International Journal of Innovative Studies in Sociology and Humanities
ISSN 2456-4931 | Open Access | Volume 7, Issue 10, 2022
DOI: https://doi.org/10.20431/2456-4931.071019

The Workplace Windows Effect: Post Occupancy Evaluation of Office Employees' Satisfaction within Daylight and Exterior View

Imene Sfaksi*[1], Toufik Mezerdi[2], Noureddine Zemmouri[3]

[123]LACOMOFA Laboratory, Architecture Department, Mohamed Khidher University. P.O Box: 145RP- 07000 Biskra –Algeria

Recieved: September 20, 2022 **Accepted**: October 12, 2022 **Published**: October 19, 2022

Abstarct

In a workspace where the tasks of writing, reading and typing are the most performed, the quality of accomplishment of these tasks depends closely on the interaction between the user and the visual quality of the space itself. Even with the intention of providing conditions favorable and consistent with the needs requested. The design of the window is one of the issues to consider when thinking about this interaction, either by the daylight that can enter the space or by the view it gives towards the external environment, where the great challenge stands up to achieve the visual requirements specific to each work task. Also to avoid the various visual discomforts and consequently to the elaboration of the well-being and the satisfaction of employees towards these two factors. The main objective of this research is to investigate the impact of daylight and exterior view guarantees by windows on the degree of the occupant satisfaction.The study employed the use of the post-occupancy evaluation approach with subjective assessments through a questionnaireand it was distributed in two office buildings in Biskra city.The results point out thatthe size of the window is the first factor associated with the admission of the amount of abundant daylight inside the offices, where the luminous environment is perceptually influential in the degree of satisfaction among the employees.Regarding exterior view, the results attesting that a view with multiple horizontal stratification and natural contents(sky, water; green spaces)provided by big WWR presumed to be preferred from employees to views with a single stratum, because the information and content is richer.

Keywords: windows, daylight, exterior view, office buildings, satisfaction, POE, employees.

INTRODUCTION

In a whole building, the key element that ensures the relationship between the interior space and the exterior environment and guarantees an ambitious interior climate is "the window".

Given its importance in any external - internal exchange, it is first necessary to know its duality of advantage and disadvantage.

As any space designed for human occupancy, the presence of a window is one of the essential factors (Farley & Veitch, 2001) in order to ensure a certain degree of satisfaction with regard to internal physical factors related to environmental stimuli and psychological factors related to user perception and expectations.It considred as the key element that ensures the relationship between the interior space and the exterior environment and guarantees an ambitious interior climate.

In past decades, designing a window was an architect decision based on multipolar references: urban situation, architectural style, aesthetics visions and others(Hellinga & Hordijk, 2014). Nowadays, interior environmental quality and people's preferences regarding windowshasbecome a prioritywhich starting with conceptual design and continuing throughout the complete design process.

Daylight as well as exterior view in buildings especially offices, where employees spend most of their time inside are considered as the most important window functions (Boyce & al., 2003).To the extent that the visual environment quality conditions of the space plays the role of a primary requirement for performing tasks comfortably (Aries et al, 2010), as long as it do not cause glare or thermal discomfort or a loss of privacy and control.

One of the most crucial needs for office buildings employees is the availability of daylight (De Carli, 2008).Having access to natural light in an office has many advantages: physiologically by stimulating the visual system and the circadian rhythm of users due to its dynamics, brightness and color rendering(Guidolin, 2014),psychologically by reducing eye fatigue and consequently improving morale and increasing productivity (Emuze et al, 2013), and energetically by reducing the energy demand of buildings in terms of electricity consumptiondue to the use of artificial lighting.The results of many studies show that daylight provided by windows is perceived as advantageous for health and productivity of employees. Bodart and Deneyer (2004) found that working in daylit office constitute 91% of participants preference. Another research by the Heschong Mahone Group (2003)showed that employees who suffered from fatigue and eyestrain are those who did not have enough daylight availability.

