2012 2nd International Conference on Biotechnology and Environment Management
IPCBEE vol.42 (2012) © (2012) IACSIT Press, Singapore
DOI: 10.7763/IPCBEE. 2012. V42. 21

Comparative Analysis of Effect of Psychological Factors on Visual Comfort in a Green and Conventional Office Building

Yakubu Aminu Dodo [1, +], Mohd Zin Kandar [2], Muhammad Babale Girei [3], Ahmed Yahaya Abdul [4] and Jallaludeen Mu'azu[5]

[1, 2] Department of Architecture, Faculty of Built Environment, Universiti Teknologi Malaysia.
[3, 4, 5] Department of Architecture, Modibbo Adama University of Technology, Yola, Nigeria.

Abstract. Individual and Architectural factors may affect the way we perceived our environment which are encompasses in three basic factors; Physical, Physiological and Psychological, these in turn affect the functional efficiency of occupants in an office building. The ability to comprehend one's environment as well as to perform a task within it is strongly dependent upon vision. The paper report a survey carried out for a proposed doctoral study in a conventional building (Perpustakaan Sultanah Zanariah (PSZ)) and a green building (Diamond Building Malaysia (DBM)) in Malaysia; relating to effects of psychology factors on visual comfort in office space. Nineteen (19) participants each from both buildings participated in the survey. Using SPSS 17 to correlate the data, result shows that occupant's in DBM are only slightly comfortable than the occupants of PSZ in aspect of Indoor Environmental Quality (IEQ) of the Malaysian Green Building Index (GBI) Malaysia rating system; as criteria for rating green buildings are still in the developmental stages, more works need to be carried out for our buildings to be totally green.

Keywords: Conventional-building, Green-building, IEQ, Psychology, Visual-comfort

1. Introduction

Environmental space needs to meet various human requirements for any visual activity has a peculiar criteria for the task it need to perform, this all depend on energy usage and most developed countries and developing countries energy usage account for 20-40% of total energy. This has negative effects on us and our environment. Many countries have developed green building rating tools, to rate buildings in terms of achieving and to curb the problem of sustainability. Green buildings are rated based on certain criteria with points allocated to each criterion based on the assessment category. The area measures are; Energy & Atmosphere, Water Efficiency, Indoor Environment Quality, Sustainable Sites, Environmental protection and Innovation in Design. Most rating system throws more weight on Energy Efficiency and IEQ, depending on which rating system one is using. The mainstream rating system include; Leadership in Energy and Environmental Design (LEED), Green Mark and the newly launch Green Building Index (GBI) which is making wave as the first Tropical green rating tool, with LEED taking the lead and most of the green rating tools need improvement as they are based on predicted (simulated) performances [1, 2, and 3].

More work in form of research and development are needed to be carryout by employing Post Occupancy Evaluation (POE) on green buildings to improve; these will help in the construction of buildings that are sustainable and integrating all possible human interventions in them which will certainly lead to a more truly sustainable built environment [4, 5, 6, and 7]. Vision and light are two compactable phenomenon, in that the human visual system provides a large part of the contact people have with the external world,

[+] Corresponding author. Tel.: + 60166486703; fax: + 6075566155.
E-mail address: dyaaminu@yahoo.com.

since it is used to translate light, colour, shapes to the brain therefore for the eye to function and a user of space need an effective satisfaction in his/her environmental field.

2. Background

2.1. Green Building Index

Green building Index (GBI) Malaysia certified office buildings on the average seems to delivers reduced energy use at a societal level, but at individual level, the performances related to human value are not seen been realized. This is possible due to focus on energy use which the scheme imposes on the rating system [3, 8 and 6]. In such a scenario there is nothing that will differentiate a GBI rated building from that of a conventional building; in order to achieve green design the integration of human value in seamless way which most green building ratings tools lack with GBI inclusive is of paramount importance [7]. Eighty five percent (85%) of human impressions are visual, office employees spend most of their time inside buildings this in turn have effect on their physical conditions and indirectly influence building performance [9].

2.2. Visual Comfort

Visual comfort and visual task performance are of a priority in which task visibility and visual comfort can be described in large part by the concepts of glare and contrast, both of which are affected by the field of vision of the viewer. Measurements vary in individual about the field of vision and the ages of the individual also count [10, 11, and 12]. Visual comfort is simply the absence of visual discomfort. Perceptions of comfort were related to feelings of well-being and aesthetics that changed little over time, and could be linked to perceptions of luxury.

