouped based on landscape characteristics and projected randomly to the respondent sample as they participated in the survey. Respondents independently rated each scene on six dimensions (exciting, relaxing, happiness, stressful, irritating, and frightening) as each picture was presented using a 5-point scale (1-5). Color can be considered a determinant that affects the quality of the environment. For this reason, the color criterion was added to the study. It can have a high impact on visitors' emotions. Colors not only affect human activities but also affecting the description of a place status, psychologically (Babakhani2017). Different hues can elicit various feelings in people, and they are a significant component in the design of spaces. Therefore, in order to optimize the use of color and create responsive urban environments, it seems that it is important to know the features of the colors. Unconscious and careless use of color, as well as a lack of awareness of the effects of color on people, can result in spaces that are not responsive to people's needs, whereas the correct use of colors in urban spaces creates a sense of vivacity and calmness in citizens and improves their sense of place (Khalili, 2019).

The survey was completed first, just before a difficult final exam in June 2010. When the senior students from the department of landscape architecture entered the classroom to take the final exam, they were told to take a couple of surveys before the exam. Before starting the study, information about the surveys was given, and the procedure was described.

First, the “stress index” instrument was distributed to the students for their response. After collecting these forms, the second questionnaire was distributed immediately. Then, all 22 photographs representing the 11 landscape types were projected on the screen for preview. After that, the pictures were shown in a paired format (such as two lake scenes together, then two city scenes, etc.). The total time to complete the survey was 45 minutes. Three professionals organized the survey. One managed the projector, the second controlled the time (max 1 minute for each pair), and the third distributed the forms. One final question (which was not on the questionnaire) was asked for the group to respond. They were asked to note which landscape types among the 11 pairs made them feel relaxed/most liked and more stressed/least liked.

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The same procedure was followed to get responses from 34 students in the exact location about a month after the first survey. One difference, however, was that the students were not under the specific stress of an impending exam. Since the students were asked to write down their names in the survey instruments (the students were promised confidentiality), they could pair and compare their responses under the first (stress) test and second conditions.

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RESULTS AND DISCUSSION

Questionnaires with 34 students were analyzed. The effect of stress on visual perception was investigated. It is very important for planners and landscape designers since we understand that stress levels are effective on visual perception. The visual characteristics of landscape elements influence cognition and then affect cognitive preference. The analysis results of the surveys are given below.

Exam Stress, Daily Activities, and Environmental Factors

The majority of the students reported that they prefer to study one day before an exam (58.8 %), while only a tiny proportion reported studying continuously (17.6 %). When asked how they generally feel just before an examination (5-category scale extending from "always feel comfortable" to "always feel stressed"), 64.7% indicated that they sometimes or always feel stressed and worried (41.2% and 23.5%, respectively) while 23.5% reported that they sometimes or always felt comfortable (17.6% and 5.9%, respectively). Only 11.8% reported that they were unaffected by the anticipation of examinations.

The results from the second section of the questionnaire indicated that a typical student in the group watches at most one hour of television (29.4 %) and spends an hour on the Internet (29.4 %) in a day. S/he also studies for 1 hour (29.4 %) and reads a book for one hour (44.1 %) a day. Most of the students came from middle-income or higher-income families and

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reported being pretty happy with their allowances. These figures may indicate that the students are unstressed on a typical day. These observations are consistent with the higher stress scores for the students on the first test (prior to the exam) versus the second test (1 month later, with no impending exam).

The respondents were asked to rank the importance of out-of-school activities. The results indicated that the use of the Internet received the top ranking in their lives (2.82 mean rating), followed by studying (2.16), watching television (1.82), and reading books/magazines (1.33).

A large majority of the students (68 %) of the students indicated that their academic success is very much affected (38.2 %) or somewhat affected (29.4 %) by environmental factors. Only 2.9 percent indicated that they were not affected by the environment. They also indicated in response to the more general question that the physical attributes of their study area (noisy, small, cold, hot) affect their performance (71.7 %). Respondents reported that when they are studying, they are affected by the view that they are facing (29.4 % reported being affected "very much" and 52 % affected "somewhat" by their view. Only 2.9 % reported not being affected by the view when studying (Figure 2). 41.2 % indicated that they sometimes feel stressed and worried when we asked how they felt before the examination, while 5.9 % always felt comfortable (Table 1).