With respect to exterior view provided by window, numerous studies confirm thatthe presence of a view which provide visual connections to the outdoors is a significant component for the workspace users (Heschong, 2021).beside that, many researchers like Heerwagen and Orians (1986) and Bringslimark et al. (2011) found that employees in windowless offices have the resort to using decoration with nature themes like interior plants or nature pictures. A good window exterior view have a positive effect on health and occupants well-being(Beute et al, 2014). In a study of Heschong Mahone Group (2003), office employees who had better acces to an outside view mentally performed 10 to 25 % bettercomparedto those with no view (Hellinga & Hordijk, 2014).In addition, the degree to which window is able to introduce more visual features is important with regard tosatisfaction and well-being. The literature of Ko et al (2022) shows that views that contain nature over built or urban views, three horizontal layer (i.e., ground, landscape, and sky) identified by Markus (1967), movement and dynamics scene, are considred to be the highest quality and found to be beneficial for building occupants by reducing self-reported discomfort versus to views with one components.Furthermore, Hopkinson and Bradley (1960), and Tuaycharoen (2006) found that there is a strong relation between occupant's subjective impression of an outside view and glare sensation. Overall, natural scenes with interesting information were often perceived as less glaring than pictures of urban scenes(Hellinga & Hordijk, 2014).

METHODOLOGY

Survey

This study is mainly based on a Post Occupancy Evaluation approach, which is a method or a broad range of activities that try to answer a number of questionskeys related to this: "Is the building working?", "If so, how can its performance be improved? By answering these questions, valuable information can be provided to improve how buildings perform once they are builtand the level of satisfaction of building users with the environment thus createdand their adaptations in the workspace (Emuze, 2013).

The objective of this research is to analyze the influence of multiple variables on the perceived daylight and the quality of view in office buildings whose window-opening ratio is between 30 and 75%.Therefore, a pre-questionnaire was made to a small sample size in order to distinguish which questions were not clear or needed to be explainedto improve before the final proposed questionnaire survey, which based on the review of POEs and it was distributed in two office buildings in Biskra city.This qualitative research tool includes questions with several types of answers (closed, ranked, multiple choice, and open ones).The questionnaire included 12 questions divided intofour sections (A-D):

A- Workspace User Personal Information.

B- Workplace Satisfaction.

C- Satisfaction with indoor luminous environment.

D- Satisfaction with exterior view.

The main field study conducted from January to mid- March 2021.The questionnaires were physically distributed to the respondents. From the 86 questionnaires distributed, only 60 were returned. This resulted in a 69.76% response rate.

The preliminary collected data examination reveals the following outcomesdescribed in table 1.

Table 1. Characteristics of the respondents in terms of age, gender, job occupancy period, wearing glasses, sensitivity to intense light and office occupancy time / day.(N_{B1}= 30 / N_{B2}= 30)

Office building Characteristics of respondents	B1 (30%WWR) %	B2 (70% WWR) %
• Age		
18-29	13.33	06.66
30-39	46.66	40.00
40-49	30.00	20.00
50-59	10.00	30.00
60-69	00.00	03.34
• Gender		
Male (Female)	53.33 (46.67)	60.00 (40.00)
• job occupancy period		
<1 year	03.33	00.00
1-2 year	10.00	13.33
2-3 year	30.00	10.00
3-5 year	23.33	10.00
> 5 year	33.33	66.67
• Wearing of glasses or lenses		
Yes	26.67	40.00
No	73.33	60.00
• Intense light sensitivity		
Yes	50.00	73.33
No	50.00	26.67
• office occupancy time/ day		
< 2 hours	23.33	30.00
2-4 hours	56.66	56.66
>4 hours	20.01	13.34

Case Study

Location and Climatic Context

The city of Biskra (figure 1): one of the Saharan regions in the South East of Algeria. Typical of Sahara town, it is characterized by a hot and dry climate most of the year (table 2) with a short winter extending from December to February .The geographical features of the city are:

- The latitude = 34.48 N.

- The longitude = 5.44 N.

- The altitude, which is equal to 128 m above sea level.

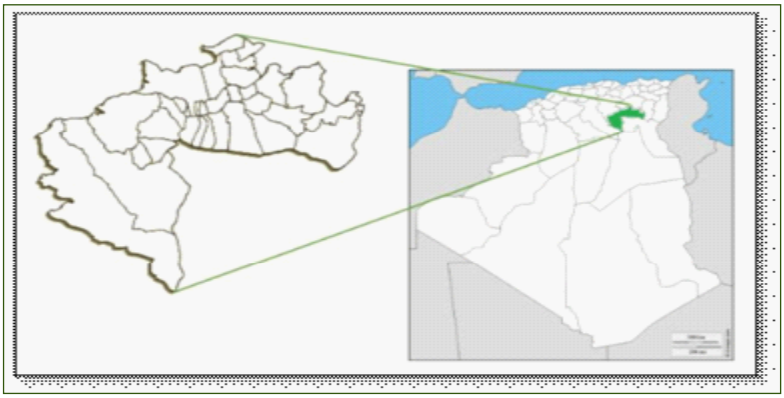

Figure 1. Location of the city of Biskra

Table 2. Climatic Data of Biskra

Temperature	**Relative Humidity**	**Precipitation**
Max. Temp: 42 °C in July Min. Temp:7 °C in January Average annual Temp: 21.5 °C	Max. R.H: 50% in January Min. R.H:10% in July	Max: 200 mm per Year

