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# Effective spatial features on stress reduction of university students

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**Abstract**

University students are exposed to stress because of their age and their particular situation. Stress can cause serious problems to the health and academic performance of students. One of the factors affecting stress is the environment. Therefore, finding ways to reduce stress in universities is important and needs to be investigated. Unfortunately, one of the fundamental problems of universities is the lack of features and qualities of a space that reduces the stress of students. This means that university spaces are not designed and constructed for reducing the stress of students and enough attention was not paid to this issue. The relative lack of research in this field makes necessary to pay attention to this issue and carry out studies in this regard. The purpose of this study is to provide effective spatial features to reduce the stress of university students and to determine the effectiveness of each of these features. The research is conducted by survey method and Delphi technique was carried out in three rounds. For this purpose, firstly open-ended questionnaires were distributed among the experts. Then the answers were investigated and the lists of features were extracted. In the next step, based on the information obtained, close-ended questionnaires were made and the importance levels of features were put into question among the experts and then data were analyzed using SPSS software. In the final stage, experts expressed their final opinions considering the statistical results of the previous stage. The results of this study showed that effective spatial features on stress reduction of students are classified by influencing level into four categories of environmental conditions, natural factors, environmental comfort and physical aspects. And among the details of these features, adequate and proper light for spaces", connecting with outdoor and semi-outdoor spaces and desirable sound in spaces, are of utmost importance

**Keywords:** *Effective spatial features on stress reduction, university, students.*

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## 1.Introduction

Education is the transfer of knowledge and enabling an individual to accomplish a task or changing his/her beliefs and feelings. And the purpose of education is to facilitate the learning process and to create a rewarding experience for individuals (Asadi Noghabi et al., 2013). The mission of educational systems is to nurture teeming people who want to be liberated from their numerous and diverse confines of their existence and pave their way of evolution (Saberian, Aghaei, 2006). Generally the learning process is a stressful experience. If the students feel the stress as a challenge, their motivation to learn will increase (Abazeri et.al,. 2003).But if the stress level is high and threatening, it can lead to educational failure and can also prevent the emergence of talents and potential abilities and flourishing of creative ideas and it can finally cause the malfunction in students' efficient operation (Rezaie, Hosseini, 2006). In any case, stress is a complex issue. Knowledge about stress and its effects over the past few decades has attracted various scientists in the neurological, psychological and social expertises (Witek, 2000).In a conducted research in 2006 in Shahid Modarres University of Iran about the stress, it has been shown that 71.1% of students suffer from stress (Rezaie Adriani et al., 2007). Students are considered as one of the most important segments of society because they play an important role in the future of the country. Therefore, the students' health is an important and considerable issue. This group of the society is exposed to diverse tensions because its age and particular situation. Studies show that the prevalence rate of mental disorders and illness is rising among the students (Heads of University Counseling Services of Royal College of Psychiatry, 2003).According to the above cases, stress can cause serious problems to the health and educational performance of students. Therefore, the study of stress and finding solutions to reduce it in educational environments is very important and needs to be investigated. A variety of factors affect stress, one of them is the environment (Cox, 1978). The role of university space on students' stress is obvious for everyone. Unfortunately, one of the fundamental problems of universities is the lack of spatial features that reduce students' stress. This means that university spaces are not designed and constructed for reducing the stress of students and enough attention was not paid to this issue. The purpose of this study is to provide effective spatial features to reduce the stress of university students and to determine the effectiveness of each of these features. For this purpose, firstly the stress, the impact of stress on educational performance and environmental influences on stress were investigated. For identifying effective spatial features on stress reduction of university students, survey method and Delphi technique were used. After distributing questionnaires and analyzing the data obtained from questionnaires and final views of experts, effective spatial features on stress reduction of students were determined.