Perceptual Assessment

Relationships among the six emotion scales used to rate the 22 scenes just before a final exam (Stressed condition), and after all, exams had been concluded (Unstressed condition) were assessed using correlations (Table 2). Correlations among the scales were generally very high, with absolute values ranging from a low of 0.75 to a high of 0.97.

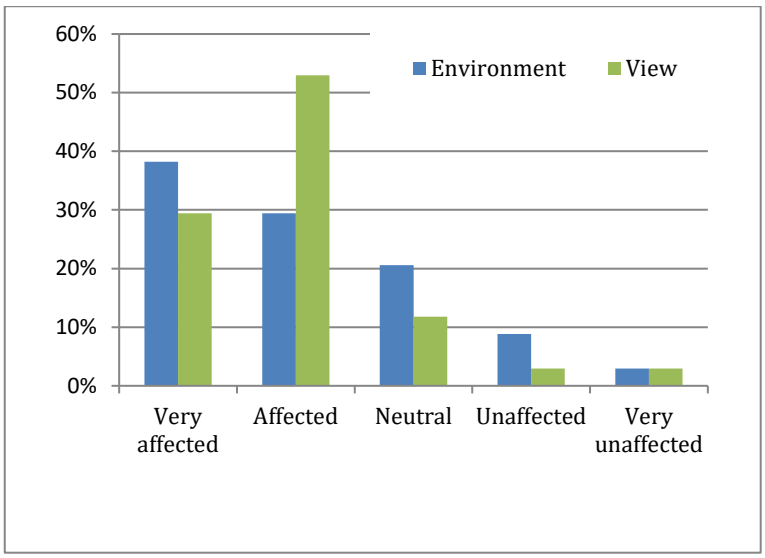

Figure 2. Reported effects of environment and views on student's academic performance

Of course, the correlations between positive (exciting, relaxing, happiness) and negative (stressed, irritating, frightening) scales are all

negative but still high in absolute terms. Most of the between-scale correlations are close to +/- 0.90, with the negative correlations consistently indicating the difference between negative and positive emotions.

Table 1. Psychological Status of the Students before Examinations

	Frequency	Percent
always feel comfortable	2	5.9
sometimes feel comfortable	6	17.6
not effect	4	11.8
sometimes stressed and worried	14	41.2
always stressed and worried	8	23.5
Total	34	100.0

Correlations between ratings under Stressed X Unstressed conditions for each emotion scale were also very high, as shown in Table 3.

Table 2. Inter-correlations among the six emotion scales as rated for the 22 scenes under Stressed (top panel) and Unstressed (bottom panel) conditions.

Stressed	***Exciting***	***Relaxing***	***Happiness***	***Stressful***	***Irritating***	***Frightening***
Exciting	0.89	0.76	0.86	-0.79	-0.88	-0.88
Relaxing		0.78	0.95	-0.79	-0.86	-0.82
Happiness			0.85	-0.85	-0.92	-0.74
Stressful				-0.90	-0.90	-0.85
Irritating					0.94	0.77
Frightening						0.85
Unstressed	Exciting	Relaxing	Happiness	Stressful	Irritating	Frightening
Exciting	0.85	0.77	0.83	-0.75	-0.83	-0.85
Relaxing		0.91	0.94	-0.81	-0.89	-0.76
Happiness			0.94	-0.93	-0.97	-0.81
Stressful				-0.87	-0.91	-0.85
Irritating					0.95	0.80
Frightening						0.85

Table 3. Correlations between Stressed and Unstressed conditions for each of the 6 emotion scales.

