Environmental Factors Affecting Students' Stress in the Educational Environment: A Case Study of Shiraz Schools

Najmeh Najafi,[1] Khosro Movahed,[1,*] Zahra Barzegar,[1] and Siamak Samani[2]

[1]Department of Architecture, Shiraz Branch, Islamic Azad University, Shiraz, Iran
[2]Department of Psychology, Shiraz Branch, Islamic Azad University, Shiraz, Iran

[*]*Corresponding author*: Khosro Movahed, Department of Architecture, Shiraz Branch, Islamic Azad University, Shiraz, Iran. Tel: +98-09171180077, E-mail: khmovahed1@yahoo.com

Abstract

Background: Environmental variables are one of the main factors affecting stress. This research aimed to determine environmental factors affecting students' stress in the educational environment in Shiraz, Iran, in the framework of survey research.

Methods: The study included a sample of 246 female high school students who were selected by multi-stage cluster sampling from a Shiraz-based educational district. As a tool for collecting data, a questionnaire was prepared by reviewing the relevant literature and in accordance with the research objectives. Cronbach's alpha coefficient was calculated to determine the reliability of the questionnaire, which was equal to 0.72, showing a good reliability. The content validity of the questionnaire was also verified by experts and faculty related to the subject. In order to investigate the construct validity, after examining the internal consistency of the questions, the questionnaire was analyzed using the main components method. Based on the results of factor analysis, four factors including thermal comfort, physical factors, environmental interventions, and security were extracted. Data analysis was done by SPSS 21. The effect of environmental factors on student stress was investigated using one-sample T-test for each of the factors. In addition, Friedman test was used to study the importance of the environmental factors referring to each other.

Results: From the viewpoint of students, thermal comfort (P value < 0.001), physical factors (P value < 0.001), security (P value < 0.001), and environmental interveners (P value < 0.001) comprised more than 60% of the factors affecting students' stress in the classroom. In addition, average rating (AR) of the environmental variable was as follows: environmental interveners (AR = 3.31), thermal comfort (AR = 2.62), physical factors (AR = 2.50), and security (AR = 1.57).

Conclusions: Environmental factors such as environmental interveners, thermal comfort, physical factors, and security could affect female high school student's stress expressed in the order of importance. They should be taken into consideration by designers of educational spaces.

Keywords: Stress, Ambient Stressors, Educational Environment, Thermal Comfort, Physical Factors, Security, Environmental Interveners

1. Background

Stress has been called the "health epidemic of the 21st century" by the world health organization (1). Stress is caused when requirements of a position are more than individual's ability to cope with them (2). Some people think that children's world is full of games and free of any pressure and tension. However, children might also feel mental and emotional pressure due to different stressors (3). Studies showed that psychological and physical signs of stress are common among school-aged children (4). As the prevalence of stress is in the world, Iranian students also suffer from stress (5).

Different factors can cause stress. These factors may be individual or environmental. Environmental stress can be defined as the cognitive, emotional, and behavioral re-

sponses to an environmental stimulus or stressor (2). Four types of environmental stressors including cataclysmic events, stressful life events, daily hassles, and ambient stressors are distinguished by Evans and Cohen (1987). Cataclysmic events include infrequent events such as natural disasters that have a major impact on people and their environment and tend to affect larger groups of people. Stressful life events like family problems or illness denote personal events that people may experience on a daily basis. Daily hassles denote the things that we experience every day, like crowding and stressful commutes. Ambient stressors such as air pollution or noise are also referred to as background stressors (6).

Ambient stressors are described as chronic, non-urgent, and negatively valued environmental stressors

that are perceptible but may go unnoticed (7). Environmental stress can play an important role in the design of our environment (8). Major ambient environmental stressors are light (9-14), color (15, 16), noise (17-21), and temperature (22, 23). The main social environmental stressors are physical privacy (8, 24), personal space (20, 25-27), crowding (20, 28, 29), territoriality (2), and other factors like green space (30, 31).

There is a growing awareness in contemporary societies about the impacts of exposure to environmental stressors on human health and quality of life. However, the vast majority of the previous research in human exposure to environmental stressors has focused on populations in urban areas. The lack of seeking environmental stressors in the educational environment could be seen in the research. It is important because stress may affect the students learning, health, and achievement (4). This paper directs the attention towards female students studying in high school, which has been less discussed by researchers. This study seeks to identify environmental stressors in the educational buildings among female students.

2. Objectives

The present study was designed to determine environmental factors affecting students' stress in the educational environment in Shiraz, Iran, in the framework of survey research.