## 2. Research background

Among the various researches in the field of stress, we can mention the cases below:

Cox (1993) carried out a research on features of environmental stimulus that cause mental clutter, tension and stress. McAndrew and Hall (2008) conducted a research on some environmental features and their effects on the stress. Shahcheraghi and Bandarabad (2015) and Mortazavi (2001) conducted a research on environmental psychology and the influence of environment on factors such as human's behavior, stress etc. Holmes and Rahe conducted a survey on life changes and stressful situations (Nezu et al., 2003). McAndrew (2008) has investigated the perception of space in his book of environmental psychology. Some researchers paid attention to a particular response that an individual may show in facing with a stressful event (Joshi, 2007). Lazarus and Folkman (1984) have investigated the opinions and perspectives of different individuals about vari-

ous situations and their relationships with the stress in them. A variety of studies have shown that people are faced with different stressful events such as poor working conditions, intolerable political conditions, death, birth (Sayyas et al., 2004, quoted by Hoffman, 2006), time pressure, financial concerns, constant quarrels in family or business situations (Delahunt et al., 2000, quoted by Hoffman, 2006) changes in the type of role (Persoud, 1994, quoted by Brown, 2008), factors such as university course selection, finding roommate, class selection, financial problems, lifestyle changes, choosing a career and marriage (Seward, 1997) . Torshim and Weld (1997) investigated the relationship between school assignments and students' stress. Houman (1998) has surveyed the relationship between different factors and sources such as personal problems, health problems, family problems, learning problems, emotional problems, and social issues etc. with the stress level of students. Many researchers have classified sources of stress in different ways (Fontana, 1990; Cordon, 1997; Markham, 1992; Smith, 2003; Robbins, 1998; Hoffman, 2006). Rozens kioski and Chlyns K (2007) and Bakhtiarpour (2001) investigated the relationship between age and stress. Rezakhani et al. (2009) have investigated the sources of stress in students. According to conducted studies, it can be said that so far, the role of spatial features of universities for reducing the stress of students have not been studied. Therefore, in this article we have attempted to conduct a survey on effective spatial features on stress reduction of university students.

**2.1. What is Stress?**

The term of "tension" or "stress" is derived from the Latin word "stringer" that means hugging, squeezing or pressing, being pressed or placed under pressure leads to repression and creates the feelings of helplessness and anxiety that takes the heart and the soul (Dadsetan, 2001, pp.25-26). Stress is the nonspecific response of the body to any pressure that is exerted on it (Selye, 1974). This response can be shown against any internal and cognitive stimulus or external and cognitive stimulus (stressors) Although Selye (1974) makes a distinction between efficient stress ad harmful stress and degree of stress is necessary for life (Cordon, 1997) but in psychology the word of "stress" is mainly applied for the harmful stress. Stress is used to describe many negative feelings and feelings and responses in challenging and threatening situations. If the stress is caused by expectations that a person is unable to mentally or physically satisfy, the physical and mental health of the person is in jeopardy (Fontana, 1990, Gallagher et al., 2003). Because of individual differences, individuals respond to stress in different ways and the severity of the perceived stress and the manner to react to it depend to differences in attitudes and perceptions (Bryst et al., 2002 quoted by Rattus, 2007). In fact according to Epicur's saying, objects and events can not cause distress in a person; this is our attitude and perspective towards the events that lead to distress (Richardson, 2007). For explaining the definition of stress, some people emphasize on the features of environmental stimulus that lead to mental clutter, tension and stress (Cox, 1993), like Holmes and Rahe who believe that life changes can create stress in individuals and being faced with many stressful situations in a short time, affect psychologically an individual (Nezu et al., 2003).

**2.2. Effect of stress on educational performance**

The issue of stress in university students has been the subject of many researches during recent years. The studies have shown that the perception of high levels of stress in university students can lead to a decrease in educational performance, depression, serious problems of psychology health weakness (Penguili and Dad, 2000; Misra et al., 2000; Had et al,. 2000), Therefore, investigating this phenomenon in students and the manner to deal with it can be useful and bring effective applications in university for educational authorities. The ef-