	Exciting	***Relaxing***	***Happiness***	***Stressful***	***Irritating***	***Frightening***
r (SxUns)	**0.91**	**0.93**	**0.96**	**0.91**	**0.96**	**0.92**

The pearson correlation analysis overall indicates that the ratings of the 22 scenes can primarily be distinguished between "positive" emotions and "negative" emotions. By far, the most significant determiner of emotion ratings was the scenes themselves. Some differences between Stressed and Unstressed conditions for specific scenes and emotion scales were observed by closely examining the relevant scatter plots. Appropriate T-tests also identified significant higher-order interaction effects, suggesting differences in stress conditions. The mean ratings for each scene (organized by the 11

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landscape scene types) are presented in Table 4 for both (Stressed) and (Unstressed) conditions.

Table 4. Emotion ratings for the 22 scenes representing 11 landscape types under Stressed (pre-exam, upper mean in each cell) and Unstressed (post-exams, lower mean) conditions.

Landscape scene Type		Pictures		Colorful	Exciting	Relaxing	*Happiness*	Stressful	Irritating	Frightening	Correlation Scene 1x2
Winter scene	A1		**Stressed**	2.15	2.45	2.26	2.44	3.09	3.15	2.56	
			Unstressed	2.21	2.70	2.58	2.45	2.88	3.12	2.59	
	A2		**Stressed**	2.27	2.36	2.36	2.79	2.82	3.12	2.50	.865
			Unstressed	2.41	2.85	2.88	2.67	2.62	2.85	2.41	.551
Lake Scene	B1		**Stressed**	3.88	3.85	3.79	4.09	1.88	1.66	1.88	
			Unstressed	3.59	3.38	4.26	3.79	1.67	1.48	1.50	
	B2		**Stressed**	4.18	3.88	4.65	4.27	1.85	1.58	1.65	.980
			Unstressed	3.85	3.85	4.41	3.97	1.48	1.32	1.33	.995
Rural/Village scene	C1		**Stressed**	1.59	1.75	1.67	1.67	3.24	3.71	3.29	
			Unstressed	1.29	1.44	1.33	1.30	3.82	4.35	3.29	
	C2		**Stressed**	3.12	2.94	3.53	3.18	2.52	2.30	2.28	-.925
			Unstressed	3.29	2.85	3.53	3.03	2.18	2.06	1.82	-.893
Urban scene	D1		**Stressed**	2.94	2.52	2.61	2.41	3.12	3.06	2.39	
			Unstressed	2.85	1.91	2.27	2.18	2.76	2.94	2.24	
	D2		**Stressed**	2.88	2.75	2.85	2.88	2.94	2.61	2.30	.352
			Unstressed	2.74	2.71	2.85	2.38	2.35	2.67	2.24	.082
City cent			**Stressed**	4.00	3.82	3.85	4.00	2.36	2.09	1.66	

	E1		**Unstressed**	4.01	3.68	3.91	3.59	2.18	1.91	1.45	
	E2		**Stressed**	3.48	3.16	2.73	2.97	3.03	2.97	2.06	.620
			Unstressed	3.15	2.79	2.42	2.79	3.33	3.12	2.09	.122
Mountain scene	**F1**		**Stressed**	2.88	2.6	4.50	2.85	2.34	2.28	2.61	
			Unstressed	2.41	2.91	3.62	2.88	2.00	1.97	2.00	
	F2		**Stressed**	3.21	2.66	2.39	2.36	2.61	2.79	2.85	-.395
			Unstressed	3.50	2.84	2.74	2.59	2.53	2.59	2.44	.177
Street with trees	**G1**		**Stressed**	2.91	2.91	3.18	2.85	2.74	2.47	2.06	
			Unstressed	2.91	2.82	3.24	3.00	2.70	2.44	2.09	
	G2		**Stressed**	3.59	3.09	3.39	3.12	2.24	2.26	2.06	.834
			Unstressed	3.76	3.38	3.65	3.29	2.42	2.21	1.79	.910
Large green areas	**H1**		**Stressed**	3.97	3.47	4.38	3.79	1.36	1.33	1.25	
			Unstressed	4.15	3.71	4.47	4.00	1.91	1.52	1.69	
	H2		**Stressed**	3.09	2.94	3.76	3.21	1.79	2.18	2.24	.955
			Unstressed	3.44	3.09	3.97	3.51	2.26	1.88	1.85	.955
Seasonal plants	**J1**		**Stressed**	4.65	3.85	3.89	3.88	1.58	1.63	1.22	
			Unstressed	4.62	3.88	3.94	4.06	1.94	1.66	1.34	
	J2		**Stressed**	4.53	4.06	4.00	3.88	3.30	1.81	1.34	.995
			Unstressed	4.65	3.76	4.03	3.65	1.61	1.47	1.28	.995
Sea [illegible]	**K1**		**Stressed**	4.06	4.50	4.62	4.47	1.56	1.56	1.50	

