*International Journal of Engineering & Technology*, 7 (3.32) (2018) 116-119

International Journal of Engineering & Technology

*Website: www.sciencepubco.com/index.php/IJET*

***Research paper***

# Office Interior: The Influence of Office Environmental Factors towards Task Performance

**Arita Hanim Awang[1,*], Zuraini Denan[2], Noor Hanita Abdul Majid[3]**

*[1]Department of Applied Arts and Design, International Islamic University Malaysia*
*[2,3]Department of Architecture, Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia*
**Corresponding author email: aritahanim@iium.edu.my*

**Abstract**

Office environment has become crucial in providing comfort for the workers and in maintaining the sustainability of an office. Office environmental comfort is significant to office workers life as the office has become their second home. Almost half of the five working days were spend in the office. Air conditioning and lighting are among the most significant contributors to high energy consumption in office building in Malaysia. In promoting an energy efficient building, consumption of electrical lighting and air condition in office from morning till evening requires an investigation. The aim of the research is to explore the environmental condition of office which occupied by design related field employees. The environmental air condition and lighting preference are among the significant variables tested. A controlled experiment of a mock-up office with combination of those variables was conducted. The findings indicate that the office workers can still perform their task in extreme conditions which are low level of lighting below 200 lux with highest or lowest temperature between 16 to 32 Degree Celsius, however, the percentage of completion (POC) of the AutoCAD drafting task relatively decreasing. This scenarios show that the designers' office environmental conditions have significant impact towards task performance. The optimum office environmental setting is needed in order to increase employee's task performance.

***Keywords***: *Control Subjective Experiment, Office environment, Office Interior, Task Performance*

## 1. Introduction

As office workers spend more indoor than outdoor every day, thus it is important for them to feel comfortable. For a country like Malaysia, which experience hot weather throughout the year, office indoor climate is normally set to the cold temperature around 18 to 20 degree Celcius to balance the heat transmitted from outside. The problems are the low temperature and the use of electrical lighting has consumed abundance of energy.

Research by Saidur (2009) showed that offices in Malaysia used 59% and 19% of total energy to air conditioning and electrical lighting accordingly [1]. Maybe because outside is hot and bright, office workers desire for colder temperature and far from visual discomfort of natural lighting. Research by Zuraini et. al (2003) showed that most office workers will use blinds to avoid glare or excessive brightness into their working space [2]. It is recommended for employees to have controlled over their own indoor environment, however problem only incurred if they are over use the electrical energy excessively and have no awareness of energy saving and effort on sustainability.

Nevertheless, providing an optimum level of air conditioning and lighting is substantial for office employers to ensure their employees be able to complete their tasks in comfort. For designers' office which occupied office space until late at night, good conditions of office environment must be critically considered.

## 2. Research Objectives

The aim of the research is to explore the preferred physical and environmental condition of office workers in Malaysia. The objectives of the research are:

a) To investigate the employee's performance in different office conditions
b) To find out whether the office physical and environmental comfort affect their perception and task performance.

## 3. Literature Review

There is an evidence that indoor environment criterion have influenced office workers' attitudes, behaviors, satisfaction and work performance [3]. Indoor environment such as temperature, water quality, lighting, and noise condition in office are main concern that may lead to low productivity. Researches show high correlation between feeling of fatigue and office environment [4]. Lots of researches are concerned on the wellbeing of office workers in order to ensure good working performance [3] [5] [6] [7].

The research is concern on two most significant factors: air conditioning and lighting. According to the Malaysian Standard MS1525 (2014), the air conditioning and lighting for a nonresidential building should be ranged from 22 to 26 degree Celcius for dry bulb temperature and 300 to 400 lux for lighting [8]. The

lighting standard is recommended for either general or drawing task office.

An experimental approach is needed in order to see the user perception towards different setting as well as to see the impact of physical environments of office towards the employee's productivity and performance. The same users who experience different type of setting; different scenario or condition can compare and gives their feedback regarding the office condition with more relative answers. This research is to test the office environmental factor in a controlled subjective experiment in order to understand their influence towards employee's task performance and perceived satisfaction.

## 4. Methodology & Procedure

For this experiment, the researcher still focuses on two variables. The log book and task is design to get the user perception and to assess the performance of the respondents when tested on two main areas which are: Lighting and Temperature. The dependent variables will be the user perception and user performance while independent variables will be the lighting and temperature.

