

The Effect of the Relationship between Indoor Architectural Design Studios and Outdoor Landscape on Increasing Students' Satisfaction Level

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ABSTRACT

The environmental factors in the educational spaces along with the other factors affect the teaching and learning process. One of the characteristics of environmental space is the type of relationship of each space with its outdoor space. This factor is more important, especially in the spaces where students spend long hours such as architectural design studios. Nowadays, outdoor spaces in academic environments provide functions like accessing to closed spaces and various buildings and creating their relationship. In this regard, the visual function is considered as another important function, which is often overlooked and less considered and created by the outdoor environments for indoor closed spaces. The main question is related to whether the type of the relationship between the closed space of the architectural design studio and the outdoor natural space is considered as an important factor in achieving students' satisfaction with long hours working in this space based on the attention restoration theory or not. The present study aimed to examine the effect of the relationship between the indoor spaces of architectural design studios and outdoor environment on increasing students' satisfaction. This research was conducted by combining the quantitative and qualitative methods. The population included 65 students majoring in architecture, who experienced designing classes in all three studied studios. This research compared three architectural design studios with different conditions of proximity and outward view. The research data were analyzed with SPSS software. The results indicated that the open and diverse outdoor natural landscape was more effective factor in increasing students' satisfaction rather than among the various factors influencing the type of relationship between the studios and the outdoor space. Accordingly, designing the university landscape from the indoor closed spaces should be considered more, especially in spaces such as studios due to the long hours of attending and working of students.

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1. Introduction

Today, the importance of designing educational spaces to improve the quality of learning and teaching is clear for anyone. The

learning environment refers to a socio-cultural and physical context in which learning takes place. Understanding the effective function of learning environment is essential for the architectural environment designing. An effective learning environment plays

an important role in education along with the other components, such as teachers, curricula, educational tools, etc. The physical environment is only one of the influential components in learning, which is considered as the most important component in an active learning environment (DeGregori, 2007). Actually, learning is highly efficient and enjoyable in an appropriate behavioral setting for education. The physical and architectural environmental factors in relation to non-environmental factors strongly influence the learning process. Based on the findings of Weinstein (1979) in the field of designing educational environments, there is no appropriate specific learning setting for all types of learning. The best learning settings have the most congruence with the learning matter. Learning is maximized when each physical setting of education is considered as much as the other effective aspects of learning such as educational aid tools, teachers' ability to explain and express, etc.

In designing educational spaces, first of all the physiological needs and then, the safety needs are considered more than other issues. However, limiting the designers' perspective on these two issues makes them unaware of the higher-level needs. However, meeting all his needs is the condition of the relative mental health of man. The type of the relationship of each space with its surrounding spaces is considered as one of the spatial features, influencing the quality of space and the better performance of the activities inside the space. In the past, the design of university campus emphasized the physical development and open spaces such as remaining and vacant lands were considered (Wang & Chen, 2012). Actually, the green space design of the campus is as important as its architectural design. The building design and academic landscape cannot be considered as two separate activities. Designing open space by the relationship with the buildings as a complementary component is regarded one of the principles of designing the open space of the university campus (Peker, 2010). Based on the results, the close relationship of the class with the nature is considered as one of the most important features of a healthy class (Dudek, 2005). Li and Sullivan (2016) indicated that the green space in educational places has aesthetic aspect and designers should create the possibility to move, access, and view the green spaces in the educational spaces, especially in spaces with more teacher-student interaction. Nowadays, outdoor spaces in academic environments provide functions such as access to closed spaces and various buildings and the creation of relationship between them. Further, the visual function is considered as another important function, which is often overlooked and created by the outdoor environments for closed indoor spaces in order to look at outdoor spaces from the indoor spaces. Accordingly, the present study aimed to examine the effect of the type of relationship between the educational indoor closed spaces and outdoor environment of the architectural design studios on students' satisfaction since it is considered as one of the important factors in shaping the plan of the educational spaces, as well as the arrangement of closed and open spaces together based on the attention restoration theory.