Visual comfort in an office environment depends on the capabilities of the visual system, characteristics of the task, and the quality of light [13]. The visual photoreception enables human to see and is defined as the biological responses of organisms stimulate by light. Visual photoreceptors are situated in the retina of the eye and consist of cones and rods [14]. The visual system has a limited range of capabilities. This capability is to set out the visual limits, what are called the thresholds of vision. Not only light properties determine a specific threshold condition, but there are many other factors that interact. Large differences between individuals in threshold measures are particularly with age

2.3. Visual Discomfort

Visual discomfort can be identified by many measures, such symptoms that may be taken as markers of visual discomfort are red, sore, itchy and watering eyes, and headaches. This visual discomfort caused by too little light, too much light, and too much variation in illuminance between and across working surfaces, glare, shadow, flicker, and reflections. Uniformity and glare are definably the most important forms of visual discomfort in an office environment. Rather, to a lesser degree of visual discomfort are shadows and flicker [15].

2.4. Results and Discussion

Seven (7) female and Eleven (11) male participated in the survey which consist of nineteen (19) questions modified from [16]. The questionnaire was distributed among occupants and collected the same day for each building surveyed. Questionnaire used for POE with a Cronbach's alpha of 0.781 realise from the questionnaire and a 95% confidence interval of difference for both the conventional and green building are 9.22349 and 4.70633. There is a significant difference ($t=4.152$, $p=0.001$; $p<0.05$) this shows that DBM occupants are slightly satisfy compare to PSZ.

The result shows that the survey carried out on the building could be improved on so as to carry out the main pilot scheme in form of a test room at the later stage of the research. The use of renewable energy for non-residential buildings in Malaysia and determining the possibilities of incorporating nonphysical dimension in the GBI rating system is of a paramount.

From the visual perception theories and the time most employees spend in their offices there is need to improve on the condition of the visual environment as this will reduce the amount of energy expend to reduce discomfort at work place and influence workers satisfaction.

Table 1: Result of the analysis on questionnaire distributed among occupant of both buildings

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Perception of respondents on psychological effects on visual comfort in a conventional building	Male	11	53.4545	9.05940	2.73151
	Female	7	53.1429	8.05044	3.04278

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Perception of respondents on psychological effects on visual comfort in a green building	Equal variances assumed	1.046	.322	-.379	16	.710	-1.02500	2.70358	-6.75633	4.70633
	Equal variances not assumed			-.403	14.682	.693	-1.02500	2.54613	-6.46219	4.41219

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Perception of respondents on psychological effects on visual comfort in a conventional building	Equal variances assumed	.016	.901	.074	16	.942	.31169	4.20387	-8.60011	9.22349
	Equal variances not assumed			.076	14.080	.940	.31169	4.08897	-8.45358	9.07695

Source: author's field work

Table 2: Result of the analysis on questionnaire and reliability test

Reliability Statistics

Cronbach's Alpha	N of Items
.781	19

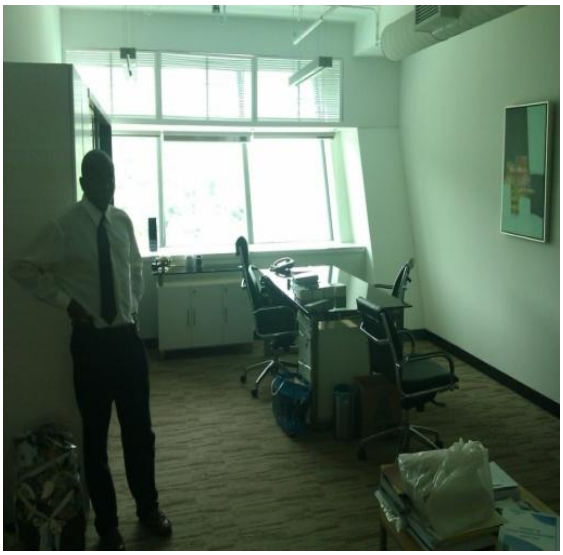
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Perception of respondents on psychological effects on visual comfort in a green building	Equal variances assumed	.012	.916	-.631	16	.537	-1.87692	2.97603	-8.18582	4.43198
	Equal variances not assumed			-.626	7.210	.550	-1.87692	2.99697	-8.92209	5.16824

Source: author's field work

The 19 questions ask in the research are viable to carry out the proposed study via the realization of the Cronbach's alpha of 0.781 as a reliability test although; that green building support visual comfort, more work is required to be carry out since most work on occupant comfort have been on thermal comfort, this research will open up avenue for further work on the other three aspect of IEQ which are; Acoustic, Indoor Air Quality and especially Visual Comfort as it relates to [17] MS 1525:2007 Code of practice on energy efficiency.