The planning for the experiment is divided into three parts. The first part is the instruments development. The second part is the site survey and site selections. The third part is the respondent's criteria and finding suitable respondent to involve in the experiment.

The criteria's of the sites that have been determined are, the site must resembles the actual office environment with the potential of re-arranging the workstation, controlling the lighting and air-condition. The site must also be in shop lot unit. Focus group for this study is the technical assistant or draftsman in architecture or build environment field.

The productivity and performance measures will be based on the relevant task. The task chosen for this experiment is drafting a given layout plan using AutoCAD Software. Each of the respondents is given the same task and the same duration for completing the task. At the end of every task, the respondents have to answer the survey form in Log Book. The model the CPU and monitors are set to be the same specification and the same versions of Autodesk Software were used.

The evaluation for this experiment will be divided into 2 parts. Part 1 is the Office Condition Evaluation (OCE). Part 2 is the Task Performance Evaluation (TPE). OCE uses log book questionnaire as the instruments. The researcher analyzed the respondent's answers in the log book. The questions in the log book are referring to respondent's perception and preference of the office conditions, type of layout and the task given. TPE requires the evaluation from the respondents, the expert and peer evaluation.

### 4.1. Respondents Criteria

The respondent is selected by their nature of work which is experience in working in build environment field. Have the skill using AutoCAD Software. Intermediate level and age below 35 years and has minimum of two years of working. Respondent is given a code number as it will make it easy to analyze.

### 4.2. Mock-up Office Setting

There is four workstation provided in the office. Each of the workstation comes with office chairs, computer cpu, monitor and mouse. Each of the workstation is given a code. T(A) = Table A , T(B) = Table B , T(C) = Table C and T(D) = Table D.

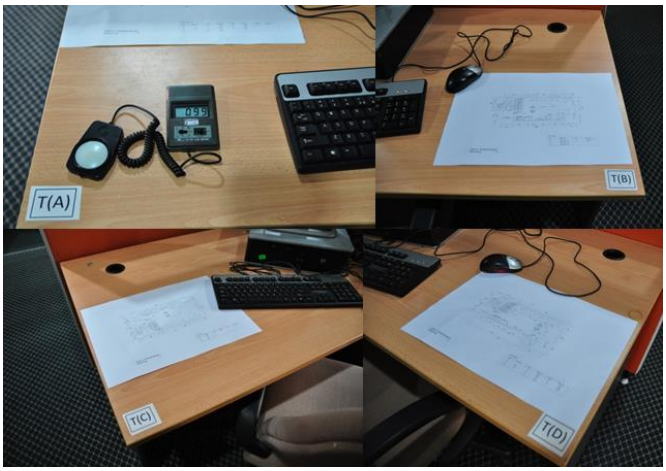



**Fig.1:** The label for each table. The hardcopy of A3 size AutoCAD drawing also placed on the table. Also in the picture is the light meter.

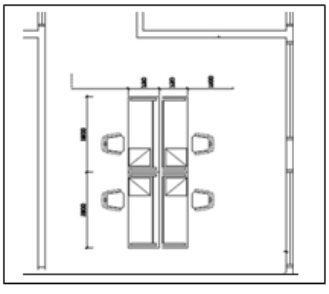
## 5. Analysis & Findings

Analyses for this experiment are divided into two parts: Part 1- Office Condition Evaluation (OCE) and Part 2- Performance analysis of the AutoCAD works by conducting Task Performance Evaluation (TPE) which using Self-Efficacy, Peer Review and Expert Assessments methods to see if they achieved the performance standard by the time given in each of the scenario and layout. For the purpose of this paper, the researchers will only focusing on TPE analysis only.

For the TPE analysis, researcher uses Grading method for TPE. The grading is referred to the Percentage of Completion (POC) scores. The evaluation combines several assessments method in TPE. The grading takes the mean score from Self-evaluation, Peer Evaluation and Expert Evaluation.

In Self-Evaluation, the target or prediction score is required before the respondents starts doing the task. This is initials to get the respondents expectations of their own scores according to their experience and skills. The respondents also need to state their perception of level of difficulties (LOD) of the task before and after doing the task. Other aspect in self-evaluation is the estimated time (ET) of completion needed to conduct the task given before and after doing the task.