fects of stress on educational performance of university and college students have been investigated and it has been concluded that too much stress can have a negative impact on students' educational performance (Whitman, 1998). The negative effects of educational stress include depression, anxiety and behavioral problems that influence the educational performance of students and young people (Dunn et al., 2010). Various stressesreduce one's resistance with negative impact that they exert on individual and social coping mechanisms of a person. In several studies, the impact of stress on physical and mental diseases and the role of it performance malfunction and reduction of the power of compatibility has been proven. For example, stress related to educational activities has various negative results like low welfare (Baker, 2003; Eremsoy, Celimli and Gencoz, 2005) and weak educational performance (Clark and Reiker, 1986; Linn and Zeppa, 1984; Akgun and Ciarrochi, 2003; Struthers, Perry and Menec, 2000, Felsten and Wilcox, 1992). Several studies focus on the relationship between educational stress and poor educational performance. According to this, Felsten and Wilcox (1992) showed that there exist a significant negative relationship between the stress level of students and their educational performance. In another study, Struthers and colleagues (2000) reported that high levels of educational stress are associated with lower scores in school and university. In overall, results of these findings emphasize on the destructive effects of educational stress on students' educational performance.

2.3. Environnementinfluence on stress

According to the interactive model of stress, stress is considered as a complicated and dynamic interaction between individuals and their environment (Cox, 1978). The environment affect significantly human's behavior (Shahcheraghi and Bandarabad, 2015, p 53). About behavioral systems, Yong believes that people are the results of social environment and equally the results of physical environment (Young, 1990). The behavior is influenced by cultural, social and the religious conditions of societies. In addition, it is also influenced by environmental conditions. A part of behavior is the physiological behavior that includes moods and behaviors such as emotional activities, stress, heart rate, depression etc. (Shahcheraghi and Bandarabad, 2015, pp. 53-54). The environment consists of unobserved aspects. These factors are constant environmental features that may not be consciously perceived. The environment around us has a profound effect on our affairs. Mood, behavior and even physical and mental health are affected by a sense that is constantly received from the environment (McAndrew, 2008, p. 71). Mood and behaviors such as emotional activities, stress, heart rate, pain, blood pressure, appetite, the amount of sleep, depression and … are influenced by the secretion of hormones and are variable depending to brain's physiological performance. And the designed environment affects the secretion of hormones (Shahcheraghi and Bandarabad, 2015). In environmental psychology, emphasize is on the subject that how the behavior, feelings and sense of trust of people are influenced by the physical environment (McAndrew, 2008, p. 2).

In environmental psychology, human's behavior is investigated in interaction with the physical, architectural and symbolic aspects of the environment (Mortazavi, 2001, p. 5). Kenneth Creek also believes that for evaluating the environment, one can use methods and approach that are common and usual in psychology and human sciences. Among them, we can mention the following methods:

1. The assessment of physical and objective dimensions of the environment such as height and the amount of light.
2. The variety and number of objects available is a space or place.
3. Location features like happy and pleasant space
4. The assessment of organizational conditions and social atmosphere of the environ-

ment (Ibid, 18).

Many researches conducted during last decades have proved that the presence of the human in natural environments can bring physical recovery for humans and reduce individual stress (Shahcheraghi and Bandarabad, 2015, 415). The perception of space size can also be influenced by various factors. Rooms in form of rectangular seem bigger that rooms in form of square. And rooms with bright colors seem to be larger and more spacious in comparison with darker rooms. Mass furniture represents a smaller and more chaotic room. Room layout, the relationship between them and the size and shape of them are important in determining the inner space of the environment (McAndrew, 2008, p. 239). Motor space in buildings, created by architects and designers is an important factor in everyday life. When there are contacts with things inside in a space, this space will be felt and perceived smaller (Hall, 1387, p. 73). We should be able to design appropriate spaces with the mood of people to reduce the pressure and the stress. We should concentrate on environmental psychology and environmental design and perceive to reduce the stress level in stressful environments (Mac Andrew, 2008, p. 36).

## 3. Research Method

In this study, Research method is survey by using the Delphic technique.

