2008-5435/14/63-136-144
INTERNATIONAL JOURNAL OF OCCUPATIONAL HYGIENE

IJOH 8: 136-144, 2016

ORIGINAL ARTICLE

The Effects of Physical Agents on Occupants' Satisfaction in Office Environment

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Received May 17, 2016; Revised May 27, 2016; Accepted July 13, 2016

This paper is available on-line at *http://ijoh.tums.ac.ir*

ABSTRACT

Employees' satisfaction based on their physical environment is an important factor that can improve employees' performance, job satisfaction, and organizational productivity in office buildings. Occupants' environmental satisfaction are related to 10 different characteristics, including thermal comfort, air quality, lighting, acoustic quality, office layout, workspace furnishing, cleanliness and maintenance, safety and security, connection with the outdoors, and location and planning of workflow. Therefore, this study aimed to identify the environmental characteristics that influence the occupants' satisfaction. The aforementioned characteristics were comprehensively evaluated in 10 different municipal office buildings in Shiraz City, Iran, in 2013. Evaluating the results of questionnaire in this field, the study showed the occupants' levels of satisfaction with physical environmental characteristics, while highlighting the relationship between physical environmental components and occupants' satisfaction. In addition, connection with the outdoors, acoustic quality, location, planning of workflow, safety, and thermal comfort are the factors that impose over half of the influence on occupants' satisfaction.

KEYWORDS: *Indoor, Environment, Quality, Occupant, Satisfaction, Office, Workplace*

INTRODUCTION

The physical features of the office environment, i.e., lighting, temperature, noise, and view have a significant effect on the behavior, health, satisfaction, performance, perception, and efficiency of worker [1-6]. In recent decades, health, and satisfaction of employees affected by their physical office environment were examined [7-9]. The provision of comfortable and quality environments that promote the satisfaction of their occupants reported using self-estimated job performance in office buildings, has been an important subject for many researchers [10-13]. In fact, indoor environmental quality (IEQ) has an effect on the duration and frequency of worker absenteeism, their intention to quit their current job, and the levels of organizational productivity [14-15]. On the other hand, a well-designed workplace can remove potential stressors and causes of dissatisfaction, helping occupants to focus on increasing their effectiveness and productivity [16]. The quality of working life (QoWL) is one of the important factors for all managers related to some features, such as safety, satisfaction, mental health, to name a few [17]. Satisfaction has a firm connection to QoWL, directly or indirectly. Therefore, occupant satisfaction is an important and fundamental factor in designing buildings. A better-designed office environment can, on average, improve organizational productivity by 21% [18]. The existence of environmental satisfaction for one group of occupants will not necessarily result in another group's satisfaction; because, the existence

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of which depends on numerous factors.

There is an inter-relationship between the physical elements of office environments and employee attitudes, behaviors, satisfaction, and performance [19-20], a few were not able to verify such an inter-relationship [21].

There are some different physical agents in offices, which one of them is noise pollution. This factor makes some side effects, i.e., arousing the nervous system, anxiety, lowering work performance, and noise-induced hearing loss [22]. Undoubtedly, the mentioned effects cause dissatisfaction, too. The effects of sound were investigated on occupant productivity and evaluated the relationship between changes in office productivity and noise sources alongside four other factors: temperature, air quality, office layout, and lighting [23]. Differences were examined in indoor air quality (IAQ), temperature, and lighting between various office types, and determined their effects on environmental satisfaction and the performance of their occupants [24].

Heat stress is known as physical agents related to some factors such as clothing, work demands, and environmental conditions [25]. A field study was conducted to recommend environmental factors for workplace interaction purposes, including sharing information, making decisions, resolving problems, creating ideas, and socializing. They identified the following factors whose provision was necessary in workplaces: the possibility of controlling temperature and air quality, access to adequate daylight and the possibility of controlling it, good acoustic conditions to eliminate the transmission of sound between various spaces, well-designed and flexible furniture, access to essential basic equipment and accessories, sufficient space to move around inside and outside, a suitably sized and shaped workspace, ease of routing, and the clear labeling of rooms [26].

In 2007, the Cost-effective Open-Plan Environments (COPE) field study, using survey data from 779 participants in nine buildings, was conducted to prove how environmental satisfaction contributed towards well-being. Throughout this survey, a relationship model was provided to show the link between four physical factors, i.e., lighting, privacy, acoustics and ventilation, and overall environmental satisfaction, which in turn could predict the occupants' job satisfaction [27-28].

The aim of this research was to clarify which characteristics of the physical office environment have the highest effect on the occupants' satisfaction. Therefore, these questions will be examined.

- How satisfied are the occupants with their physical office environment?
- Which characteristics of the physical office environment have an influence on the occupants' overall satisfaction?