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			**Unstressed**	3.94	4.15	4.65	4.44	1.64	1.52	1.61	
	K2		**Stressed**	3.76	3.94	3.71	3.97	2.03	1.91	1.88	.991
			Unstressed	3.44	3.41	3.85	4.03	1.73	2.00	1.61	.984
Forest area	**L1**		**Stressed**	3.59	3.62	3.56	3.36	2.29	2.24	2.50	
			Unstressed	3.41	3.68	3.74	3.29	2.12	1.85	2.58	
	L2		**Stressed**	2.91	3.24	3.21	2.82	2.15	2.29	2.39	.957
			Unstressed	3.09	3.03	3.41	2.85	2.36	2.42	2.61	.937
Mean ($\overline{X}$)			**Stressed**	**3.35**	**3.19**	**3.40**	**3.23**	**2.32**	**2.30**	**2.11**	
Mean ($\overline{X}$)			**Unstressed**	**3.29**	**3.11**	**3.43**	**3.14**	**2.23**	**2.25**	**1.98**	
Landscape Type		**Scene**		**Colorful**	**Exciting**	**Relaxing**	***Happiness***	**Stressful**	**Irritating**	**Frightening**	**Correlation Scene 1x2**

The mean scores for each emotion scale aggregated over the 22 scenes, shown across the bottom of the table above for Stressed and Unstressed conditions, are depicted in the graph in Figure 3 below. The positive emotions, exciting, relaxing, and happiness, we have all given mean ratings more significant than 3.0 under both stress conditions and negative emotions. Stressful, Irritating and frightening all received mean ratings lower than 2.50 under both stress conditions. The substantial similarity in the pattern of ratings for Stressed and Unstressed conditions is evident in Figure 3.

T-tests and Duncan's multiple comparison tests were used to assess the effects of stress conditions on emotional ratings of the landscape scenes.

The results indicated that the students under stress rated higher positive emotion scales for photos that included water surfaces, open green urban areas, and seasonal flowering plants. However, the negative emotions were more dominant against the other photos. The statistical results indicated that stress significantly affected landscape ratings as the main effect (M Stressed = 3.24; M Unstressed = 3.82, $p<0.01$). Duncan's multiple comparison test also indicated that positive emotions had higher scores, but negative emotions had lower scores (Table 5, 6, and 7). These results are a bit complicated because the Stress condition, with few exceptions, gave higher ratings on all emotion scales, whether positive or

negative, suggesting that stressed conditions experienced higher emotionality overall compared to the unstressed condition. Two-way interactions indicated a significant relationship between stressed versus un-stressed conditions and scenes. Also, it is understood that there is an essential relation between scenes and emotional changes in both conditions. The quad interaction proved to be insignificant.