2. Research Hypothesis

Among the various factors affecting the type of the relationship between the indoor space of the studio and the outdoor environment such as the level of natural light, lack of outdoor

noise, and outdoor natural landscapes, wide and open outdoor natural spaces visible from the indoor spaces is considered as the most important factor in students' satisfaction based on the attention restoration theory due to the long hours of presence and work in the studio and students' mental fatigue.

3. Background Of The Study

The attention restoration theory (ART) of Kaplan has been examined in many experimental studies and the results indicated that the natural environments significantly increase the cognitive function and attention of individuals. A large number of studies considered the attention restoration theory on adults. In the same vein, Bratman et al. (2015) indicated that adults' walking in the natural environments influences their concentration and attention improvement. Based on the results of early studies, looking at the nature or natural elements from indoor spaces is effective in improving people's concentration and attention (Holden & Mercer, 2014; Kuo, 2001; Lee et al., 2015). Further, looking at the images of nature has a positive effect on improving concentration and attention of people (Berman et al., 2008; Berto, 2005; Chow & Lau, 2015; Gamble et al., 2014; Thompson & Bendall, 2014). A limited number of studies considered the link between the attention restoration theory and educational spaces. Moreno et al. (2018) confirmed the positive effect of attending the natural environments instead of built environments on improving children's cognitive function, which is consistent with findings of some studies conducted on children's educational spaces. Wu et al. (2014) evaluated the relationship between the natural conditions around the classroom and students' performance in math and language and indicated the positive relationship between vegetation and students' academic performance. Matsuoka (2010) examined the effect of the environment around the high school, namely the amount of green space visible from the classroom and cafeteria window, size of windows, and density of green space in each section of the high school campus on the students' performance. The results indicated a positive relationship between the nature around the educational space and students' performance. Further, Li and Sullivan (2016) demonstrated the better performance in attention and concentration activities among high school students attended in classrooms with windows to the green spaces compared to the students attended in the classrooms without windows or with windows facing buildings. Another similar study indicated that the college students, facing more natural landscapes from indoor windows, scored higher on the direct concentration-required tests compared to the students facing the lower natural landscapes (Tennessen & Cimprich, 1995). In this regard, Moreno et al. (2018) restored the children's attention required for their concentration activities using attention restoration theory of Kaplan by providing software, which included natural images with the characteristics of Kaplan's theory.

There is limited studies about the effect of existence of nature in educational spaces in university.

Van Den Bogerd, et al. (2018) examined preference for university indoor and outdoor spaces with and without greenery. They showed that students gave higher preference ratings to the indoor

spaces with a nature poster, a green wall and interior plants than to the standard designs without natural elements.

Gulwadi et al. (2019) examined normalized differential vegetarian index at three spatial levels. Their correlation analysis demonstrated positive association between objective and perceived greenness and quality of life between university students.

The study results of Felsten (2009) indicated that generating indoor natural conditions such as large wall paintings of the nature in indoor spaces of academic environments creates attention restoration for students, suffering from mental fatigue. However, the appropriate views of the outdoor natural green spaces should be created as much as possible. Actually, the large wall paintings of the nature are not a substitute for outdoor natural green spaces. However, they can be used as a suitable tool in places, where it is not possible to create appropriate natural landscapes or in the seasons when the natural landscapes are not attractive.

In none of previous researches were examined the effect of views from inner to outdoor nature on university students according to their majors. Among the various educational spaces of the university environments, the architectural design studios create a lot of physical fatigue due to the long hours of students' attendance and continuous work. Accordingly, the present study selected the architectural design studios as the case study.