The levels of occupant satisfaction with the office's physical characteristics have an influence on their overall satisfaction. Accordingly, the following hypothesis is stated. "The level of the occupants' overall satisfaction could be affected by the physical characteristics of their office buildings". Furthermore, proper job design has a prominent effect on quality of life [17] in which satisfaction based on environmental agents plays an important role.

To assess the effects of the physical office environment on the occupants' satisfaction in 10 different municipality buildings in the Shiraz City, Iran, in 2013, this research was conducted following four main steps (Fig.1).

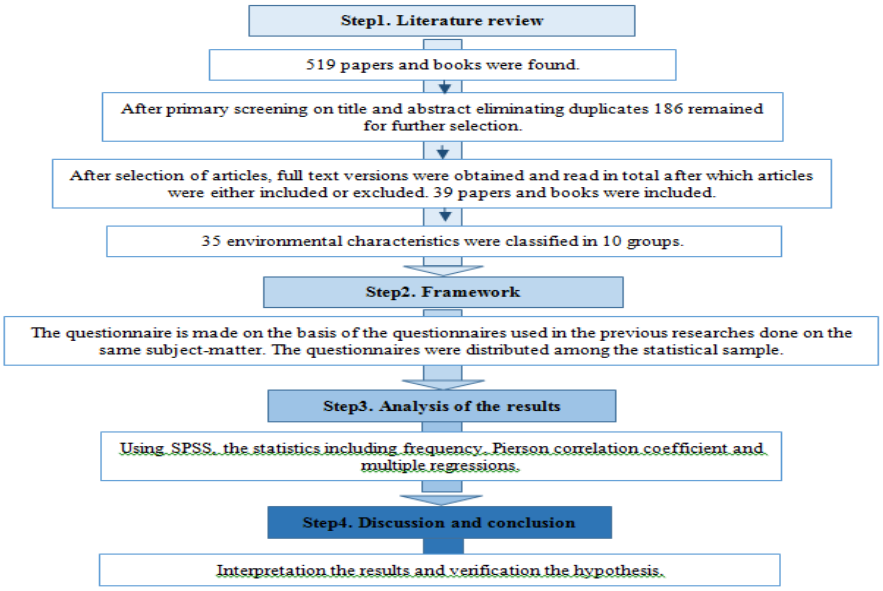

Fig.1. Flowchart of the research process

Published online: September 25, 2016

In step 1, the literature relevant to the office environment was reviewed to identify the different groupings of physical characteristics of office environments. More specifically, these documents were chosen through searching keywords. Thirty-five environmental characteristics have been extracted and classified into 10 main groups (Table 1).

Table 1. Environmental characteristics and their references and grouping

Group	Code	Environmental Characteristic	Reference
Air Quality (AQ)	AQ1	Indoor air quality (stuffy air, cleanliness, smell, etc.)	[15, 20, 29, 32]
	AQ2	Ventilation (natural ventilation, evaporative coolers, etc.)	[9, 15, 20, 30, 33]
Thermal Comfort (TC)	TC	Room temperature	[9, 15, 20, 31, 34]
Lighting (L)	L1	Amount of artificial lighting (quality, light intensity, etc.)	[9, 15, 33]
	L2	Visual comfort of task/overhead lighting (glare, reflections, contrast etc.)	[9, 20, 33]
	L3	Amount of natural lighting	[9, 20, 33]
Acoustic Quality (AcQ)	AcQ1	Noise level	[9, 15, 31]
	AcQ2	Sound privacy (conversational privacy)	[9, 15, 31]
Office Layout (OL)	OL1	Size of office/workstation and working space	[9, 20, 33]
	OL2	Visual privacy (comfort working with confidential materials)	[9, 15, 31]
	OL3	Ability to focus on individual work (degree of enclosure of workstations)	[9, 15, 35]
	OL4	Availability of space to support scheduled face-to-face interactions with others (scheduled meetings, briefings, training, etc.)	[9, 20, 31]
	OL5	Availability of space to support unscheduled, face-to-face interaction with others (impromptu conversations, informal meetings, etc.)	[9, 20, 31]
	OL6	Proximity to colleagues to support face-to-face interaction with others	[9, 31, 35]
	OL7	Ease of accessing to supervisors	[9, 20, 31]
	OL8	Ease of accessing to colleagues in your immediate team/working group/unit/functional area	[9, 20, 31]
	OL9	Space for communication with clients at workstation	[9, 31, 35]
	OL10	Personalization (ability to change office/workstation to do works)	[9, 31, 35]
Office Furnishing (OF)	OF1	Seating comfort and adjustability	[9, 20, 31]
	OF2	Furniture size and adjustability	[15, 20]
	OF3	Storage space	[9, 20, 31]
	OF4	Floor covering	[20]
	OF5	Colors and texture	[15]
	OF6	Arrangement of furnishings and equipment	[20]
	OF7	Height of workstation partitions	[20]
	OF8	Shape of workstation partitions	[20]
Cleanliness and Maintenance (CM)	CM1	Hazard-free environment	[9, 15, 20, 31]
	CM2	Cleanliness of equipment	[9, 15, 20, 31]
	CM3	Restrooms (access to restrooms nearby, number, etc.)	[9, 15, 20, 31]
Safety and Security (SS)	SS1	Physical security (safe workplaces without accentual events)	[20]
	SS2	Emergency detection (e.g. smoke detector, sprinkler, emergency exit, etc.)	[20]
Connection with Outdoor (CO)	CO1	Visual connection to outside windows	[20]
	CO2	Accessing to green space	[34]
Location and Planning of workflow (LP)	LP1	Location of office/workstation in building	[20]
	LP2	Ease of navigation	[20]