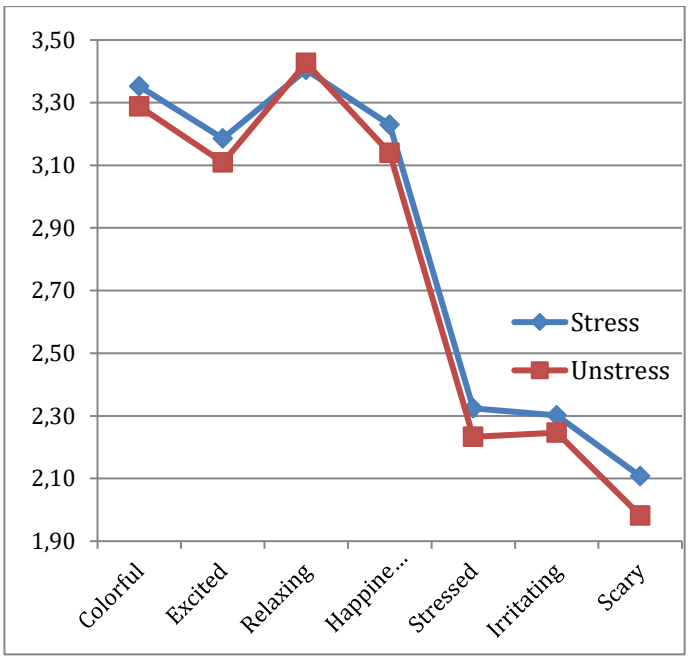

Figure 3. The mean scores were given to the photos under stressed and unstressed conditions

A Paired Samples Test was performed to determine the differences due to the students' stress level according to the different landscape scenes. Students' attitudes towards the same photograph were measured at two different times in which students were more and less stressed. Scenes displaying significant differences are listed in the table below. According to the analysis results concerning the scenes listed in table 4, students demonstrate different attitudes towards some emotions depending on their stress level. For example, the sense of relaxation depended on the stress level of repliers for the A2 photograph ($p < 0.05$); relaxation ratings were significantly lower when the responders were stressed (Table 5).

On the other hand, a sense of happiness, stress, and irritation depended on the stress level of repliers for the C1 photograph ($p < 0.05$). When the respondents are stressed, the sense of happiness is significantly decreased, and stressfulness and irritation are significantly increased. Also, students' sense of excitement displays significant differences at ($p<0,05$) for the K1 and K2 scenes. It was seen that when respondents were stressed, the sense of excitement significantly decreased. The mean differences, stressed minus unstressed, for each respondent per scene per emotion scale make up the numerator for the reported t values. The great majority of the comparisons are consistent with stressed conditions giving higher ratings than unstressed for almost

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all emotion scales, except for C1, which shows a pattern of the stressed condition giving lower ratings (3.42 for stressed and 3.82 for unstressed conditions). The magnitude of differences between stressed and unstressed conditions for other landscape scenes are evident in Table 5. In general, ratings for the negative emotion scales were substantially lower than for the positive emotion scales overall scenes tested. According to the results of the analyses, it can be said that when the students were stressed, their positive attitudes decreased while the negative ones increased.

Table 5. Significant differences in students' attitudes towards scenes: stressed minus unstressed.

Landscape Scene Type (LST)	t	df	Sign (2-tailed)	Mean Square	
				Unstress	Stress
A2 (LST)					
Relaxing	2.126	31	.042	2.8824	2.2941
C1 (LST)					
Happiness	2.431	32	0.021	1.6667	1.3030
Stressful	-2.458	33	0.019	3.2353	3.8235
Irritating	-2.427	33	0.021	3.7059	4.3529
D1 (LST)					
Exciting	3.304	32	0.002	2.7500	2.7188
D2 (LST)					
Happiness	2.153	32	0.039	2.8824	2.3824
Stressful	2.291	32	0.029	2.3333	2.9394
Irritating	2.810	32	0.008	1.9091	2.6061
E1 (LST)					
Happiness	2.508	33	0.017	4.000	3.5882
E2 (LST)					
Exciting	2.368	31	0.024	2.6252	2.9053
F1 (LST)					
Colorful	3.668	33	0.001	2.4118	2.8824
Frightening	2.899	31	0.007	1.9355	2.6129
H1 (LST)					
Stressful	2.408	32	0.022	1.3636	1.9091
Frightening	2.308	31	0.028	1.2500	1.6875
H2 (LST)					
Exciting	2.908	32	0.044	3.4412	3.0882
J1 (LST)					
Stressful	2.171	32	0.037	1.5758	1.9394
J2 (LST)					
Irritating	2.156	31	0.039	1.3438	1.4688
K1 (LST)					
Exciting	2.425	33	0.021	4.5000	4.1471
K2 (LST)					
Exciting	2.547	33	0.016	3.9412	3.4118