**Table 1**: Below is the scene design for the office environment to be tested to the respondent.

| **Layout** | |
|---|---|
|  | The type of layout use in the experiment is HIVE type of office layout which related to design's or collaborative work culture according to Duffy (1976) |
| **Normal Condition** | |

**Normal Condition**
Temperature between : 22-26 degree Celsius
Lighting : General Office work – 400 Lux

**NORMAL CONDITION:**

Temperature is set on average thermal comfort as stated in Guidelines On Occupational Safety And Health In The Office by the Department Of Occupational Safety And Health, Ministry Of Human Resources, Malaysia

**Extreme Conditions**

**EXTREME CONDITION 1:**
The office environment is set in cold condition and with low lighting.
Temperature between : 16-18 degree Celsius
Lighting : General Office work – 200 Lux or lower
**Situation: Cold and Dark**

**EXTREME CONDITION 2:**
The office environment is set in hot condition and with low lighting.
Temperature between : 30 - 32 degree Celsius
Lighting : General Office work – 200 Lux or lower
**Situation: Hot and Dark**

Peer and Expert evaluation only assesses the (POC) using the same rubric form designed specific for the task given in this experiment. All of the respondents were given one hour after each session to evaluate other respondent's task. Two experts in the related working fields, in this case expert in AutoCAD works and drawings are selected to evaluate the respondent's task in terms of POC. They were given a briefing before the assessments.

## 5.1 Self- Evaluation - Perception on level of difficulties (LOD) of the task

**Table 2:** Contingency table of the percentage of respondents remarks stated on their Log Book before and after doing the task.

| | Before | | | After | | |
|---|---|---|---|---|---|---|
| | Easy | Intermediate | Hard | Easy | Intermediate | Hard |
| Scenario 1 | 12.50% | 75% | 12.50% | 25% | 0 | 75% |
| Scenario 2 | 0 | 100% | 0 | 0 | 100% | 0 |
| Scenario 3 | 0 | 100% | 0 | 0 | 75% | 25% |

In this section, each respondent were given 5 minutes before conducting the task to look at the AutoCAD drawings in order to estimates the LOD. 75% of the respondents rate the task as intermediate before conducting the task. However, after 30 minutes given, 75% give the ratings as hard. For the scenario 2, 100% agree that the task is in intermediate level before and after conducting the task. While in scenario 3, 25% change the rates as hard level after conducting the task while the rest still agree that the task given as intermediate level. It can be observed that the respondents start to lower their rates of perception of LOD in order to meet the task expectations.

## 5.2 Self – Evaluation - Respondent perception on the estimated time (ET) needed to finish the task

**Table 3:** Contingency table of the percentage of respondent's remarks stated on their Log Book before and after doing the task for the time needed to finish the given task.

| | Before | | | After | | |
|---|---|---|---|---|---|---|
| | 30 minutes | 45 minutes | 1 hour | 30 minutes | 45 minutes | 1 hour |
| Scenario 1 | 62.50% | 37.50% | 0 | 25% | 12.50% | 62.50% |
| Scenario 2 | 0 | 100% | 0 | 0 | 100% | 0 |
| Scenario 3 | 0 | 100% | 0 | 0 | 75% | 25% |

The same trends can be seen in this section, where more than 62 % of respondents believe that they can finish the task within 30 minutes but later change to 1 hour of ET after conducting the task. For the scenario 2 and 3, 100% of the respondents choose 45 minutes of ET before conducting the task.

## 5.3 Percentage of Completion Score (POC)

This section will discuss on the percentage of completion (POC) score for each scenario. This is the mean score for each task in each table. This is also the score from the respondent's self-evaluation, peer evaluation and expert evaluation.