In step 2, the research questionnaire has been prepared based on questionnaires [9, 15, 20], under the supervision of two professors from the Departments of Architecture and Psychology. The questionnaires incorporated five questions in two main subsections: "Respondent demographics", with four questions, and "Occupants' IEQ evaluation", with one question. In the first part, the individuals were classified in terms of age, gender, work categories, and workplace type. The second part was designed in the form of a test of 35 questions, which investigated the occupants' satisfaction level based on the physical conditions of their workplaces. In Oct 2015, the questionnaires were distributed among 196 participants in total whom being employees of municipality. Finally, 152 fully answered questionnaires, out of 196, were collected (a return rate of 77.0%).

In step 3, the occupants' satisfaction level has been measured using the self-evaluation reports and comments. The dependent variable is the occupants' environmental satisfaction level and the independent variables are the aforementioned physical characteristics of the office environment extracted from the literature. The occupants' satisfaction level is graded on a five-point Likert scale. The scale ranges from "very satisfied" to "not at all satisfy". To assess the possible influence of the physical characteristics of the office environment on the occupants' overall satisfaction

the Stepwise Multiple Regression is used. The relationship between the study's variables was examined before regression analysis was carried out. Therefore, the coefficient was estimated using Pearson Correlation. After examining and calculating the assumptions, regression analysis was performed.

Finally, step 4 is allocated for interpreting the results and, accordingly, the verifying the hypothesis.

RESULTS

Respondent demographics: Overall, 152 fully answered the questionnaire. Tables 2 to 5 present the demographics of the subjects including gender, age, work categories, and workplace types. As Table 2 illustrates, 67.1% of the participants are male and 32.9 % are female. Table 3 shows that the participants' age ranges from 20 to 60 yr.

According to the respondents' answers, 17.8% of the participants are managers and supervisors, 65.8% are professional employees, and 16.4% are technical workers (Table 4). The respondents work in shared rooms (44.1%), high-cubicle offices (17.7%), closed private offices (15.8%), low-cubicle offices (13.2%), and bullpen spaces (9.25%) (Table 5).

Table 2. Respondents' demography (gender)

Gender	Frequency	Percent
Male	102	67.1
Female	50	32.9
Total	152	100

Table 3. Respondents' demography (age)

Age (yr)	Frequency	Percent
< 30	58	38.2
31 – 40	56	36.8
41 – 50	28	18.4
> 51	10	6.6
Total	152	100

Table 4. Respondents' demography (work categories)

Work category	Frequency	Percent
Managerial	27	17.8
Professional	100	65.8
Technical	25	16.4
Total	152	100

Table 5. Respondents' demography (workplace types)

Workplace type	Frequency	Percent
Shared-room	67	44.1
Low-cubicle office	27	13.2
High-cubicle office	20	17.7
Private office	24	15.8
Bullpen	14	9.2
Total	152	100

Office environment and satisfaction: Table 6 shows the employees' responses about their level of satisfaction with their office environment. Here, the sum of percentages of "very satisfied", "satisfied", and "somewhat satisfied" answers are considered as the total percentage of the level of "satisfaction", whereas answers of "somewhat dissatisfied" and "not at all satisfied" contribute to the "dissatisfaction" level.

In the "air quality" group, respondents are generally satisfied with indoor environment quality (IAQ) (63.1%) and ventilation (61.2%). They are also satisfied with the temperature of workplaces (62.5%), applicable to the "thermal comfort" group. The occupants are satisfied with the three factors listed in the "lighting" group. The "amount of artificial lighting in workstations" represents the highest satisfaction level (74.3%) in this category (Table 6).

Occupants are dissatisfied with "noise level" (54.6% dissatisfaction) and "sound privacy" (66.5% dissatisfaction), listed in the "acoustic quality" group. The respondents have complained about "visual privacy" (55.2%) and the ability to work on confidential documents without any distraction as listed in the "office layout" group, which involved 10 characteristics.