The present study aimed to evaluate the effect of the type of relationship between the indoor spaces of architectural design studios and the surrounding outdoor space on the students' satisfaction with an emphasis on the attention restoration theory of Kaplan. For this purpose, the students' satisfaction with the types of relationship between the indoor space and its surrounding outdoor environment and their satisfaction with each of the studios were examined. The relationship between indoor space and outdoor was defined by three factors including: level of the natural light, lack of outdoor noise, and attractiveness of outdoor visual landscapes. Among the various educational spaces of the university environments, the architectural design studios create a lot of physical fatigue due to the long hours of students' attendance and continuous work. Accordingly, the present study selected the architectural design studios as the case study. The present study aimed to evaluate the effect of the type of relationship between the indoor spaces of architectural design studios and the surrounding outdoor space on the students' satisfaction with an emphasis on the attention restoration theory of Kaplan. For this purpose, the students' satisfaction with the types of relationship between the indoor space and its surrounding outdoor environment and their satisfaction with each of the studios were examined.

4. The Attention Restoration Theory

Some functions of the outdoor spaces in the academic environments included providing the access to the closed spaces and various buildings, creating their relationship, and giving the designer the ability to create spaces for sitting, talking, and studying in the natural context in order to create the vitality and

variety in the outdoor space. In addition, the visual function is considered as another important function, which is often overlooked and less considered and created by the outdoor environments for indoor closed spaces to look at outdoor spaces from the indoor spaces. The attention restoration theory is considered as one of the theories in the landscape architecture, providing a new method to understand the cognitive mechanism. This theory is formed based on the early studies indicating the separation of attention mechanism into two components including involuntary attention, where a person's attention is captured voluntarily by attractive stimuli, and direct attention, and the individual's attention is captured to a stimulus through a controlled attention process. The distinction between the types of attention was first proposed by James (1892), and subsequent research confirmed the difference in the concentration mechanism for the voluntary and direct attention and involuntary attention (Fan, et al., 2002; Jonides, 1981). There are two processes in ART to focus attention on a stimulus by individual (Kaplan and Kaplan, 1989). These processes are selected based on the structural features of the environment. The first attention process, called direct attention, requires mental concentration since the stimulus does not capture attention or the individual should be able to distinguish the stimulus from the other types of environmental stimuli. Therefore, the constant exposure to these stimuli leads to the mental fatigue and reduced cognitive function (Kaplan, 1995). The second attention process refers to the attracting stimulus, in which the person is paying attention to the inherently intriguing stimulus without any need for mental focus and expending energy due to the inactive nature of this state of attention. Kaplan and Kaplan believed that there are inherently absorbing elements and stimuli in the natural environments, where spending time can restore the energy needed for the mental concentration. (Kaplan&Kaplan,1989)

Based on the attention restoration theory, the constant attention such as studying and working behind a desk exhausts the mind, leads to the fatigue or distraction of the mental focus, increases the mental error, and results in the irritability, distraction, bad temper, impatience, and reduced efficiency (Berman, et al., 2008). The mental fatigue is restored and improved through the natural environments, parks, and gardens. As already mentioned, based on the Kaplan's research, there are two mechanisms of attention including voluntary attention and involuntary attention. In this regard, students should focus their attention voluntarily during the classroom activities and consciously remove the distracting elements. This inhibitory mechanism causes mental fatigue after a while (Kaplan & Berman, 2010). Among these focused voluntary activities, the involuntary attention of individual is activated by a window, which opens to the natural space in the classroom. After a short time, the voluntary inhibitory mechanism is rested and the student's ability to focus attention is restored and improved (Li & Sullivan, 2016). It was once thought that the windowless classrooms are more useful for students' focus and attention. However, the windowless environments had no positive effect on improving student's performance (Holden & Mercer, 2014). The attention restoration theory (ART) of Kaplan and Kaplan is an appropriate practical model for reducing stress and anxiety in urban environments away from the nature. Accordingly, the landscape in the educational

campuses should not only be seen from the green and beauty perspective. However, the importance of the natural landscapes for students' health and attention restoration should be considered (Akpinar, 2016). According to Kaplan, the natural environments have a soft fascination feature, which automatically and simultaneously attracts attention and generates a sense of pleasure in the viewer (Pearson and Craig, 2014).