3. Methods

3.1. Population, Sample

The statistical population of the study included all 15 to 17-year-old female students in Shiraz, Iran. The sample size was 246 students, calculated by Cochran formula. The sample was selected by multi-stage cluster sampling from high schools of Shiraz. Regarding the educational districts of Shiraz, in the first stage, a district was selected randomly from the four districts. Then, four schools were randomly selected from the schools in the area.

3.2. Methods

The research method used in this study was a survey method. The research was generally done in three phases. In the first phase, by using the review of the sources and using the views of the professors and researchers in the field of environmental psychology, environmental factors influencing stress in the educational environment were obtained. A researcher-made questionnaire was designed based on these factors. The questionnaire had a good validity and reliability.

In the second phase, the questionnaire was distributed among students with their own personal satisfaction to determine the impact of environmental factors affecting stress among high school female students. In the third phase, the data were analyzed using SPSS 21. One-sample T-test was used to obtain the impact rate of environmental factors on students' stress in the classroom and Friedman test was used to determine the importance of environmental factors.

3.3. Tools

To investigate the environmental factors affecting students' stress in the educational environment, a researcher-made questionnaire was used. The questionnaire consisted of 20 items that were measured using a five-point Likert scale.

3.4. Reliability of the Questionnaire

The reliability of the tool was evaluated using Cronbach's alpha, and the value of 0.721 was found to be indicative of internal consistency. If the Cronbach's alpha coefficient is 0.7 or higher, the questionnaire has a satisfactory reliability and we can be sure of the internal correlation of the questions.

3.5. Validity of the Questionnaire

After determining the research questions and hypotheses, a questionnaire prepared by the researchers was used to collect information. In order to ensure its validity, the questionnaire was presented by the professors of the field of psychology and distributed to the sample after their confirmation. After analyzing the internal consistency of the questions, the questionnaire was factor analyzed using the main components method.

Based on the findings of the factor analysis, the KMO value was 0.645, which indicated the sample size is suitable for the factor analysis, and the Bartlett value was 241.728, which indicated the suitability of the correlation of the entered variables for the factor analysis. Following the factor analysis, four factors were extracted. The four factors were able to explain 63% of the total variance. The first factor with a specific value of 2.606 explained more than 20% of the total variance (Table 1). The positioning of the variables in the factors was assumed with the assumption of variables with factor load greater than 0.5, following the rotation of the factors by the varimax method.

The eigenvalue decreased rapidly with the extraction of factors after the fourth factor. The first to fourth factors eigenvalues were greater than one; therefore, they remained in the output (Figure 1). Factor loadings are presented in Table 2.

Table 1. Factors Extracting Factor Analysis

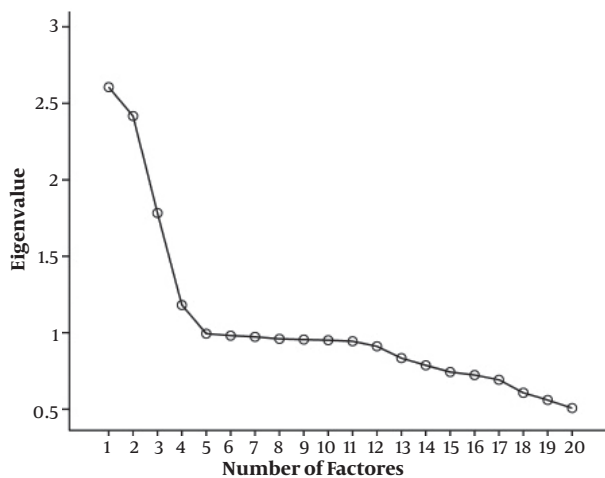| Factors	Special Amount	Special Variance Percentage	Cumulative Variance Percentage
1	2.606	20.179	20.179
2	2.417	19.243	45.478
3	1.783	12.085	57.563
4	1.181	5.904	63.467

Figure 1. Scree Plot of Eigenvalue

Based on the results of factor analysis, four factors were extracted. After determining the factors, we what studied the main variables assigned to each of the factors. In this stage, it was expected that some of the variables would be assigned to one of the other factors and another to another. The preliminary extraction of the factors did not determine which variable belonged to, which is why we entered the factor rotation for the interpretation of the factors. The quadruple factors extracted were largely in line with the design questions and the explanatory variables for the research model. Considering the factors that make up the factors, each factor, naming, and four environmental factors affecting students' stress in the educational environment were obtained (Table 3).