Spaces supporting scheduled interactions (such as meeting rooms) are somewhat more represented than the unscheduled face-to-face ones. The respondents have a large level of satisfaction with their proximity to colleagues, which supports informal interactions (76.3%). They are satisfied with access to supervisors (76.3%) and colleagues (85.5%). Personalization, or the ability to adapt the environment according to demand or individual identity, is the characteristic that led to the most respondent dissatisfaction (64.4%).

The respondents are satisfied with all factors relevant to the "office furnishing" group, except for furniture adjustability (61.2% dissatisfaction). The cleanliness and maintenance of spaces and equipment, as well as the number of toilets and their location in the office building, are factors with which occupants report being sufficiently satisfied. The office environment is adequately safe, posing no accidental risk (68.4%).

They are nearly satisfied with the amount of green space (53.3%) and visual connection to outside windows (59.9%). Respondents were also satisfied with the location of their workstations in office buildings (54.6%) and the ease of navigation for communication with other sections (63.7%).

Among the 35 items of IEQ, five earned the highest level of occupant satisfaction: "ease of access to supervisors" (85.5%), "ease of access to colleagues in functional areas" (80.2%), "availability of space to support scheduled face-to-face interactions with others" (76.3%), "amount of artificial lighting" (74.3%), and "visual comfort of task/overhead lighting" (73.7%). However, the five

following items represent the highest level of dissatisfaction among the respondents: "sound privacy" (66.5%), "personalization" (64.4%), "furniture adjustability" (61.2%), "visual privacy" (55.2%), and "noise level" (54.6%). Finally, the occupants' overall satisfaction with their physical working environment is 55%, indicating a relative environmental desirability.

Table 6. Examination of the level of occupants' satisfaction in terms of equipment and facilities of their office environment

Answer options	Amount of satisfaction											
	Not satisfied at all		Somewhat dissatisfied		Somewhat satisfied		Satisfied		Very Satisfied		Total dissatisfied	Total satisfies
	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	Percent	Percent
AQ1	27	17.8	29	19.1	49	32.2	42	27.6	5	3.3	39.6	63.1
AQ2	38	25.0	21	13.8	47	30.9	38	25	8	5.3	46	54
TC	26	17.1	31	20.4	54	35.5	32	21.1	9	5.9	37.5	62.5
L1	12	7.9	27	17.8	48	31.6	54	35.5	11	7.2	25.7	74.3
L2	12	7.9	28	18.4	61	40.2	42	27.6	9	5.9	26.3	73.7
L3	28	18.4	15	9.9	50	32.9	45	29.6	14	9.2	28.3	71.7
AcQ1	47	30.9	36	23.7	39	25.7	20	13.2	10	6.6	54.6	45.4
AcQ2	61	40.2	40	26.3	23	15.1	21	13.8	7	4.7	66.5	33.5
OL1	28	18.4	28	18.4	57	37.5	27	17.8	12	7.9	36.8	63.2
OL2	47	30.9	37	24.3	37	24.3	24	15.8	7	4.7	55.2	44.8
OL3	39	25.7	36	23.7	46	30.3	21	13.8	10	6.6	49.4	50.6
OL4	30	19.7	36	23.7	47	30.9	27	17.8	12	7.9	43.4	56.6
OL5	29	19.1	50	32.9	45	29.6	24	15.8	4	2.6	52	48
OL6	13	8.6	23	15.1	52	34.2	56	36.8	8	5.3	23.7	76.3
OL7	13	8.6	9	5.9	31	20.4	62	40.8	37	24.3	14.5	85.5
OL8	7	4.7	23	15.1	42	27.6	59	38.8	21	13.8	19.8	80.2
OL9	27	17.8	42	27.6	44	28.9	33	21.7	6	3.9	45.4	54.6
OL10	65	42.7	33	21.7	27	17.8	17	11.2	10	6.6	64.4	35.6
OF1	31	20.4	21	13.8	51	33.5	35	23	14	9.2	34.2	65.8
OF2	57	37.5	36	23.7	34	22.4	19	12.5	6	3.9	61.2	38.8
OF3	39	25.7	29	19.1	41	27.0	28	18.4	15	9.9	44.8	55.2
OF4	27	17.8	37	24.3	51	33.5	33	21.7	4	2.6	42.1	57.9
OF5	41	27.0	32	21.1	56	36.8	18	11.8	5	3.3	48.1	51.9
OF6	37	24.3	39	25.7	46	30.3	18	11.8	12	7.9	50	50.0
OF7	27	17.8	32	21.1	48	31.6	32	21.1	13	8.6	38.9	61.1
OF8	32	21.1	29	19.1	45	29.6	32	21.1	14	9.2	40.2	59.8
CM1	21	13.8	29	19.1	50	32.9	39	25.7	13	8.6	32.9	67.1
CM2	20	13.2	30	19.7	56	36.8	29	19.1	17	11.2	32.9	67.1
CM3	41	27.0	31	20.4	51	33.5	21	13.8	8	5.3	47.4	52.6
SS1	18	11.8	30	19.7	53	34.9	45	29.6	6	3.9	31.5	68.5
SS2	53	34.9	29	19.1	44	28.9	16	10.5	10	6.6	54	46.0
CO1	38	25.0	23	15.1	32	21.1	35	23	24	15.8	40.1	59.9
CO2	27	17.8	44	28.9	48	31.6	24	15.8	9	5.9	46.7	53.3
LP1	36	23.7	33	21.7	39	25.7	33	21.7	11	7.2	45.4	54.6
LP2	23	15.1	32	21.1	49	32.2	42	27.6	6	3.9	36.2	63.8
Overall Satisfaction	40	26.3	28	18.4	52	34.2	24	15.8	8	5.3	44.7	55.3