Office Buildings Sample Case

Two different office buildings were selected from a typological study has been drawn up, grouping different buildings of the offices located in the city Biskra. In order to test the effect of different windows wall ratio on the satisfaction of employees within daylight and exterior view, the only selection criteria of two samples case was WWR: 30% which considered as a reference for the optimal window wall ratio for an office to achieve a visual satisfaction for employees, and 70% Which expresses the too big percentage for offices in hot and arid climate like Biskra city. This outcome corresponds to existing recommendations suggesting that windows surfaces, in any orientation, should be minimized in the hot and dry regions (Lee et al., 2013).

1st office building (B1): The Property Development and Management Office – Biskra-

Built in 2018 by the architect Ariouette Ibrahim. The office building is characterized by an elongated plan along the East - West axis and along the length of this axis are 55 offices spread over five floors with an average area ranging from 18.30 m^2 to 29.15 m^2. Each facade of the building has a particular treatment according to the needs and the function of the interior space: large glazed surfaces giving towards interior halls or towards the stairwells, as well as windows of identical shape, a rhythmic location and with an area of 4.32 m^2 designated for workspaces especially those facing east and west (figure 2).

Figure 2. The Property Development and Management Office – Biskra-a: principal facade; b: east façade; c:view of interior office; d: building ground floor plan.

2nd office building (B2):Public Works Department – Biskra –

Built by the architect Cherrad kamel in 2012. The direction is square in shape with three floors in a single block. Each floor consists of a number of partitioned peripheral offices whose configuration is almost identical, with a maximum area of 18m^2. It has 3 transparent facades, although there are some offices that have undergone size reductionsof the window (transparence wall) by the integration of plaster walls (plasterboard), with the exception of the north facade which is characterized by ordinary windows with an average size (figure 3).

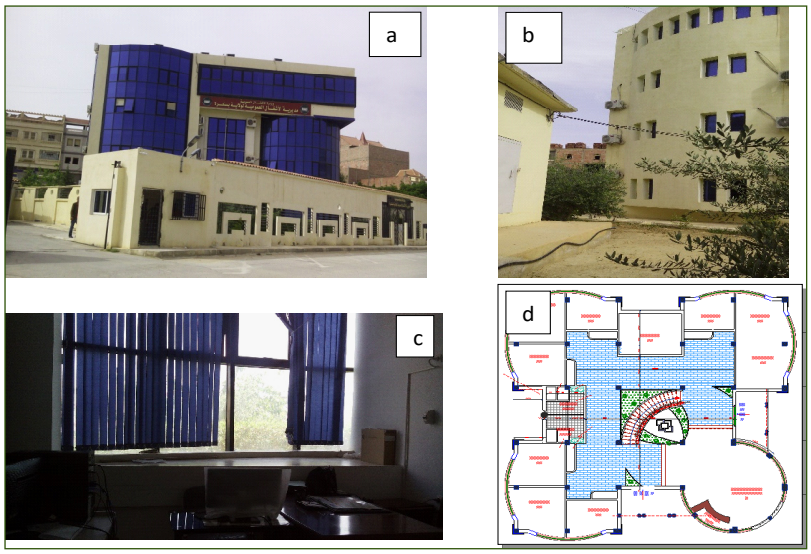

Figure 3. Public Works Department – Biskra –a: principal facade; b: north facade; c: view of interior office; d: building ground floor plan

Table 3 represents the Characteristics of the two selected office buildings samples.

Table 3. Characteristics of office buildings samples.