The mental fatigue related to the constant focus and working behind the desk is higher in educational spaces such as architectural design studios, where students work and spend more time. The research hypothesis, formed based on the ART, is that the mental fatigue is improved to some extent through the surrounding natural environments and the possibility of looking at outdoor spaces with a pause from the indoor closed spaces. The natural environments next to the closed spaces should have specific characteristics in order to create mental liberation and expansion of the mind. The landscape should be wide and open and its end should not be visible as soon as observed. The minimum opening in the landscape should be in such a way that it can create a deliberate pause in the mind to get rid of the preoccupation with the subject and the previous user in the architecture and should not be immediately occupied by the new subject or user. The amount of keeping the mind away from the current situation and relieving its fatigue is directly related to the extent of the opening or the extent of the field of view. The breadth of the landscape to the extent which end is not visible quickly is enough to relieve mental fatigue from before and after preoccupations.

5. Methodology

In the present mixed-method study, the field data were collected by observing and completing the questionnaire. The characteristics of the studio outdoor openings were recorded through the observation and measurements. A questionnaire with open-ended and close-ended questions was used to examine the students' satisfaction level and the relationship between the architectural design studios and their neighboring outdoor space. The qualitative data obtained from the open-ended questions were coded and analyzed by SPSS software along with the data obtained from the closed-ended questions.

Three architectural design studios of the Babol Noshirvani university of technology were selected as the case study that all the practical lessons of bachelors' students were held on these studios (see Figure 1). Given that none of these studios had a direct access to the outdoor environment, the students' satisfaction with the level of the natural light, lack of outdoor noise, and attractiveness of outdoor visual landscapes was questioned. Further, the students were asked to prioritize these three studios based on their satisfaction level with the three factors and express the factors influencing their satisfaction and dissatisfaction in the open-ended question. The openings of the three studios were also examined and analyzed in terms of quantitative dimensions.



Figure 1 Situation of the studios in the university campus

The population was included 65 students majoring in architectural engineering including 19 freshmen, 28 juniors and 18 senior students. These respondents were selected because of their experiences of more than 3 hours' class in all three studios. They were in the range of age 18-21; 24% male and 76% female.

Given that none of these studios had a direct access to the outdoor environment, the students' satisfaction with the level of the

natural light, lack of outdoor noise, and attractiveness of outdoor visual landscapes was questioned.

The variables examined were included: independent variable (students' satisfaction level) and dependent variables (level of the natural light, lack of outdoor noise, and attractiveness of outdoor visual landscapes). The students' satisfaction level was examined through these three factors with questionnaire.

Further, the students were asked to prioritize these three studios based on their satisfaction level with the three factors and express the factors influencing their satisfaction and dissatisfaction in the open-ended question. Further, the openings of the three studios were examined and analyzed in terms of quantitative dimensions.

6. Data Analysis

The present study aimed to examine the satisfaction level of students when attending architectural studios with several variables including the level of natural light, lack of outdoor noise, and outdoor natural landscapes, which measured students' satisfaction with the type of light, sound, and visual relationship between the indoor space and outdoor environment in the studio, respectively. The present study examined three architectural design studios of the university on the ground floor as a case study. The studio 1 has wide north and south windows, providing the visual view to the green spaces of the university on both sides. Further, it is located next to the entrance of the building on the south side, where students gather there and make noise during the day. The studio 2 has two windows on the south side, which is open to the entrance of the building, which is a place for students to stop and a green landscape is visible. The studio 3 is located with a distance from the entrance of the building and has a west window with a view to the wall of building and a north window with a view to the back of the building that is not designed and the surrounding buildings are visible. Table 4 represents the characteristics of the windows in all three studios such as the number of window, sides of the placement of the openings, the area of the windows, OKB and height of the windows, the ratio of the opening area to the wall area, and the use of the outdoor space next to the windows. The simulation has been done in parametric CAD environment of the Rhino/Grasshopper software with the ladybug environmental simulation analysis. Ladybug imports standard EnergyPlus Weather files (. EPW) in Grasshopper and allows users to work with validated energy and daylighting engines such as EnergyPlus, RADIANCE and DAYSIM. (Roudsari, M.S et al., 2013) daylighting analyzes results of these three studio has been indicated in table 1.