Table 7 and 8 present the possible influence of the physical characteristics of the office environment on the occupants' overall satisfaction. The results are indicative of a relationship between the variables and are represented by large correlations in some cases (Table 7). This point emphasizes that "collinearity", as a state of very high inter-correlations or inter-associations between the independent variables should be analyzed prior to carrying out regression analysis. The assumption variables that are predictors of non-collinearity are studied using the two indicators of Variance Inflation Factor (VIF) and Tolerance Parameter, where the existence of collinearity is shown. Therefore, all components have simultaneously entered the influence equations on overall satisfaction. In order to undertake the analysis without the collinearity phenomenon, "office furnishing" and "cleanness and maintenance", as they have high correlation with others and thus result in multi-collinearity, are to be excluded from the regression equation. After examining and calculating the assumptions, regression analysis has been performed (Table 8).

Published online: September 25, 2016

Table 7. The zero-order correlations of the variables

	Overall Satisfaction	TC	AQ	L	AcQ	OL	OF	CM	SS	CO	LP
Overall Satisfaction	1										
TC	.529**	1									
AQ	.673**	.769**	1								
L	.586**	.680**	.656**	1							
AcQ	.592**	.591**	.604**	.581**	1						
OL	.657**	.652**	.702**	.687**	.747**	1					
OF	.799**	.664**	.750**	.666**	.705**	.813**	1				
CM	.722**	.655**	.702**	.723**	.621**	.680**	.802**	1			
SS	.692**	.678**	.743**	.662**	.632**	.682**	.769**	.785**	1		
CO	.702**	.592**	.622**	.697**	.602**	.619**	.737**	.702**	.645**	1	
LP	.684**	.534**	.641**	.574**	.541**	.623**	.785**	.701**	.703**	.618**	1

Table 8. Overall satisfaction regression on the physical characteristics of the office environment

Coefficients [a]					
Model	**Standardized Coefficients**		**Not standardized Coefficients**	**t**	**Sig**
	B	Std. Error	Beta		
TC	-.172	.088	-.164	-1.960	.05
AQ	.125	.049	.231	2.529	.013
L	-.018	.034	-.043	-.531	.596
AcQ	.025	.043	.045	.578	.564
OL	.022	.014	.146	1.639	.103
SS	.107	.046	.176	2.012	.053
CO	.181	.042	.327	4.270	.000
LP	.118	.042	.208	2.788	.006

a. Dependent Variable: Overall satisfaction

The findings depicted in Table 8 show that the five components of "thermal comfort", "air quality", "location and planning of workflow", "connection with the outdoors" and "safety and security" are effective factors which have significant effects on the statistical population's overall satisfaction. Among these factors, "connection with the outdoors" is the strongest influential factor on overall satisfaction, which has a positive and meaningful influence on employees' satisfaction with their office environment (β=0.33, P<0.0001).

Accordingly, the amount of communication with the outside has a direct effect on the occupants' satisfaction. "Air quality" (ß = 0.23, P<0.006) and "safety and security" (ß = 0.18, P<0.04) are other positive and meaningful variables. "Thermal comfort" is the last environmental variable that predicts satisfaction negatively (β= -0.16, P<0.05). The estimated quantity is positive (Table 7). The other mentioned variables have such a drastic efficacy that it results in a decreased importance of employees' perception of "thermal comfort" in the office environment. Generally, when considering the resulting r^2, 64% of the variance in the "occupants' overall satisfaction" could be explained by the regression model.