Analysis criteria			B1	B2
Building	Principal facade orientation		South	South
	Floors number		underground + ground floor + 4	Ground floor +3
	Exterior wall color		Crème /orange	Crème
	Wall thickness		25 cm	30 cm
offices	Total number of offices		55	43
	Office type		Cloisonne100%	Cloisonne 100%
	Office dimension		4.70*3.90= 13.92m^2	4.10*4.20=17.22m^2
	Interior wall color		Light yellow ocher	White
windows	N° of windows/office		01	01
	Dimensions (width *Height)		3.60*1.20	4.10*3.00
	Windows surface S (m^2)		4.32m^2	12.30m^2
	Ratio type (glazing/office S)		0.31	0.71
	Type of glass		Tinted	Tinted
	Position	horizontal	in the middle	lateral
		Verticale (height above ground)	1.20 m	0.20 m
	Position relative to the desk		Behind	Behind
	Solar protection		Venetian blinds	Venetian blinds

RESULTS AND DISCUSSION

Windows Size Judgment

Just over half (67%) of employees in B1 rate the size of the window in their office as exactly "good". Although, 23% of them say that the size of their windows is "small" (respectively slightly small17%, and too small6% (figure 4).

Furthermore, 70% of employees in B2 judge that the windows size is from "big"(40%) to "too big" (30%); while 27% of them rate the size as "good" (figure 4).

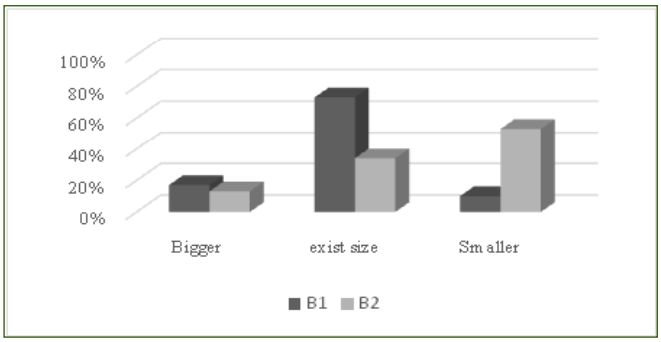

Figure 4. B1 and B2 employee's windows size judgment.

We note that there is some ambiguity in the judgment of employees in relation to the size of windows in offices. A window judged 'too big or too small' is also judged 'big or small' as well as 'exactly good', hence three different judgments for the same window size.

Windows Size Preference

When it comes to preferred window size, the majority of employees (56%) in B1 prefer the ratio of the existing window (30%), with a small portion remaining (17%) who prefer a bigger size and 10% for a smaller size (figure 5). Contrary to the first building, more than half of B2 employees (53%) prefer a smaller windows ratio,with a significant percentage of employees who preferred the existing window size (34%) (Figure 5).

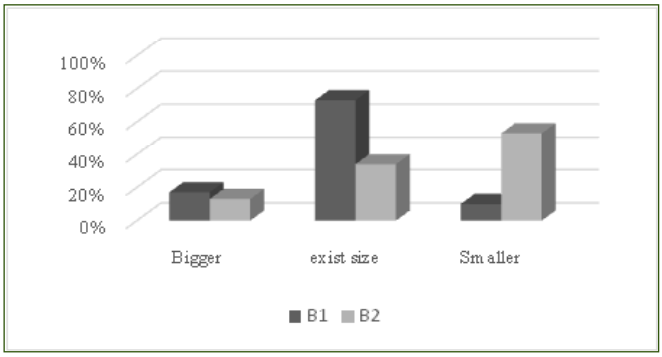

Figure 5. B1 and B2 employee's windows size preference.

These results seem to be in agreement with the results from the literature review that a window area of 30% is preferred by employees in offices (Veitch, 2007).It could also correspond to a desire of employees to reduce the amount of unwanted sunlight in their offices by reducing the size of the window.

Satisfaction With Daylight Levelsin the office

Majority of B1 employees are satisfied with daylight levels in their offices, workstations and computer screens, and they rated their tasks of paper or computer reading and writing regarding the daylight level as: 'comfortable' for an average of 34% of them, 'Appropriate' and 'clear' with 33%, 18% of rate.A very small percentage of employees (6%) considred the task of reading and writing on computer as 'unpleasant' or 'glaring' (figure 6). This is due to the position of the windowrelative to thedesk (Behind), which sometimes leads to reflections on the screen.

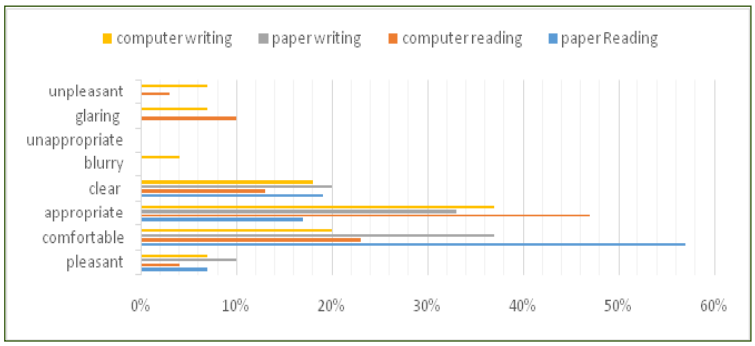

Figure 6. Daylight level B1 employee's judgment regarding different office tasks.