4. Results

A total of 246 female high school students participated in this study. 39% of the students were in the 9th grade, 36% of them were in the 10th grade, and 25% were in the 11th grade. The mean age of the students was 16.4 ± 1.47.

To test the first hypothesis based on the effect of environmental factors (thermal comfort, physical factors, security, and environmental interventions) on students' stress in the classroom, one sample T-test was used. According to the four factors extracted, the test was performed for each of the factors (Table 4). In addition, the test values for environmental factors affecting students' stress in the class were analyzed ($P < 0.001$); therefore, thermal comfort factors, physical factors, security, and environmental interventions were effective in the stress management of students in the educational environment and it can be said that in these factors, the average of sample is larger than the average of the society.

Friedman test was used to investigate the second hypothesis of the research, i.e. the importance of environmental factors including thermal comfort, physical factors, security, and environmental interveners. In Table 5, the average, standard deviation, and average rating of the factors are observable. Chi-square statistic with 3 degrees of freedom was equal to 246.227 that, given the significance level ($P < 0.001$), the zero assumption can be rejected at the level of 0.001. Therefore, it can be concluded that the average of environmental factors is different and based on the viewpoint of the students, the environmental intermediary is the most important factor, and security is the least important factor affecting students' stress in the classroom. According to the average rank, the factors can be identified from the most important to the least important problem, as follows: Environmental interveners, thermal comfort, physical factors, and security (Figure 2).
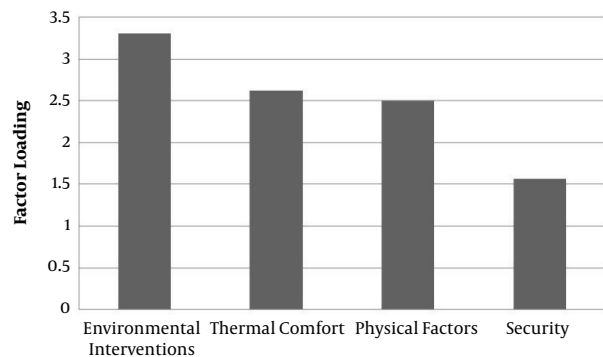

Figure 2. Factor Loadings Based on Friedman Test

5. Discussion

It is important to identify environmental factors affecting students' stress in the educational building. In today's society, students spend as much time at school as they do

Table 2. Determination of Factor Loading

Subgroup Variable	Component			
	1	**2**	**3**	**4**
Air temperature	0.735			
Humidity	0.730			
Air velocity	0.672			
Student's clothes	0.587			
Physical activity	0.512			
Space geometry		0.769		
Building age		0.749		
Space color		0.717		
Green space		0.528		
Space materials		0.516		
Space readability			0.694	
Privacy			0.692	
Space standards			0.622	
Crowd congestion			0.597	
Security			0.521	
Sound pollution				0.673
Light				0.641
Classroom cleanliness				0.586
Ventilation				0.539
Visual contamination				0.514

Table 3. Environmental Factors Affecting Students' Behavior in the Educational Environment

Factors	Observed Factors	Variables	Number of Questions
1	Thermal Comfort	Air temperature, Humidity, Air velocity, Student's clothes, Physical activity	2.5,9,14,16
2	Physical factors	Space geometry, Building age, Space color, Greenspace, Space materials	8,10,11,18,20
3	Security	Space readability, Privacy, Space standards, Crowd congestion, Security	3,6,12,13,15
4	Environmental interventions	Sound pollution, Light, Classroom cleanliness, Ventilation, Visual contamination	1,4,7,17,19

at other places such as home. The objectives of this study were to identify the environmental stressor among female students in Shiraz.

The results of this study showed that thermal comfort factors, physical factors, security, and environmental interventions were effective in the stress of students in the educational environment.

In this study, thermal comfort factors included air temperature, humidity, wind speed, and student's clothes and physical activity was 3.27 on average. These findings are in line with Epstein and Moran (2006) (32) research that investigated thermal comfort and heat stress indices. It follows the heat balance equation in which ambient temperature per se is seldom the cause of heat stress. According to Fanger, the interactions of six fundamental factors define the human thermal environment. Ambient temperature, humidity and air movement, metabolic rate, and clothing are variables that affect human response to thermal environment (33). Thus, any consideration of thermal stress should explore these six factors (32).