DISCUSSION

The occupants are less satisfied when the temperature of workplaces is low or high [36], and at higher temperatures, as expected, their performance decreases [37]. The comfort conditions, including speed and amount of ventilation, CO_2 levels, indoor temperature, and air velocity [38] have also been measured in the workplaces of 10 office buildings and the results have fallen within the acceptable ranges.

Almost all the investigated office environments have both artificial and natural light. The main goal of lighting in offices is to prepare an efficient and comfortable workplace that ensures the health and motivation of its occupants, which results in their increased performance and efficiency at work [39, 40], and accordingly, this is the probable reason for the respondents' satisfaction with "lighting".

The majority of respondents (66.5%) work in shared spaces and workplaces with low-level partitions and only 33.5% of employees are in enclosed and high-level partition offices (Table 5). Accordingly, one of the possible reasons for the result of low satisfaction with acoustic quality seems to be the high percentage of clients and open-plan workstations, causing increased levels of noise. Increased distraction from noise in open plan offices caused significant negative effects on performance, job satisfaction, motivation, and privacy [36, 41]. Most of clients or employees speak loudly no matter what the type of space is. A convenient noise level for different types of work is

mentioned in the relative studies [42]. The other factors, including participants' gender, age, personality [43], and the duration or length of conversations [44] may also play an important role in individual perception of overcrowding by noise sources.

Possible reasons for low employee satisfaction with "visual privacy" and the ability to work on confidential documents without distractions could be the low amount of physical separations, i.e., the number and height of physical borders like partitions, around them, as well as too much traffic and the moving around of employees and clients. Unfortunately, spontaneous communication could turn into interruptions and distractions. However, the ability to work uninterrupted is very crucial and important for the employees, whose task is complex and requires their undivided attention. Since the correlation between the satisfaction level of employees and the height of workstation partitions is high, the respondents' gender, age, having a large number of clients, and the location of workstations seems to be influential in this regard.

Price and Fortune indicate that having meetings, walking together, and using common equipment in workplaces would improve interaction among employees. Also, "spontaneous" or "informal" communication, a kind of unscheduled face-to-face interaction, may help to understand and solve problems due to the enriched context, organizational and individual learning, and the elimination of ambiguity and uncertainty [45]. The respondents report large levels of satisfaction with their proximity to colleagues, which supports informal interactions, besides, most informal face-to-face interactions would occur at workstations during regular work and the office layout has space deficiencies to enable this.

The occupants are satisfied with their access to supervisors and colleagues. The spatial settings encounters as well as the opportunity to have conversations have a significant influence on the level of satisfaction among office occupants and their clients in office environments, creating a rich and strong organizational workflow.

The studies conducted by the National Research Council of Canada show that employees who display more personal items in their offices show higher environmental satisfaction, job satisfaction, and well-being, and rate their organizations more positively, while organizations with policies permitting personalization are perceived as healthier [46]. However, organizational policies meant that few personal items could be seen in the working area.

Office furniture meets employees' physical, mental, and job-specific needs. Therefore, dissatisfaction with the size, comfort, or adjustability of furniture can cause physical problems for them, thus decreasing their long-term efficiency.

The office environment is adequately safe, posing no accidental risk. In spite of the previous results and considering the fact that Iran is an accident-prone country, the employees were not sufficiently satisfied with the amount of emergency detection equipment.

The occupants are nearly satisfied with the amount of green space and their visual connection to outside windows. Looking at green spaces and natural plants could decrease human stress levels, enhancing feelings of positivity [47-48]. There is evidence to suggest that people prefer natural scenery to artificial [49]. The respondents are also satisfied with the location of their workstations in office buildings and the ease of navigation in terms of communicating with other sections. Finally, the occupants' overall satisfaction with their physical working environment seems to be in the normal range, which indicates the relative environmental desirability.

Among the physical characteristic of the office environment, "connection with the outdoors" is the most influential variable on the dependent variable, i.e., overall satisfaction. Most workplaces in Iran do not have sufficient green spaces, and this demonstrates the important role it has to play in the occupants' level of satisfaction.

The study suffers from some limitations. Firstly, the research was conducted in one country. Secondly, because of limitations in data collection in this country, the study did not use a huge sample size. In order to generalize the findings of the survey to other countries, more office buildings with bigger statistical populations should be studied.

CONCLUSION

Overall, the study reveals differences in the occupants' perception of satisfaction in terms of 35 physical characteristics of municipal office buildings, in the city of Shiraz, Iran, in 2013. The occupants indicated their overall satisfaction with physical environment as a whole to be approximately in middle of the range, demonstrating the relative desirability of the environment, which shows a medium level of environmental satisfaction. The factor which most contributes to satisfaction is the ability to communicate and interact with the employees and factor most contributing to dissatisfaction is associated with a lack of visual and acoustic privacy resulting, in distraction and the inability to adequately carry out individual work. It shows the importance of striking a balance between privacy and interaction in offices, in order to help the employees, concentrates on their jobs, communicates with colleagues, and meets with clients at the same time."