### 3.1 The Delphi technique

The Delphi technique is a widely used and accepted method for gathering data from respondents within their domain of expertise. The technique is designed as a group communication process which aims to achieve a convergence of opinion on a specific real-world issue. The Delphi technique is well suited as a method for consensus-building by using a series of questionnaires delivered using multiple iterations to collect data from a panel of selected subjects. The Delphi process has been used in various fields (Hsu and Sandford, 2007, p. 1). Several studies have shown that the practical number of rounds or iterations usually needed is between two and three (Mitchell, 1991; Gallego et al., 2008) in order to reach consensus. The rounds generally proceed as follows:

**Round 1:** The Delphi method traditionally begins with an open-ended questionnaire which is used to obtain specific information about a content area from the experts (Custer et al., 1999). After receiving subjects' responses, investigators need to convert the collected information into a well-structured questionnaire. This questionnaire is used as the survey instrument for the second round of data collection (Hsu and Sandford, 2007, p. 3).

**Round 2:** Each participant receives a second questionnaire and is asked to review the items, to rate them or to put them in rank order so as to establish provisional priorities among them. As a result of this round, areas of disagreement and agreement are usually identified. In this round, consensus begins forming and the actual outcomes can be presented among the participants' responses (Ludwig, 1994; Jacobs, p. 1996).

**Round 3:** In the third round, each Delphi panelist receives a questionnaire that includes the items and ratings summarized by the investigators in the previous round and are asked to revise his/her judgments or "to specify the reasons for remaining outside the consensus" (Pfeiffer, 1968, p. 152). Usually in this round, consensus is obtained and the fourth round is not needed.

**Round 4:** In the fourth and often final round, the list of remaining items, their ratings, minority opinions, and items achieving consensus are distributed to the panelists. This round provides a final opportunity for participants to revise their judgments. It should be remembered that the number of Delphi iterations depends largely on the degree of consensus sought by the investigators and can vary from three to five (Delbecq et al., 1975; Ludwig, 1994).

### 3.2 Subject selection

The selection of subjects is a vital aspect of

any Delphi survey. Usually people are considered eligible to participate if they have backgrounds; expertise or experience related to the target issue, are capable of contributing helpful inputs and are willing to revise their initial or previous judgments for the purpose of reaching or attaining consensus (Pill, 1971; Oh, 1974). About number of experts, Ludwig (1997) found that between 15 and 20 respondents is common. In this study 15 experts formed the panel. In this study, the target was to obtain 15 participants in the panel in order to fulfil the recommendations noted above. With this aim in mind, 20 invitations were sent out to experts. 15 experts agreed to participate and completed three rounds.

**3.3 Research Question:**

The research question asked: what are effective spatial features on stress reduction of university students?

**3.4 Research Process**

The study presented here comprised three round that two questionnaire were sent to panel members. Two weeks were given for the experts to complete the questionnaire in each round, as recommended by Delbecq et al. (1975). Therefore in present study, during the first round; open-ended questionnaires were distributed among experts and specialists in the intended field. They were also asked to express their views and ideas freely. Then questionnaires were collected, responses were analyzed and the initial list of spatial features was developed and the study's hypotheses were formed. During the second round, based on the information were obtained first round, the 24-item closed-ended questionnaire was made on a Likert scale and was distributed among respondents and the effectiveness of each factor was determined by a panel of experts through a closed-ended questionnaire. Then the collected data were analyzed statistically. At the third round, the experts were asked to evaluate the results and restate their views accordingly. Experts determined the effectiveness of each factor and eliminated irrelevant factors. Then, they confirmed the statistical results and reached a consensus; therefore, the fourth round was not run. Lastly, spatial features were identified and prioritized. The results were presented through a table showing the identified spatial features; then the percentage average of respondents answering the questionnaire was presented. After that, the study's hypotheses were stated and tested through one-sample t-test (SPSS software). Using Friedman test, to determine prioritize each features. Finally, the final list of effective spatial features on stress reduction of university students was presented based on the significance and prioritize of each factor.

**4. Discussion**

In this part the initial list of spatial features and their details, the statistical results of data analysis and the final list of effective spatial features on stress reduction of university students, are presented.