Table 6. Duncan multiple comparisons showing significantly different subsets of landscape types based on emotion ratings averaged over stress conditions and emotion scales

Landscape type	N	Subset			
		1	2	3	4
Rural /Village Landscape type	937	2.60d			
Winter	941	2.62d			
Urban	935	2.62d			
Mountain	932	2.67d			
Street with trees	941		2.81c		
Large green areas	945		2.87bc	2.87bc	
Forest area	940		2.88bc	2.88bc	
City center with large squares	935			2.96ab	2.96ab
Lake	937				2.99a
Seasonal plants	940				3.02a
Sea	939				3.06a
Sig.		.146	.152	.061	.083

Table 7. Duncan multiple comparisons distinguishing different subsets of emotion scales based on ratings averaged over scenes/landscape types and stress conditions.

Emotions Perceptions	N	Subset				
		1	2	3	4	5
Scary	1457	2.05e				
Irritating	1466		2.29d			
Stressed	1471		2.32d			
Excited	1476			3.17c		
Happiness	1482			3.20c		
Colorful	1487				3.33b	
Relaxing	1483					3.41a
Sig.		1.000	.339	.384	1.000	1.000

Pearson Correlation Analysis

Scatter plots and associated regression equations relating Stressed x Unstressed conditions over the 22 scenes for each emotion scale are shown in Figure 4. Overall the two stress conditions largely agreed in their ratings on each scale. There were some deviations from this pattern for some scales where some individual scenes did show up as outliers. These deviations were captured in the factor analysis and reflected in the factor loadings for specific scene x emotion scale combinations. Displays the values of the X-Axis independent variable and the Y-Axis dependent variable. The coefficient of determination (R2) are close to 1, which shows that the correlation is statistically significant, and the model performed perfectly.

The results indicated that the students gave an even lower perception of the negative photos with scary stress. In both cases, stressed or unstressed, the students scored higher than 3.4 for convenience perception. On the other hand, it was obtained that the students gave

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lower perception for the landscape photos with good visual perception and worse for the landscape photos with wrong visual perception when they were under stress. As a matter of fact, this situation was also stated in different studies (Maas et al. 2006; Mitchell and Popham 2007; Barton and Pretty 2010; Roe et al. 2013; Xue et al., 2017).