Published online: September 25, 2016

ACKNOWLEDGEMENT

The authors declare that there is no conflict of interest.

REFERENCES

1. Bluyssen PM, Janssen S, van den Brink LH, de Kluizenaar Y. Assessment of wellbeing in an indoor office environment. *Build Environ* 2011; 46(12): 2632-40.
2. de Korte EM, Spiekman M, Hoes-van Oeffelen L, van der Zande B, Vissenberg G, Huiskes G, et al. Personal environmental control: Effects of pre-set conditions for heating and lighting on personal settings, task performance and comfort experience. *Build Environ* 2015; 86:166-76.
3. Dinç P. Gender (in) difference in private offices: A holistic approach for assessing satisfaction and personalization. *J Environ Psych* 2009; 29(1): 53-62.
4. Lee SY, Brand JL. Effects of control over office workspace on perceptions of the work environment and work outcomes. *J Environ Psych* 2005; 25(3): 323-33.
5. Oldham GR, Rotchford NL. Relationships between office characteristics and employee reactions: A study of the physical environment. *Admin Sci Quart* 1983; 28(4) 542-56.
6. Sundstrom E, Town JP, Rice RW, Osborn DP, Brill M. Office noise, satisfaction, and performance. *Environ Behav* 1994; 26(2): 195-222.
7. Wargocki P, Wyon DP, Sundell J, Clausen G, Fanger P. The effects of outdoor air supply rate in an office on perceived air quality, sick building syndrome (SBS) symptoms and productivity. *Ind Air* 2000; 10(4): 222-36.
8. Humphreys MA, Nicol JF. Self-Assessed Productivity and the Office Environment: Monthly Surveys in Five European Countries. *ASHRAE Tran* 2007; 113(1): 606-16.
9. Kim J, de Dear R, Candido C, Zhang H, Arens E. Gender differences in office occupant perception of indoor environmental quality (IEQ). *Build Environ* 2013; 70:245-56.
10. Lahtinen M, Huuhtanen P, Kähkönen E, Reijula K. Psychosocial dimensions of solving an indoor air problem. *Ind Air* 2002; 12(1): 33-46.
11. Kostiainen T, Welling I, Lahtinen M, Salmi K, Kähkönen E, Lampinen J. Modeling of subjective responses to indoor air quality and thermal conditions in office buildings. *Hvac &R Research* 2008; 14(6): 905-23.
12. Haghighat F, Donnini G. Impact of psycho-social factors on perception of the indoor air environment studies in 12 office buildings. *Build Environ* 1999; 34(4): 479-503.
13. Veitch JA, Charles KE, Farley KMJ, Newsham GR. A model of satisfaction with open-plan office conditions: COPE field findings. *J Environ Psych* 2007; 27(3): 177-89.
14. Van Dick R, Christ O, Stellmacher J, Wagner U, Ahlswede O, Grubba C, et al. Should I stay or should I go? Explaining turnover intentions with organizational identification and job satisfaction. *Brit J Manag* 2004; 15(4): 351-60.
15. Altomonte S, Schiavon S. Occupant satisfaction in LEED and non-LEED certified buildings. *Build Environ* 2013; 68: 66-76.
16. Veitch JA. Workplace design contributions to mental health and well-being. *HealthcarePapers* 2010; 11: 38-46.
17. Mazloumi A, Kazemi Z, Nasl-Saraji G, Barideh S. Quality of Working Life Assessment among Train Drivers in Keshesh Section of Iran Railway. *Int J Occup Hyg* 2015; 6(2): 50-5.
18. Schneider JW. Focus on Workplace Design. *Build Desig + Const* 2007; 48(3): 33-7.
19. Clements-Croome D. *Creating the productive workplace*, 2nd, London and New York, Taylor & Francis, 2006.
20. Zhu L, Zhu L. The physical office environment in technical services in ARL libraries. *Acqui and Tech Servi* 2013; 37(3): 124-37.
21. Kamarulzaman N, Saleh AA, Hashim SZ, Hashim H, Abdul-Ghani AA. An overview of the influence of physical office environments towards employee. *Proc Eng* 2011; 20: 262-8.
22. Jafari MJ, Karimi A, Haghshenas M. Extrapolation of experimental field study to a National Occupational Noise Exposure Standard. *Int J Occup Hyg* 2010; 2(2): 63-8.
23. Mak CM, Lui YP. The effect of sound on office productivity. *Build Serv Eng Res Tech* 2012; 33(3): 339–345
24. Lee YS, Guerin DA. Indoor environmental quality differences between office types in LEED-certified buildings in the US. *Build Environ* 2010; 45(5): 1104-12.
25. Golbabaei F, Monazzam M, Hematjo R, Hosseini M, Fahang-Dehghan S. The assessment of heat stress and heat strain in pardis petrochemical complex, Tehran, Iran. *Int J Occup Hyg* 2015; 5(1): 6-11.
26. Haynes BP, Oseland N, Marmot A, Swaffer F, Ceneda S. Environments for successful interaction. *Facili* 2011; 29(1/2): 50-62.
27. Newsham G, Brand J, Donnelly C, Veitch J, Aries M, Charles K. Linking indoor environment conditions to job satisfaction: a field study. *Build Res Info* 2009; 37(2): 129-47.
28. Thirion-Venter EM. *Embracing Eastern and Western principles: towards an intercultural office design framework*. *PhD thesis*, University of South Africa, 2012.
29. Al horr Y, Arif M, Katafygiotou M, Mazroei A, Kaushik A, Elsarrag E. Impact of indoor environmental quality on occupant well-being