Using the descriptive statistics of SPSS software frequency and percent of students', satisfaction level of three variables of each

studio was evaluated (level of the natural light, lack of outdoor noise, and attractiveness of outdoor visual landscapes).

The results indicated that 84% of students reported their satisfaction with the level of natural light as desirable in the studio 1. In the studio 2, 66% reported the level of natural light as desirable and 34% as low light, and no one considered the light to be high. However, only 22% considered the light of the studio 3 as desirable and 78% as low light.

Further, the students' satisfaction with the lack of outdoor noise during the working hours in architectural studios was considered. Based on the results, 19% of students were satisfied with the lack of outdoor noise in the studio 1, 66% were somewhat satisfied, and 16% were dissatisfied. Regarding the studio 2, 13% were satisfied with the lack of outdoor noise during the working hours, 56% were somewhat satisfied, and 31% were dissatisfied. In addition, 38% were satisfied with the lack of outdoor noise in the studio 3, 44% were somewhat satisfied, and 19% were dissatisfied.

Furthermore, the results of examining the satisfaction level of students with the visual relationship of studios with the outdoor environment indicated that in the studio 1, 75% of the students were satisfied with the outdoor natural landscapes, 22% were somewhat satisfied, and only 3% were dissatisfied. In the studio 2, 9% were satisfied with the outdoor natural landscapes, 75% were somewhat satisfied, and 16% were dissatisfied. Additionally, in the studio 3, 6% were satisfied with the outdoor natural landscapes, 19% were somewhat satisfied, and 75% were dissatisfied.

The students were asked to prioritize the studios based on the sound (lack of outdoor noise), light (the level of natural light), and visual (outdoor natural landscapes) relationship with the outdoor environment. The results were investigated using the descriptive statistics of SPSS software. The results indicated that 91% considered studio 1 as the first priority, 91% considered studio 2 as the second priority, and studio 3 was the third priority among 91% of students (Figure 2)

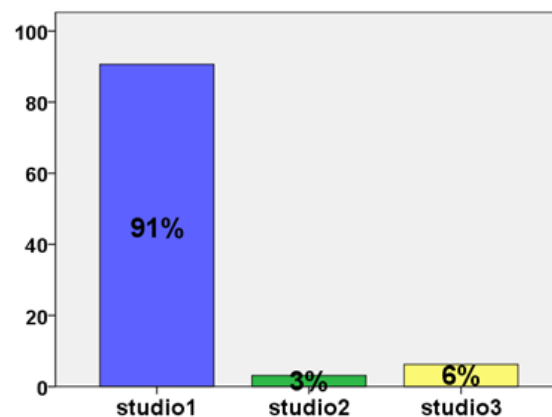



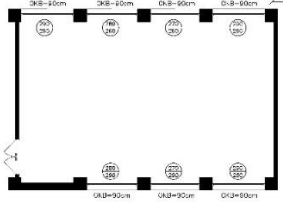
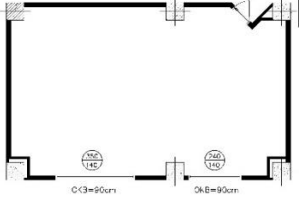
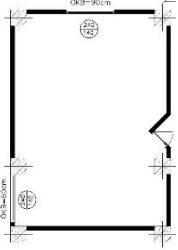
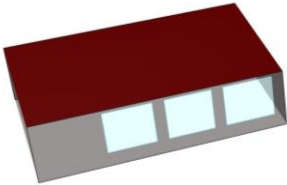
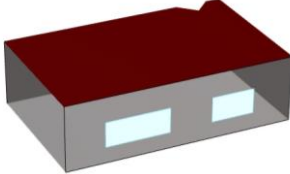
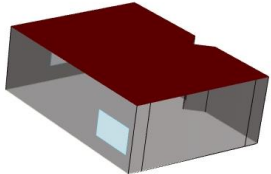