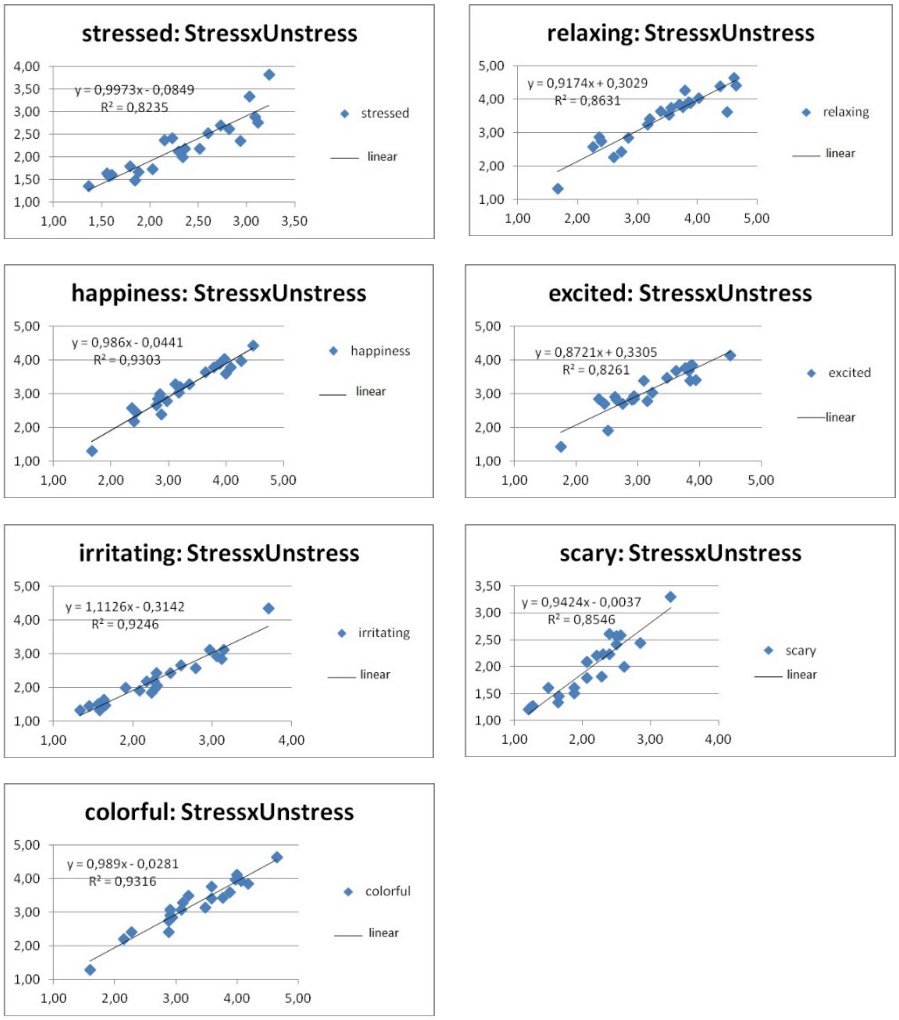

Figure 4. Scatter plots and the regression equations for correlations between rating under stressed and unstressed conditions

The respondents indicated that they did not like the primitive rural photograph before the exam. Their dislike for this picture increased after the exam. The sea and lake photographs were among the best-liked photographs (Perhaps this is because of the craving of the young population for the sea and the beaches). In visual quality evaluation, it has been stated that it always makes a positive contribution to water-related studies. Understanding these aspects of people's perception of the on-water landscape facilitates the management and development of water tourism in cities and improves urban planning and management (Cao et al., 2021; Li et al., 2021).

A rural village photograph (C1) was chosen as disturbing with a score of 4.35. Students rated the mountain landscape photo without trees (F1) as frightening (Table 5). The findings of this study's link between significant impact factors and visual quality scores are consistent with

those of prior studies.: the visual quality of the environment is reduced by unforested mountain structures and harsh village landscapes. (Saeedi and Dabbagh, 2021). Also, in this study, students' sense of excitement displays significant differences at ($p<0,05$) for the sea and lake scenes. It was seen that when respondents were stressed, the sense of excitement significantly decreased. For other natural mountain landscape scenes, the size of the differences between stressed and unstressed conditions was found to be statistically significant ($p<0,05$). Human factors could be predictors of the sense of safety; people with deeper connections to nature may be expected to feel safer (Xue et al., 2017; Li et al., 2021). It was determined that forest areas representing natural areas were ineffective. L1 and L2 forest photograph were insignificant in the stress level of the respondents ($p < 0.05$). Whereas, in terms of psychological effects, visiting forests has been found to contribute to mitigating psychological symptoms, such as anxiety, tension, nervousness, and fatigue, and improving mood states and cognitive function (Korpela et al., 2017). This may be because the selected photos are dark. A more impressive photo should have been chosen. The light of the photo is important in visual end environmental perception (Nasar and Bokharaei, 2017).

Students rated the photograph of seasonal plants (J1-J2) with the highest score above 4.5 in both stressed and unstressed states (Table 4). This was the photo with the most colorful flowers among the pictures. In the survey, it was seen that they are affected by the color. Therefore, it could be said that colors have a combination of visual and biological functions on human and these effects should be considered in cities where humans live. Most of existing literature demonstrates that natural elements are a powerful and positive predictor of aesthetic quality. For example, trees or flowers are considered to be one of the most important landscape elements and attract people's attention (Nordh and Østby, 2013; Khalili, 2019; Saeedi and Dabbagh, 2021; Wang et al., 2021).