**Table 4:** Contingency table of the mean score for the task completion predictions target before doing the task and Mean percentage of completion after doing the task.

| Respondents | SCENARIO 1 | | SCENARIO2 | | SCENARIO 3 | |
|---|---|---|---|---|---|---|
| | Self-Prediction Target | MEAN of percentage | Self-Prediction Target | MEAN of percentage | Self-Prediction Target | MEAN of percentage |
| R1 | 70% | 90% | 67% | 70% | 67% | 70% |
| R2 | 67% | 82% | 67% | 60% | 67% | 60% |
| R3 | 100% | 97% | 67% | 53% | 67% | 53% |
| R4 | 67% | 87% | 67% | 63% | 67% | 63% |
| R5 | 75% | 82% | 67% | 69% | 67% | 68% |
| R6 | 100% | 99% | 67% | 67% | 67% | 66% |
| R7 | 67% | 79% | 67% | 62% | 67% | 61% |
| R8 | 84% | 89% | 67% | 60% | 67% | 60% |
| TOTAL | 79% | 88% | 67% | 63% | 67% | 63% |

In scenario 1, the total mean of POC is 88%, 9% higher than the self-prediction POC target. The percentage of POC decline in scenario 2 and 3 to 63%. However, the percentage of self-prediction POC also had been made lower to 67% making the different of mean percentage POC and self-prediction POC is only 4%. In scenario 2, only 3 respondents meets their POC targets while in scenario 3, only 2 respondents meets their own targets.

**Table 5:** Contingency table of the percentage for the respondents who achieved their own targets for percentage of completion (POC).

| | Achieved | Did not achived |
|---|---|---|
| Scenario 1 | 100% | 0 |
| Scenario 2 | 25% | 75% |
| Scenario 3 | 12.50% | 87.50% |

This gives some insight on the respondent's performance. In scenario 1, 100% of the respondents achieved their target of POC, while in scenario 2, only 25% achieve their POC and the rest of 75% did not achieve their target. The percentage of achieved POC declines greater in scenario 3 to only 13% of the respondents. It can be said that the respondent's performance are decreasing in scenario 2 and 3 even when they lower their own expectations.

This experiments indicated that the respondents task performance are relatively affected by the two independent variables tested which are the temperature and lighting. This is represented by the decrease number of respondents who achieved their POC.

## 6. Conclusions

Designer's office usually operates more than normal office hours especially when they are having submissions and have to fulfill tight deadlines. This situation exposed the employees to longer working hours and longer usage of electricity. The optimum provisions of lighting and temperature will give more comfort to the employees and will definitely help them to increase their focus and performance. Lighting and temperature settings which have been as stated in Guidelines On Occupational Safety And Health In The Office by the Department Of Occupational Safety And Health, Ministry Of Human Resources, Malaysia have been tested as normal conditioned in this experiment showed a better result than the extreme conditioned where less lighting provisions and extreme temperature tested. Therefore, it is very important for the employers to follow the guidelines of the office environmental settings in order to give better working environment to the employees especially to the designers who are exposed to the longer working hours.

## Acknowledgement

The authors gratefully acknowledge use of the services and facilities of the International Islamic University Malaysia (IIUM). This research is funded by IIUM Research Grant - RIGS17-074-0649

## References

[1] R. Saidur (2009). Energy Consumption, Energy Savings and Emission Analysis in Malaysian Office Buildings, Vol. 37, Issue 10, October 2009, Pp. 4104-4113

[2] Zuraini Denan, Prof. Phil Jones, and Don Alexander. (2003). The Awareness of Visual Comfort Through the Application of Passive Low Energy Design in Office Building in Kuala Lumpur, Malaysia-A Case Study, Post-Graduate Conference 2003, April, Lisbon Portugal,

[3] N. Kamarulzaman, A.A. Saleh, S.Z. Hashim, H. Hashim and A.A. Abdul Ghani. (2011). An Overview of the Influence of Physical Office Environments Towards Employees, Procedia Engineeing, 20 (2011), pp. 262-268.

[4] Seok-bong Park and Shigeru Gotoh. (1993). Researchon Office Environment Evaluation and worker Fatigue, Journal of Thermal Biology, Vol.18, Issue 5-6, December 1993, pp. 565-570.

[5] Vischer and Jaqueline (1989). Environmental Quality in Office, Van Nostrand Reinhold. New York.

[6] Chapins, A. (1995).Workplace and the Performance of Workers. Reston: USA.

[7] Ajala, A.M. (2012). The Influence of Workplace Environment on Workers' Welfare, Performance and Productivity, The African Symposium, Vol. 12, No.1, June 2012.

[8] MS1525 (2014) Code of Practice for Energy Efficiency and Use of Renewable Energy for Nonresidential Buildings: Department of Standards Malaysia.