Figure 2 The first priority of three architectural design studios

Table 1 The specifications of the windows in the studio 1, 2, and 3

	Studio 1	Studio 2	Studio 3	
picture				
Plan				
Dimensions of space	14 * 8.5 m	12.4 * 7.6 m	10.6 * 7.6 m	
Height of space	3.5 m	3.5 m	3.5 m	
windows	Number Of each side	4 northern 3 southern	2 southern	1 northern 1 western
	area	29.6 m ² northern 22.2 m ² southern	8.4 m ² southern	3.3 m ² northern 3.3 m ² western
	Next function	Side passage space - green space Main passage space - green space	Main passage space - green space	Unplanned landscape from the behind buildings
	OKB	0.9 m	0.9 m	0.9 m
	Height	2.6 m	1.4 m	1.4 m
	Modeling picture For daylighting analysis			
illuminance values (lux)	May (Ordibehest)	2348.278	749.339	383.874
	August (Mordad)	2218.055	665.903	374.379
	November (Aban)	2620.316	1079.76	231.704
	February (Bahman)	1516.424	590.52	166.158

The students were asked to respond the open-ended questions in relation to the factors influencing their satisfaction and dissatisfaction with the outdoor environment from each studio. The results indicated that 73% of students stated the effect of landscape and good green space next to the studio 1 on their satisfaction and only 9% of the students mentioned the natural light. In addition, 18% of the students expressed their dissatisfaction with the outdoor noise in the studio 1.

These results are more varied in studio 2 since the students expressed several factors. In this regard, 26% stated the effect of good landscape of the studio on their satisfaction. However, the rest of the students only mentioned the reasons for their dissatisfaction with the studio 2 including 32% high noise, 16% window shortage and outward view, 11% lack of green space, 11% simultaneous access of facilities and services to the side of the building, and 5% lack of natural light

The results of evaluating the students' satisfaction and dissatisfaction with the architectural design in studio 3 indicated that most of the students only referred to their dissatisfaction factors. In the same vein, 64% of the students stated that the bad class vision to the abandoned and unplanned building spaces influences their dissatisfaction with the studio 3. Further, 23% expressed low windows and 9% considered high noise as the factors influencing their dissatisfaction.

The existence of a linear relationship between the independent variable (students' satisfaction level) and the dependent variables (level of the natural light, lack of outdoor noise, and attractiveness of outdoor visual landscapes) was examined with Beta coefficient. The Spearman correlation test was then used to measure the correlation between the variables. Accordingly, there was no significant linear relationship between light and students' satisfaction with the studio 3 and this variable was not examined in the correlation tests (Table 2)

Table 2 The beta coefficient to measure the existence of a linear relationship between the dependent variables and the level of satisfaction with studios

	Beta coefficient	Sig.
Satisfaction with the light in studio 3	-0.042	0.792
Satisfaction with the lack of outdoor noise in studio 3	-0.305	0.008
Satisfaction with the visual vision in studio 3	0.731	0.000
Satisfaction with the light in studio 1	4.467	0.000
Satisfaction with the lack of outdoor noise in studio 1	-2.921	0.007
Satisfaction with the visual vision in studio 3	-5.408	0.000

Given the ranking of independent and dependent variables, the Spearman correlation test was used to significantly measure the correlation between the variables. As indicated in Table 2, the negative correlation coefficient (-0.594) between the satisfaction level with the visual view to outdoor in the studio 1 and the selection of the most satisfactory studio demonstrated that their selection of the most satisfying studios reduced from the studio 1 to studio 3 when the students' opinions changed from the dissatisfaction towards the complete satisfaction with the view to outdoor. Therefore, the studio 1 was selected as the most satisfactory studio among three studios in terms of the view to outdoor.