**4.1 The initial list of effective spatial features on stress reduction of university students**

Table (1) is the initial list of spatial features on stress reduction of university students. The list includes 4 main categories and 24 details.

**4.2. The average percentage of respondents**

In table 2, the average percentage of respondents to questionnaire is shown (Overall average is 5)

According to table 2,adequate andproper light for spaces, connecting with outdoor and semi-outdoor spaces and desirable sound in spaces, have respectively the highest amounts.

**4.3. Inferential statistics**

In this part of study, the hypotheses and the significance level of hypotheses details are examined.

**4. 3. 1. Research hypotheses testing**

According to the subject of this research, to determine the effectiveness or ineffectiveness of each factor, independent t-test is used.Accordingly, we should propose the following hypotheses and test them.

| Feature | Details |
|---|---|
| 1. Environmental conditions | 1. Adequate and proper light for spaces<br>2. Desirable sound<br>3. Proper temperature and ventilation |
| 2. Natural factors | 4. The presence of water and greenery in spaces<br>5. Type of green space and vegetation |
| 3. Physical aspects | 6. Suitable materials<br>7. The availability of facilities<br>8. The form and geometry of spaces<br>9. Standard, dimensions and color of spaces and their components<br>10. Creating filters between spaces<br>11. Proper alignment of different spaces together (classroom, corridor etc.)<br>12. Equipment<br>13. Furniture with proper materials, color and arrangement |
| 4. Environmental comfort | 14. Creating a desirable level of privacy<br>15. Visual connection between spaces<br>16. Nonexistence of things that put human in impasse<br>17. Creating pleasant views<br>18. Flexibility of spaces<br>19. Providing clarity and readability<br>20. Defining the limits and the territory of each activity<br>21. Multifunctional spaces<br>22. Avoid congestion in spaces<br>23. Connection with outdoor and semi-outdoor spaces<br>24. Proper visual appearance of spaces |

**Table 1.The initial list of effective spatial features on stress reduction of university students**



**4. 3. 1. 1. First hypothesis: Spatial features of universities influenced by environmental conditions can reduce the stress of students.**

**H0:** Spatial features of universities influenced by environmental conditions can not reduce the stress of students.

**H1:** Spatial features of universities influenced by environmental conditions can reduce the stress of students.

According to the result, the H0 is rejected. It means that, the factor of "environmental conditions" is in the category of effective spatial features on stress reduction of students (Table 3).

The results of T- test related to each of the factors corresponding to the first hypothesis, 3 questions of questionnaire are shown in table 4.

As it can be seen in the table above, all factors related to "environmental conditions" (As a spatial feature), have significant impact on stress reduction of students.

**4. 3. 1. 2. Second hypothesis: Spatial features of universities influenced by natural factors can reduce the stress of students.**

**H0:** Spatial features of universities influenced by natural factors can not reduce the stress of students.

**H1:** Spatial features of universities influenced by natural factors can reduce the stress of students.

| Question number | Question content | The average from: 5 | Question number | Question content | The average from: 5 |
|---|---|---|---|---|---|
| 1 | Adequate and proper light for spaces | 4.90 | 13 | Furniture with proper materials, color and arrangement | 3.80 |
| 2 | Desirable sound | 4.37 | 14 | Creating a desirable level of privacy | 4.30 |
| 3 | Proper temperature good ventilation | 3/84 | 15 | Visual connection between spaces | 3.57 |
| 4 | The presence of water and greenery in spaces | 4.17 | 16 | Nonexistence of things that put human in impasse | 3.03 |
| 5 | Type of green space and vegetation | 3.30 | 17 | Creating pleasant views | 4.33 |
| 6 | Suitable materials | 3.70 | 18 | Flexibility of spaces | 3.73 |
| 7 | The availability of facilities | 3.13 | 19 | Providing clarity and readability | 3.80 |
| 8 | The form and geometry of spaces | 4.17 | 20 | Defining the limits and the territory of each activity | 3.23 |
| 9 | Standard, dimensions and color of spaces and their components | 4.10 | 21 | Multifunctional spaces | 3.04 |
| 10 | Creating filters between spaces | 3.50 | 22 | Avoid congestion in spaces | 4.30 |
| 11 | Proper alignment of different spaces together (classroom, corridor etc.) | 3.83 | 23 | Connection with outdoor and semi-outdoor spaces | 4.70 |
| 12 | Equipment | 3.10 | 24 | Proper visual appearance of spaces | 4.04 |