While the students were stressed, they gave the highest score of 4.35 to large green areas (H1) as a relaxing effect in visual quality evaluation. The results indicated that perceived large grass richness is positively associated with negative mood states. In line with these findings, many studies had confirmed that the relaxation effect can also be achieved by exposure to large green areas. Like urban green spaces, the presence of grass in the landscape has been widely thought to have a restorative effect. It is a widely held view that urban green space which can contribute to the mental health of urban residents, but the link between the landscape composition (Vert et al., 2020; Ha et al., 2022).

Points awarded to natural field photos are affected by the stress (Table 4). In the analysis results, the design with the living comfort of humans and natural arrangements reduces stress since the people gave the highest scores to the lake, vast green areas, and forest photos. Thus, similar results were obtained from the studies made in this field. Landscape, gardens, open space areas, color, music, and plant areas

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decrease the pressure on inhabitants in urban places. There are many studies about the decreasing effects of natural places on stress. These places are beneficial for all age groups relieving stresses (Kaplan and Kaplan 1989; Ulrich, 2001; Xue et al., 2017). There is an essential need for landscape design to reduce people's pressure and urban stress. Natural landscape photos affect human physiology (Parsons and Daniel 2002). The artificial atmosphere in urban areas harms human physiology. Enough attention should be given to determining and reducing these adverse effects. For instance, in Millennium Park (Chicago, USA), a collection of natural plants exists and modern design. People in this area get a positive perception because of neutrality. So this is an example where landscape design affects human physiology. As an example, settings including trees, grass, and open spaces are stated in the literature as the solution to reducing physiological stress (Hartig et al. 2003; Ulrich et al. 1991; Van den Berg et al. 2007; Beil and Hanes 2013; Jiang et al. 2014; Wang et al., 2021).

The results of the pearson correlation analysis showed that stressed students rated higher positive emotion scales for photographs that included water surfaces (0.985), light green urban areas (0.955), and seasonal flowering plants (0.955). As a matter of fact, in the analyses made with visual photographs, it has been determined that the brightly colored flowers used in the green areas in urban spaces affect people more positively (Hoyle et al. 2017; Wang, et al., 2019). Visual quality assessments of photos showed that natural components such as grass, trees and bushes were predictors of restoration likelihood. Similarly, the photograph with grass, trees and flowers received the highest score in the visual assessment (Nordh and Østby, 2013).

During the about 20 years of teaching, the researchers observed that the students working on landscape projects had performed better when they worked in "good" classrooms with windows, appropriate design desks and chairs, and proper lighting. The reverse was true for students who worked in "bad" classrooms, usually in basements with low ceilings and inappropriate lighting. This might be another indication that people are affected by the environment. Thus, landscape architects should consider human expectations and analyze them well. Thus, they can minimize the undesirable potential impact at a later time.

CONCLUSION

As a result, it has been shown that stressful conditions affect perception and stressful conditions generally give higher emotionality than non-stressed ones. In general, in both conditions, students gave the highest scores as a convenience and the lowest score as frightening. Overall, it was concluded that when students are under stress, they have a superficial perception of the photographs. However, when they are relaxed, they perceive the pictures in more detail and study them more.

The t-test and Duncan's multiple comparison test results indicated that stress affected visual perception. Therefore, every type of design in

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urban areas should be analyzed more in-depth. The water surfaces, seasonal flowering plants, and vast areas within urban areas which are comfortable and happy places and encourage positive emotions in people should be increased. Mainly it should be considered in University campuses intensively used by the students. When the students are under stress, they perceive the visual quality of the picture as low. They identify the pictures as giving bad feelings worse than usual. These types of scenery should be considered to reduce the impact of stress to adopt landscape preferences and the perceptions of all concerned and to aid decision-making in landscape planning. Campus administrators, landscape architects, and planners should pay their efforts to stress improvement and emotional convenience when planning or renovating campus landscape.

In the analysis results, the design with the living comfort of humans and natural arrangements reduces stress since the people gave the highest scores to the lake, vast green areas, and forest photos. This study indicated that landscape architectures should consider water surfaces, colorful plants, and open green areas in design to reduce stress on people in intensive urban and high-pressure areas.

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Resume

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