The negative correlation coefficient of (-0.558) between the level of satisfaction with the lack of outdoor noise in studio 1 and selecting the most satisfactory studio indicated that most of students selected the studio 1 as the most satisfactory studio among three studios in terms of the lack of outdoor noise. Accordingly, the appropriate view to outdoor and lack of outdoor noise were considered as the factors influencing the selection of studio 1 as the most satisfactory studio, respectively. Further, despite the students' satisfaction with the level of daylighting in the studio 1, this variable was not considered as an effective factor in their selection of the studio 1 as the most satisfying studio. Therefore, the appropriate view to outside significantly influenced students' choice (Table 3).

Table 3 The Spearman correlation coefficient between the studied variables in the studio 1 and the selection of the most satisfying studio

The most satisfying studio	Spearman correlation coefficient	Satisfaction with the light of the studio space 1	Satisfaction with the lack of outdoor annoying noise in the studio space 1	Satisfaction with the space visual view to outside in the studio 1
		0.319	-0.558	-0.594
	Sig.	0.076	0.001	0.000

As already mentioned, the light variable in studio 3 was not examined in the correlation test due to the lack of its linear relationship with the satisfaction with the studios. As shown in Table 3, a positive correlation ($r=0.633$) between the satisfaction with the visual view to outdoor in the studio 3 and the selection of the most satisfactory studio indicated that the high selection of the most satisfying studio increased from studio 1 to studio 3 when the students' opinions changed from dissatisfaction to the full satisfaction with the view to outdoor. Namely, the students chose studio 3 as the most dissatisfying studio in terms of the lack of visual view to the outdoor space.

Further, the negative correlation ($r=-0.488$) between the satisfaction with the lack of outdoor noise in the studio 3 and

selecting the most satisfactory studio demonstrated that the greatest selection of the most satisfying studio reduced from studio 1 to studio 3 when the students' opinions shifted from dissatisfaction to the satisfaction with the lack of outdoor noise. Accordingly, the studio 3 was highly chosen as the most dissatisfying studio among the three studios. (Table 4).

Based on the results, there is a significant positive relationship between the selection of studio 3 as the most unsatisfactory studio and the dissatisfaction with the appropriate visual view to outdoor in studio 3. In addition, although the students expressed their satisfaction with the lack of outdoor noise in the studio 3, this variable was not considered as an effective factor in their satisfaction with this space.

Table 4 The Spearman correlation coefficient between the studied variables in the studio 3 and the selection of the most satisfying studio

		Satisfaction with the lack of outdoor annoying noise in the studio space 3	Satisfaction with the space visual view to outside in the studio 3
The most satisfying studio	Spearman correlation coefficient	-0.488	0.633
	Sig.	0.005	0.000

7. Conclusion

The present study aimed to evaluate and compare the students' satisfaction with the type of relationship between the indoor space of studios and the outdoor environment in three architectural design studios. The studios had relatively similar areas and geometric shapes and the type of their relationship with the outdoor environment including the dimensions, side of the placement of the openings, and their proximity to the outside was different. The type of the relationship of studios with the outdoor environment refers to the factors influencing the students' satisfaction with the level of the natural light, the lack of outdoor noise, and the outdoor natural landscapes in the studios. Based on the results, students had the highest satisfaction level with the natural light in studio 1, which had the highest opening area compared to the wall area. The students' satisfaction with the natural light of studio 2 was much more than that of studio 3 since 66% of students considered the level of natural light in studio 2 as desirable, while only 22% considered the level of natural light in studio 3 as desirable. However, the ratio of the opening area to the wall was similar in these two studios (Table 1) and both of the studios had two windows with relatively similar area. Further, the side of the placement of the openings was different in these two studios. In studio 3, the openings are located on the north and west sides, where less light enters into the indoor space compared to the south side, and the low distance between the wall with opening and the opposite building creates shadow on the window. The difference between the level of daylighting in these two studios was indicated in table 1. Therefore, the side of the placement and the amount of shading of the openings are considered, leading to the different results in the level of the same openings in a space in terms of the level of natural light entering.