Nevertheless, regarding B2 employees, we note that percentage of employees whoseconsidred the task of reading and writing on paper or computer as 'unpleasant', 'glaring' and 'unappropriated'is highest (32.25%). This explains why the 70% of employees in B2 judge that the windows size is from "big"to "too big". However, there is still a significant percentage of employees are satisfied with daylight levels in their offices (67%) (Figure 7).

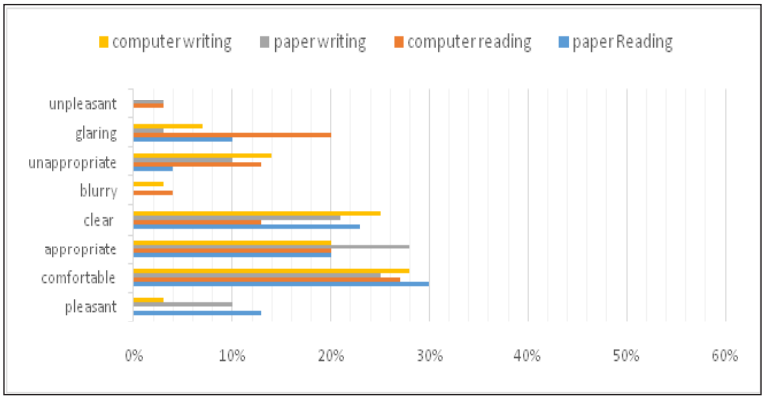

Figure 7. Daylight level B2 employee's judgment regarding different office tasks

Of all B1 employees, 26/30 answered that the artificial lighting in their offices is (always, often and regularly) active (figure 8). Only 36% said they could never work with daylight alone (figure 9).This means that in offices with WWR of 30%, artificial lighting is often required.

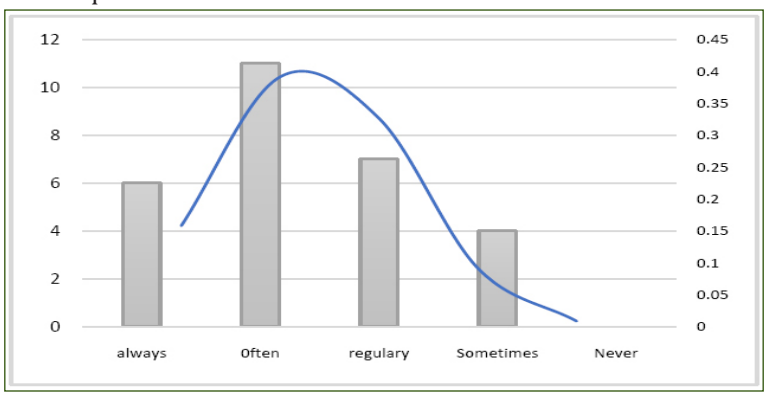

Figure 8. Frequency of use of artificial light during work in B1

Figure 9. Ability to perform work without artificial lightin B1.

Contrary to B1, 2/3 of employees in B2 answered that the artificial lighting in their offices is (Sometimes or never) active (figure 10), and 25/30 of them said that they are always to often perform work tasks without artificial light, therefore only with available daylight (figure 11).

This confirms previous findings about window size considerationas 'big' in this building, which allows a large quantity of daylight to enter, which confirm also the percentage of employees whose considred the task of reading and writing on paper or computer as 'unpleasant', 'glaring' and 'unappropriated'.