**Table 2.The average percentage of respondents**

| Hypothesis | Mean | t-value | Degree of freedom | α | Sig. | Result |
|---|---|---|---|---|---|---|
| $H_1$ | 4.377 | 11.724 | 14 | 0.05 | 0.00 | Rejection of $H_0$ |

**Table 3.T-test of first hypothesis**

According to the result, the H0 is rejected. It means that, the factor of "natural factors" is in the category of effective spatial features on stress reduction of students (Table 5).

The results of T- test related to each of the factors corresponding to the second hypothesis, 2 questions of questionnaire are shown in table 6.

As it can be seen in the table above, all factors except the fifth factor (Question number5), re-

| Question number | The number of respondents | t | df | α | sig |
|---|---|---|---|---|---|
| 1 | 15 | 16.776 | 14 | 0.05 | 0.000 |
| 2 | 15 | 7.465 | 14 | 0.05 | 0.000 |
| 3 | 15 | 5.354 | 14 | 0.05 | 0.000 |

Table 4.T-test of first hypothesis factors

| Hypothesis | Mean | t-value | Degree of freedom | α | Sig. | Result |
|---|---|---|---|---|---|---|
| $H_2$ | 3.735 | 3.971 | 14 | 0.05 | 0.00 | Rejection of $H_0$ |

Table 5.T-test of second hypothesis

| Question number | The number of respondents | t | df | α | sig |
|---|---|---|---|---|---|
| 4 | 15 | 4.372 | 14 | 0.05 | 0.001 |
| 5 | 15 | 1.424 | 14 | 0.05 | 0.145 |

Table 6.T-test of second hypothesis factors

| Hypothesis | Mean | t-value | Degree of freedom | α | Sig. | Result |
|---|---|---|---|---|---|---|
| $H_3$ | 3.666 | 3.367 | 14 | 0.05 | 0.00 | Rejection of $H_0$ |

TTable 7.T-test of third hypothesis

| Question number | The number of respondents | t | df | α | sig |
|---|---|---|---|---|---|
| 6 | 15 | 2.553 | 14 | 0.05 | 0.023 |
| 7 | 15 | 1.481 | 14 | 0.05 | 0.087 |
| 8 | 15 | 5.172 | 14 | 0.05 | 0.000 |
| 9 | 15 | 5.143 | 14 | 0.05 | 0.000 |
| 10 | 15 | 1.261 | 14 | 0.05 | 0.182 |
| 11 | 15 | 4.516 | 14 | 0.05 | 0.000 |
| 12 | 15 | 0.524 | 14 | 0.05 | 0.467 |
| 13 | 15 | 3.214 | 14 | 0.05 | 0.005 |

Table 8.T-test of third hypothesis factors

lated to "natural factors" (As a spatial feature) have significant impact on stress reduction of students.

**4. 3. 1. 3. Third hypothesis: Spatial features of universities influenced by physical aspects can reduce the stress of students.**

**H0:** Spatial features of universities influenced by physical aspectscan not reduce the stress of students.

**H1:** Spatial features of universities influenced by physical aspectscan reduce the stress of students.

According to the result, the H0 is rejected. It means that, the factor of "natural factors" is in the category of effective spatial features on stress reduction of students (Table 7).

The results of T- test related to each of the factors corresponding to the third hypothesis, 8 questions of questionnaire are shown in table 8.

As it can be seen in the table above, all factors except the ninth,eleventh, thirteenth factor (Question number 9, 11, 13), related to "physical aspects" (As a spatial feature) have significant impact on stress reduction of students.