Further, the students' satisfaction level with the lack of outdoor noise in the design studio space was measured. Based on the results, the highest dissatisfaction rate in studio 2 was 31%, the openings of which are located beside the stop space of the entrance of the building and the students gather there at various times for their social activities.

Another factor considered in this research was the students' satisfaction with the outdoor natural landscapes in studios. The results indicated that 75% of students were satisfied with the outdoor natural landscapes in studio 1, 75% were somewhat satisfied with the outdoor natural landscapes in studio 2, and 75% were dissatisfied with the outdoor natural landscapes in studio 3. It is worth noting that there is a significant difference in the satisfaction with the outdoor natural landscapes in studios 1 and 2 although both of these spaces were adjacent to the designed green spaces. This difference is related to the open and closed view in the studios 1 and 2. Based on the attention restoration theory of Kaplan, the natural environments next to the closed spaces should be wide and open and not limited in order to gain the liberation of mind during the continuous activities indoors, which has been tangible in the landscapes of the studios 1 and 2. The designed natural landscape next to the studio 1 is wide and open and the distance from the wall with the opening to the next building is far greater than the distance from the openings to the next wall in the studio 2. This factor can increase the students' satisfaction with the landscapes of the studio 1. The other difference between studio 1 and studio 2 is that, there are two sides windows in studio 1 in north and south, but the studio 2 only has one side windows in south. This factor could effect on satisfaction level of students from view to natural outside. In studio 2 when students seat in their chair only a little of them can see the outer nature from one side windows but in

studio 1 because of two sides bigger windows a lot of students in many parts of studio have good view from windows.

Further, the present study identified the various factors influencing the students' satisfaction and dissatisfaction with each of these studios. In this regard, the open-ended questions were asked from students and their answers were coded. Based on the results, the students considered the good view and the green space next to the studio 1 as the most influential factor in their satisfaction, and only 18% of the students mentioned outdoor noise as an important factor in their dissatisfaction. Further, 64% expressed the bad view of the classroom to the abandoned and unplanned spaces as the most important factor influencing their dissatisfaction with studio 3. Despite the high statistical results in the dissatisfaction with the lack of natural light, only 5% mentioned the lack of natural light. Accordingly, between two factors: "lack of outdoor noise" and "attractiveness of outdoor visual landscapes" the latter is more important in satisfaction level of students from architectural studio. Also between the factors of "level of natural light" and "attractiveness of outdoor visual landscapes" the latter is more important in satisfaction level of students. These could be explained with respect to the long hours of attending studios and students' mental fatigue according to Attention restoration theory. Accordingly, the most important factor influencing students' satisfaction and dissatisfaction with the three studios is the presence or absence of open natural views designed next to their studios. In total, 91% of students chose studio 1 with good natural landscapes and view as the best studio for architectural design courses, and their lowest selection was studio 3 due to its unplanned and bad view as the most important factor affecting their dissatisfaction.

Finally, "the open and wide view to natural landscape", is considered as the most important factor among those influencing the type of the relationship between an architectural design studio and outdoor environment ("lack of outdoor noise", "attractiveness of outdoor visual landscapes" and "level of natural light") due to the long hours of attending studios and students' mental fatigue. Therefore, it is necessary to pay more attention to the natural landscape design next to the closed spaces in the academic environments, especially in spaces, such as studios, where students spend more time there.

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