and comfort: A review of the literature. *Int J Sust Built Environ* 2016; 5(1): 1-11.
30. Hummelgaard J, Juhl P, Sæbjörnsson KO, Clausen G, Toftum J, Langkilde G. Indoor air quality and occupant satisfaction in five mechanically and four naturally ventilated open-plan office buildings. *Build Environt* 2007; 42(12): 4051-8.
31. Kim J, de Dear R. Workspace satisfaction: The privacy-communication trade-off in open-plan offices. *J Environ Psych* 2013; 36: 18-26.
32. Yau YH, Chew BT, Saifullah AZA. Studies on the indoor air quality of Pharmaceutical Laboratories in Malaysia. *Int J Sust Built Environ* 2012; 1(1): 110-24.
33. Li DHW, Lam TNT, Wong SL, Tsang EKW. Lighting and cooling energy consumption in an open-plan office using solar film coating. *Energy* 2008; 33(8): 1288-97.
34. Ricciardi P, Buratti C. Thermal comfort in open plan offices in northern Italy: An adaptive approach. *Build Environ* 2012; 56: 314-20.
35. Sundstrom E, Sundstrom MG. *Work places: The psychology of the physical environment in offices and factories*. CUP Archive; 1986.
36. Young HH, Berry GL. The impact of environment on the productivity attitudes of intellectually challenged office workers. *Hum Fact* 1979; 21(4): 399-407.
37. Rashid M, Zimring C. A review of the empirical literature on the relationships between indoor environment and stress in health care and office settings problems and prospects of sharing evidence *Environ Behav*. 2008; 40(2): 151-90.
38. Neufert E, Jones V, Thackara J, Miles R. *Architects' data*. 2nd ed,Granada St Albans, Herts; 1980.
39. Manav B. An experimental study on the appraisal of the visual environment at offices in relation to colour temperature and illuminance. *Build Environ* 2007; 42(2): 979-83.
40. Ozdemir A. The effect of window views openness and naturalness on the perception of rooms spaciousness and brightness: A visual preference study. *Sci Res and Essa* 2010; 5(16): 2275-87.
41. Oldham GR, Brass DJ. Employee reactions to an open-plan office: A naturally occurring quasi-experiment. *Admin Sci Quart* 1979; 24(2): 267-84.
42. Etemadi F. *Designing Office Building based on Work Pattern in order to Achieve Job Satisfaction: A case study of Shiraz Municipality- the Urban Region*. *Msc thesis*, University of Shiraz, Iran, 2013.
43. McAndrew FT. *Environmental psychology*. Pacific Grove, CA: Brooks/Cole; 1993.
44. Altaian I. *The environment and social behavior*. Brookes/Cole, Monterey, CA. 1975.
45. Price I, Fortune J, editors. *Open plan and academe: pre-and post-hoc conversations*. 2008. In: THEN, D. S.-S. and FINCH, E., (eds.) Proceedings of the W070 conference: healthy and creative facilities. CIB publication (315). CIB, 613-620.
46. Noorian T. *Personalization of Space in Office Environments*. *Msc thesis*, University of Eastern Mediterranean, 2009.
47. Ulrich RS, Simons RF, Losito BD, Fiorito E, Miles MA, Zelson M. Stress recovery during exposure to natural and urban environments. *J Environ Psyc* 1991; 11(3): 201-30.
48. Devlin AS, Arneill AB. Health care environments and patient outcomes a review of the literature. *Environ Beha*. 2003; 35(5): 665-94.
49. Kaplan R. Employees' reactions to nearby nature at their workplace: The wild and the tame. *Landsc Urb Plann* 2007; 82(1): 17-24.

Published online: September 25, 2016