**4.3.1.4. Fourthhypothesis: Spatial features of universities influenced by environmental comfort can reduce the stress of students.**

H0: Spatial features of universities influenced by environmental comfort can not reduce the stress of students.

**H1:** Spatial features of universities influenced by environmental comfort can reduce the stress of students.

According to the result, the H0 is rejected. It means that, the factor of "natural factors" is in the category of effective spatial features on stress reduction of students (Table 9).

The results of T- test related to each of the factors corresponding to the fourth hypothesis, 11 questions of questionnaire are shown in table 10.



| Hypothesis | Mean | t-value | Degree of freedom | α | Sig. | Result |
|---|---|---|---|---|---|---|
| $H_4$ | 3.741 | 5.824 | 14 | 0.05 | 0.00 | Rejection of $H_0$ |

**Table 9.T-test of fourth hypothesis**

| Question number | The number of respondents | t | df | α | sig |
|---|---|---|---|---|---|
| 14 | 15 | 6.100 | 14 | 0.05 | 0.000 |
| 15 | 15 | 1.925 | 14 | 0.05 | 0.066 |
| 16 | 15 | 0.452 | 14 | 0.05 | 0.710 |
| 17 | 15 | 6.425 | 14 | 0.05 | 0.000 |
| 18 | 15 | 3.245 | 14 | 0.05 | 0.006 |
| 19 | 15 | 3.762 | 14 | 0.05 | 0.004 |
| 20 | 15 | 1.342 | 14 | 0.05 | 0.136 |
| 21 | 15 | 0.667 | 14 | 0.05 | 0.379 |
| 22 | 15 | 6.100 | 14 | 0.05 | 0.000 |
| 23 | 15 | 9.872 | 14 | 0.05 | 0.000 |
| 24 | 15 | 5.127 | 14 | 0.05 | 0.000 |

**Table 10.T-test of fourth hypothesis factors**

| | |
|---|---|
| Number | 15 |
| Chi-2 statistic | 26.574 |
| Degree of freedom | 3 |
| Sig. | 0.000 |

Table 11.Results of Friedman test

| Effective spatial features on stress reduction of university students | Mean rank |
|---|---|
| Environmental conditions | 3.85 |
| Natural factors | 2.73 |
| Physical aspects | 1.64 |
| Environmental comfort | 2.20 |

Table 13.The final list of effective spatial features on stress reduction of university students

As it can be seen in the table above, all factors except the fifteenth,seventeenth, nineteenth factor (Question number 15, 17, 19), related to "environmental comfort" (As a spatial feature) have significant impact on stress reduction of students. Resultsshow the confirmation of each hypothesis.

**4. 3. 2 Friedan test**

After doing T- test and determining the effectiveness or ineffectiveness of factors related to each spatial feature, Friedman test was used to prioritize spatial features. The results are shown in table 11.

As it can be seen in table 12, "environmental conditions" with average rating of 3.9 has the highest priority and "natural factors", "environmental comfort" and "physical aspects" are respectively in next priorities.

**4.4 The final list of Effective spatial features on stress reduction of university students**

In table 13, the final list in four categories and 17 details are shown in order of the highest effectiveness and importance.

As it was previously mentioned, we should design spaces in accordance with the mentality of people to reduce stress and pressure (McAndrew, 2008). Since one of the main factors affecting stress is the environment, so the spatial features have an important role in stress reduction. Students are exposed to stress like all other people, so the university spaces should be designed in a manner to reduce the stress of students. According to conducted surveys, the following spatial features can be effective for reducing students' stress:

**1. Environmental conditions:** The most important feature in the present study is "environmental conditions" with an average rating of 3.85. Environmental irritants cause tension and stress (Cox, 1993). According to conducted survey, in fact, environmental conditions include "adequate and proper light for spaces", "desirable sound" and "proper temperature and ventilation". As it has been shown in table 4, all factors are significant and can reduce the stress level of students. Light can create different states in human. So if there exists a proper and adequate light in the environment of university, this factor can have a significant impact on reducing the stress. Sound is also effective on the stress and a desirable sound in the space can increase the tranquility and reduce the stress. Like two other factors, proper temperature and ventilation can create positive positions and reactions in individuals. In case of creating and controlling these factors, we can prevent adverse effects.