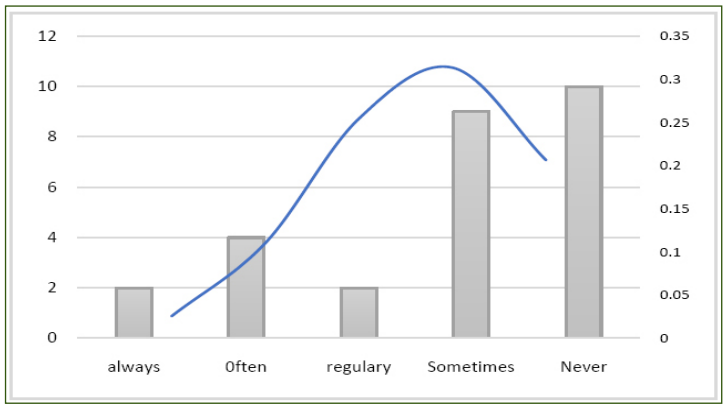

Figure 10. Frequency of use of artificial light during work in B2**.**

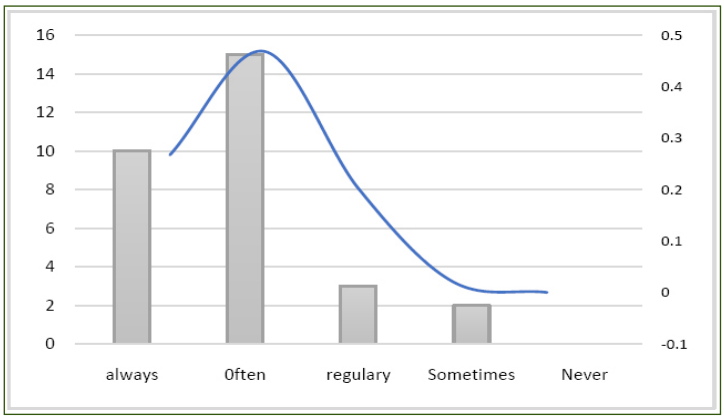

Figure 11. Ability to perform work without artificial light in B2.

Satisfaction With Exterior View

Possibilities of Access to Exterior View

For B1 employees, there is a disparity in the ability to see all external elements by the employees through their window. Just 30% of them can see the sky, 43% for the street,while most of them can see surrounding buildings (96%) (Figure 12).This is due to WWR (30%) of offices, which cannot give an overall picture of all outside elements(less than two layers).

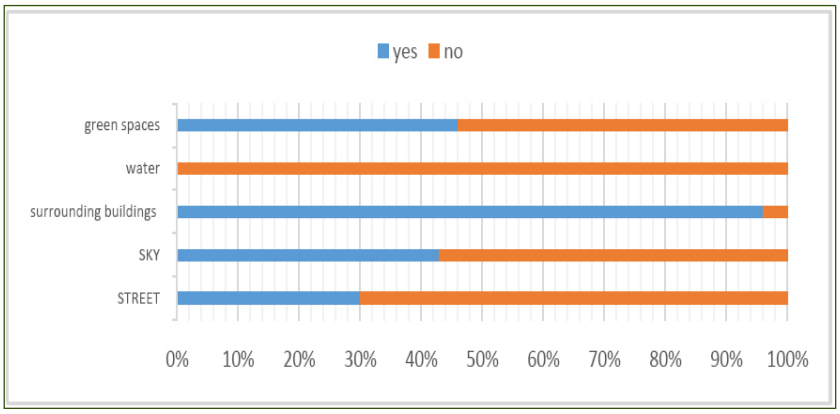

Figure 12. Frequencies of exterior view elements visible through the windowfrom workstations in B1.

The majority of employees (96%) in B2 can see the sky and surrounding buildings through the window from their workstations. A significant number (more thanThree-quarters) can also see the street, and the greenery(figure 13).This result is due tothe big size of window that make access to all exterior elements view to be visible and content is at least two layers.As for the water, it is a missing element in the site itself.

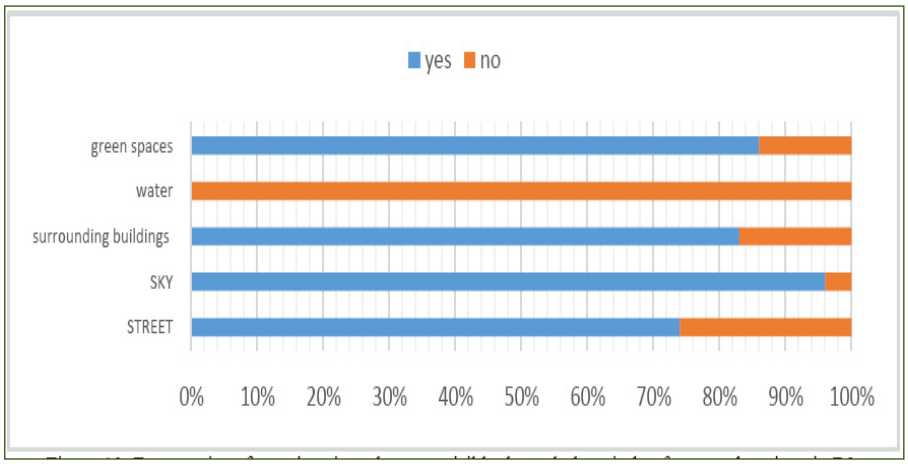

Figure 13. Frequencies of exterior view elements visible through the windowfrom workstations in B2.