Interior showing reception in (PSZ)



Interior of one of the room in (DBM))

Perpustakaan Sultanah Zanariah (PSZ)

Diamond Building Malaysia (DBM))

Fig. 1: Photograph of both buildings that the survey was conducted; (source author's field work)

3. Acknowledgements

The authors would like to acknowledge and thank the International Doctorial Fellowship (IDF) initiated by Universiti Teknologi Malaysia (UTM) supported by the Ministry of Higher Education (MOHE) Malaysia and The Educational Trust Fund (ETF) Nigeria for contributing to this research.

4. References

[1] Gifford, H. A Better Way to Rate Green Buildings: LEED sets the standard for green buildings, but do green buildings actually save any energy? 2008, www.henrygifford.com.

[2] Newsham, G. R., Brand, J., Donnelly, C., Veitch, J., Aries, M., & Charles, K. Linking indoor environment conditions to job satisfaction: a field study Building research & Information. 2009a, 37 (2)129-147 ISSN 0961-321 DOI: 10.1080/09613211108027102 98

[3] Scofield, H. J. Do LEED-certified buildings save energy? Not really… Energy and Buildings. 2009, (41)1386-1390.

[4] Newsham, G. R., Mancini, R, & Birt, J., B. Do LEED-certified buildings save energy? Yes, but… Energy and Buildings. 2009b, (41)897-905

[5] Nawawi, A. & Khalil, N. Post-occupancy evaluation correlated with building occupants' satisfaction: An approach to performance evaluation of government and public buildings. Journal of Building Appraisal. 2008, (4)59–69. DOI:10.1057/jba.2008.22.

[6] Meir, I. A., Garb, Y., Jiao, D. & Cicelsky, A Post-Occupancy Evaluation: an inevitable step toward sustainability. Advances in Building Energy Research. 2009, (3)189-220.

[7] Newsham, G. R., Research matter post occupancy evaluation of green buildings. 2010, pp1-5 NRCC-53568.

[8] Yeang, K. Briefing: Strategies for designing a green built environment: Proceedings of the ICE - Urban Design and Planning. 2010, 163 (4)153-158 ISSN: 1755-0793, E-ISSN: 1755

[9] Aries, M. B. C., Veitch, J A. & Newsham, G. R. Windows, view, and office characteristics predict physical and psychological discomfort. Building and Energy. 2010, (30) 533-541

[10] Robbins, C. L. Day lighting design and analysis: 1936, (pp. 21-24) ISBN 0-442- 27949-3 Van Nostrand Reinhold Company.

[11] Breedlove, et al, Biological psychology, and fifth edition sin aver associates. 2007, www.sumanasins.com/webcontent/animalion/neurobiological.html).

[12] Goodman, T. M. "Measurement and specification of lighting: A look at the future," Lighting Research and Technology. 2009, Vol.4 1, (3) 229-243, DOI: 10. 11 77/ 1 477 1 5350933888 1.

[13] Boyce, P.R. Human factors in Lighting. Lighting Research Center. 2003.

[14] Brainard, G.C., Hanifin, J.P., Greeson, J.M., Byrne, B., Glickman, G., Gerner, E., Rollag, M.D.

Action spectrum for melatonin regulation in humans: evidence for a novel circadian photoreceptor, the journal of Neuroscience. 2001, 21 (6), pp 6405-6412

[15] Berk Alexander Windows and people; A model based on a literature study to identify the influence of windows on people in an office environment with respect to daylight and view. 2010, Technische Universiteit Eindhoven Faculteit Bouwkunde Unit Building Building Physics of the Environment

[16] Woo, H. J. Towards sustainable workspaces: effects of indoor environmental quality on occupant comfort and workspace performance Unpublished PhD Thesis, Faculty of Built Environment. 2010, The University of New South Wales Sydney, Australia

[17] Department of Standards Malaysia. MS 1525:2007 Code of practice on energy efficiency and use of renewable energy for non-residential buildings. 2007, ICS: 91.040.01 first edition http;//www.standardsmalaysia.gov.my.