**2. Natural factors:** The second most important feature in the present study is "natural fac-

| Feature | Details |
|---|---|
| 1. Environmental conditions | 1. Adequate and proper lightfor spaces<br>2. Desirable sound<br>3. Proper temperature and ventilation |
| 2. Natural factors | 4. The presence of water and greenery in spaces |
| 3. Environmental comfort | 5. Connection with outdoor and semi-outdoor spaces<br>6. Creating pleasant views<br>7. Avoid congestion in spaces<br>8. Creating a desirable level of privacy<br>9. Proper visual appearance of spaces<br>10. Providing clarity and readability<br>11. Flexibility of spaces<br>12. Visual connection between spaces |
| 4. Physical aspects | 13. The form and geometry of spaces<br>14. Standard, dimensions and color of spaces and their components<br>15. Proper alignment of different spaces together (classroom, corridor etc.)<br>16. Furniture with proper materials, color and arrangement<br>17. Suitable materials |



tors" with an average rating of 2.73. The presence of human in a natural environment brings psychological recovery and reduces personal stress (Shahcheraghi and Bandarabad, 2015). As it has been shown in table 6,the presence of water and green spaces is significant. The presence of water and green space can have a positive impact on students, psychologically and physiologically. Basically, the presence of water and green space can bring physical health, mental comfort and better educational performance.

**3. Environmental comfort:** The third feature is "environmental comfort" with an average rating of 2.20. According to research findings, this can be achieved by:connection with outdoor and semi-outdoor spaces, creating pleasant views, avoid congestion in spaces, creating a desirable level of privacy, proper visual appearance of spaces, Providing clarity and

readability, flexibility of spaces and visual connection between spaces.According to table 10, these factors were significant.

**4.Physical aspects:** The fourth feature is "physical aspects" with an average rating of 1.64. Physical aspects of the environment and location features are effective on people's behavior, moods and stress (Mortazavi, 1380). Rooms in form of rectangular seem bigger that rooms in form of square. And rooms with bright colors seem to be larger and more spacious in comparison with darker rooms. Mass furniture represents a smaller and more chaotic room. Room layout, the relationship between them and the size and shape of them are important in determining the inner space of the environment (McAndrew, 2008). As research findings showed, the form and geometry of spaces, standard, dimensions and color of spaces and their components, proper alignment of different spaces together (classroom, corridor etc.), furniture with proper materials, color and arrangement and suitable materials are the factors associated with this feature. According to table 8, these factors are significant. So all obtained features are effective and can reduce students' stress.

**Conclusion**

Facilitating of learning and creating a pleasant experience of learning are important issues in educational environments. Learning process is a stressful experience and the stress can cause serious problems to the health and educational performance of students. The purpose of this study is to provide effective spatial features to reduce the stress of university students and to determine the effectiveness of each of these features. The research question, what are the effective spatial featuresto reduce the stress of university students is answered in discussion part. According to obtained results, effective spatial features on stress reduction of university students are in four categories. In order of effectiveness, they are as follows: "Environmental conditions", "Natural factors", "Environmental comfort" and "Physical aspects". According to statistical results, all four features are effective on stress reduction of university students. According to obtained results, among these four features, "Environmental conditions" has the greatest impact on stress reduction. Also among details related to these four features, "adequate and proper light for spaces", "connection with outdoor and semi-outdoor spaces" and "desirable sound in spaces" are of utmost importance. Paying attention to effective spatial features on stress reduction of university students can be helpful in recognizing the current situation and knowledge of the strengths and weaknesses of university spaces. In other words, by taking profit of effective spatial features on stress reduction in educational environment of universities, students will have greater mental health, therefore, they can better focus on academic experiences and thus, educational outcomes and performance will be higher in universities.

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