Exterior View Perception

The opinions of B1 and B2 employees concerning the degree of pleasantness (very pleasant to pleasant) of the external elements of the view reveal that:the sky (for 30/30), green spaces (29/30 in B1 and 30/30 in B2) and water (for 28/30 in B1 and 30/30 in B2) present the most pleasant elements. Buildings and the street are the least important elements respectively, 14/30, 11/30 of B1 employees and 13/30, 14/30 of B1 employees (figure 14, 15).

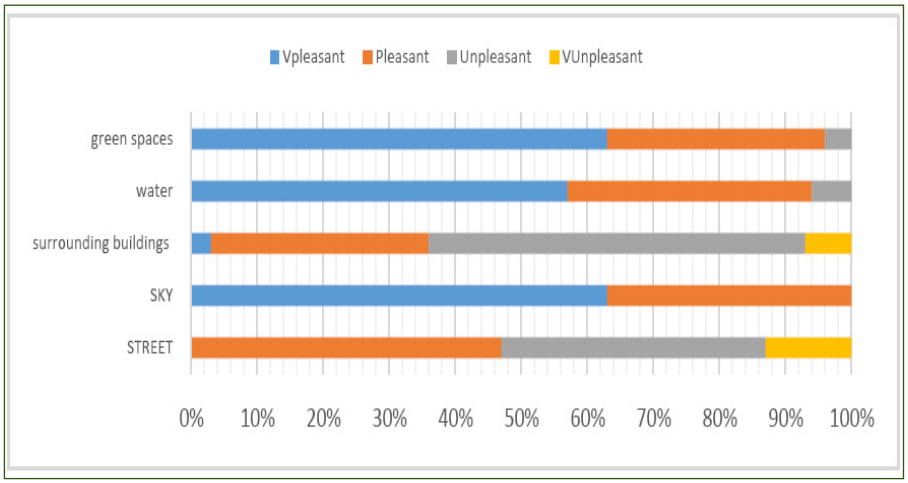

Figure 14. Frequencies of the degrees of pleasantness of B1 employees to see the elements exterior view through their windows.

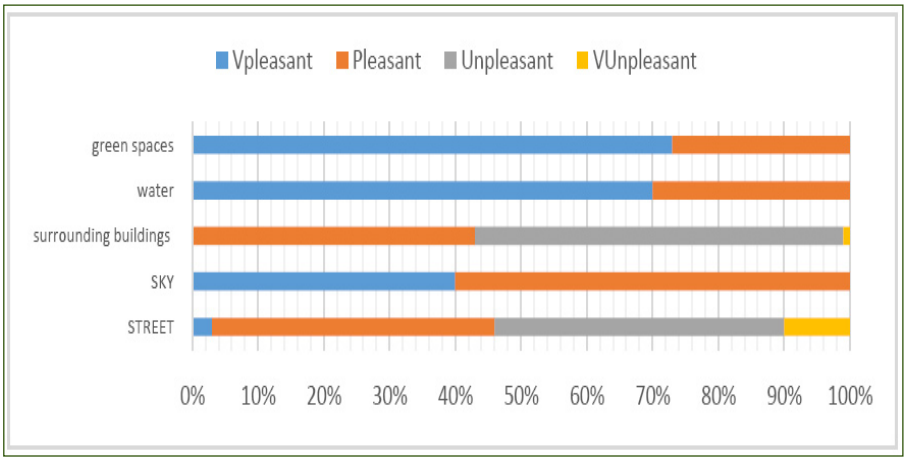

Figure 15. Frequencies of the degrees of pleasantness of B2 employees to see the elements exterior view through their windows.