According to the results of the study, physical factors

Table 4. T-Test on the Effect of Environmental Factors on Students' Stress in the Educational Environment

Factors	Mean $\pm$ Standard Deviation	Test Value	Test Statistic(t)	Degrees of Freedom	significance Level	Bottom Limit	95% Confidence Interval[a]
							Upper Line
Thermal Comfort	3.27 ± 0.480	3	8.818	245	< 0.001	0.21	0.33
Physical factors	3.24 ± 0.428	3	8.667	245	< 0.001	018	0.29
Security	2.84 ± 0.412	3	-6.185	245	< 0.001	-0.21	-0.11
Environmental interventions	3.61 ± 0.449	3	21.199	245	< 0.001	0.55	0.66

[a] 95% confidence interval for averages difference.

Table 5. Descriptive Statistics and Average Rating of Environmental Factors

	Number	Average $\pm$ Standard Deviation	Average Rating
Thermal Comfort	246	3.27 ± 0.480	2.62
Physical factors	246	3.24 ± 0.428	2.50
Security	246	2.84 ± 0.412	1.57
Environmental interventions	246	3.61 ± 0.449	3.31

such as space geometry, building age, space color, green space, and space materials are another group of stressors in the educational environment with an average of 3.24. As AL-Ayash et al. (2016) have proven in their study, there is a relationship between space color and stress (15). The impact of green space factor is in line with Ekkel and Vries (2016) study (34). Visual contact with green space can have a positive effect on stress reduction, even through a window (34). Moreover, Arnberger and Eder (2015) (35), Berto (2014) (30), and Li and Sullivan (2016) (31) described green space as a stress-reducing factor that is in line with the results of this study.

Space readability, privacy, space standards, crowd congestion, and privacy are security factors that affect students stress. Security factors were 2.84 on average. Privacy is an important factor the effect of which has been investigated on stress by Barnes (2002) and Lee (2010) (8, 24). Overcrowding has been expressed as a security factor affecting stress. This factor was illustrated in Shah and Inamullah (2012) and Khan and Iqbal (2012) studies as an environmental stressor in schools, making problems for students and teachers (28, 29). Overcrowding was also described as a stressor in another review, specifically concerning children's health. Evans et al. (1998) concluded that in the case of children, crowding is associated with stress, poor educational outcomes, and behavioral problems at schools (36).

Environmental interventions such as sound pollution, light, classroom cleanliness, ventilation, and visual contamination are another group of environmental stressors that was the most effective factor among others by an average of 3.61. Previous research by Bluyssen (2014), Walinder et al. (2007), and Frackiewicz et al. (2015) has shown that sound pollution and noise play a role in increasing student's stress, which is in line with this research results (17, 18, 21). However, this result was not in line with those of Haines et al. (2001) (37) research that expressed chronic aircraft noise exposure was associated with impaired reading comprehension and high levels of noise annoyance but not with mental health problems in students. Mental health was examined by salivary cortisol test. There is a recommendation that the mean noise level inside a classroom should be between 35 and 45 dB (38). Moreover, light is another environmental intervention stressor. This finding is in line with Mathalamuthu et al. (2014) and Newman and Rebman (2016) research (10, 11). A combination of artificial and natural light can be useful for classroom lighting (39).

5.1. Limitations and Suggestions

As a limitation of this research, some students might have over- or under-reported their stress and stressful factors. It is also possible that individuals who indicated no stress had different or lower expectations than those who experienced stress. Finally, to continue the research, it is recommended the mentioned factors as environmental stressors are studied in an experimental method and using the hormone stress test to evaluate the effect of each of them separately.

5.2. Conclusions

In this study, stressors in the educational environment were extracted from sources, studies, and opinions of experts in the field of environmental psychology. The factors were divided into 4 groups including thermal comfort factors (air temperature, humidity, wind speed, student's

clothes, and physical activity), physical factors (space geometry, building age, space color, green space, and space materials), security (space readability, privacy, space standards, crowd congestion, and privacy), and environmental interventions (sound pollution, light, classroom cleanliness, ventilation, and visual contamination). Then, using the extracted factors, a questionnaire was designed to measure the students' stress levels relative to different factors. Based on the results, the four groups of factors, along with their micro-factors, affect students' stress in the educational environment. In addition, the factors can be mentioned from the most to the least importance: environmental interveners, thermal comfort, physical factors, and security.

These findings can provide guidance to parents, teachers, school administrators, architects, landscape architects, planners, and policymakers interested in creating healthier environments for learning.

Acknowledgments

Footnote

Authors' Contribution: That is written by the first author under the supervision of the second author and the advisory of the third and fourth authors.

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