CONCLUSION

This study investigates whether relationships between window size, and the visual environment quality (daylight and exterior view), also exist in the context of the workplace by focusing on office employees satisfactionusing the post-occupancy evaluation approach. A questionnaire Survey was distributed inside two office buildings in the city of Biskra with two different window to wall ratio (30% - 70%). The main findings of this study can be summarized as follows:

- Offices with 30% of wwr: the employees considred the size as acceptable and confirmed their satisfaction with the daylight level regarding different office tasks, although they emphasized that the use of artificial lighting is often required. On the other hand, the exterior view results revealed that this size of the window gives less than two strata, which is considered as not very satisfying for users who need to see more exterior view contents.
- Offices with 70% of wwr: the size is considred as big; this led to daylight being considered as 'unpleasant' or 'glaring' for computer work tasks for some employees due to the reflection of daylight rays on the screen. These findingsconfirm theAbility of employees to perform work without artificial light in this building. While, window signification as 'big' was equivalent with view contents as 'more rich' with more than two strata availability.

Overall, we can conclude that the interior visual quality guaranteed by the window is perceptually influential on the feeling of discomfort among employees if office buildings.

REFERENCES

1. Aries, M. B., Veitch, J. A., & Newsham, G. R. (2010). "Windows, view, and office characteristics predict physical and psychological discomfort". *Journal of environmental psychology*, 30(4), 533-541.
2. Beute, F., & de Kort, Y. A. (2014). "Salutogenic effects of the environment: Review of health protective effects of nature and daylight". *Applied psychology: Health and well-being*, 6(1), 67-95.
3. Bodart, M., & Deneyer, A. (2004). "Analyse of the survey on the office workers' interest in windows". *IEA*.
4. Boyce, P., Hunter, C., & Howlett, O. (2003). "The benefits of daylight through windows. Troy, New York": Rensselaer Polytechnic Institute.
5. Bringslimark, T., Hartig, T., & Grindal Patil, G. (2011). "Adaptation to windowlessness: do office workers compensate for a lack of visual access to the outdoors?". *Environment and behavior*, 43(4), 469-487.
6. De Carli, M., De Giuli, V., & Zecchin, R. (2008). "Review on visual comfort in office buildings and influence of daylight in productivity". *Indoor Air*, 2008, 17-22.
7. Emuze, F., Mashili, H., & Botha, B. (2013). "Post-occupancy evaluation of office buildings in a Johannesburg country club estate". *Acta Structilia*, 20(1), 89-110.
8. Farley, K. M., & Veitch, J. A. (2001). "A room with a view: A review of the effects of windows on work and well-being" (pp. 1-33). Institute for Research in Construction, National Research Council Canada.
9. Guidolin, E. (2014). "Impact of window amount and size on user perception, daylighting and energy demand in an office space".
10. Heerwagen, J. H., & Orians, G. H. (1986). "Adaptations to windowlessness: A study of the use of visual decor in windowed and windowless offices". *Environment and Behavior*, 18(5), 623-639.
11. Hellinga, H., & Hordijk, T. (2014). "The D&V analysis method: A method for the analysis of daylight access and view quality". *Building and Environment*, 79, 101-114.
12. Heschong, L., & Roberts, J. E. (2009, September). "Linking daylight and views to the reduction of sick building syndrome". *In Proceedings of healthy buildings*.
13. Heschong, L. (2021). "Visual Delight in Architecture: Daylight, Vision, and View". *Routledge*.
14. Hopkinson, R. G. (1960). "A study of glare from very large sources". *Illuminating Engineering*, 55, 288-294.
15. Ko, W. H., Schiavon, S., Altomonte, S., Andersen, M., Batool, A., Browning, W., & Wienold, J. (2022). "Window View Quality: Why It Matters and What We Should D"o. *LEUKOS*, 18(3), 259-267.

16. Lee, J. W., Jung, H. J., Park, J. Y., Lee, J. B., & Yoon, Y. (2013). "Optimization of building window system in Asian regions by analyzing solar heat gain and daylighting elements". *Renewable energy*, (50): 522-531.

17. Markus, T. A. (1967). "The function of windows—A reappraisal". *Building Science*, 2(2), 97-121.

18. Veitch, J. A., Charles, K. E., Farley, K. M. J., & Newsham, G. R. (2007). "A model of satisfaction with open-plan office conditions: COPE field findings". *Journal of Environmental Psychology*, 27(3), 177-189.

Citation: **Imene Sfaksi, Toufik Mezerdi*, et al.*** *The Workplace Windows Effect: Post Occupancy Evaluation of Office Employees' Satisfaction within Daylight and Exterior View. Int J Innov Stud Sociol Humanities. 2022;7(10): 210-220. DOI: https://doi.org/10.20431/2456-4931.0710019.*