POST OCCUPANCY EVALUATION (POE) AND INDOOR ENVIRONMENTAL QUALITY (IEQ) ASSESSMENT: A CASE STUDY OF UTEM'S TECHNOLOGY CAMPUS

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This report is submitted
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DECLARATION

I declare that this project report entitled "Post Occupancy Evaluation (Poe) And Indoor Environmental Quality (IEQ) Assessment: A Case Study of UTeM's Technology Campus" is the result of my own work except as cited in references.

Signature : 

Name : THAMARAI VATHANI ELANGKOVAN

Date : 20/7/2020

APPROVAL

I hereby declare that I have read this project report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering.

Signature :

Supervisor : DR TEE BOON TUAN

Date :

DEDICATION

To my beloved mother and father

ABSTRACT

Satisfaction and comfort level in a building is most demandable aspect by occupants that required to be concerned. Good management of indoor environmental quality can results enhancement towards health and well-being of occupants. Thus, by determining factors which involves in indoor environmental quality such as thermal comfort parameters and air quality parameters, various illness and unstable emotions of the occupants. This study of evaluating the indoor environmental quality works along the process of post occupancy evaluation which is to gather feedback performance of the building in use. The main objective of this research is to identify occupants' satisfaction and perception level on academic building in technology campus of UTEM especially in Faculty of Mechanical Engineering (FKM) and Faculty of Technology Management & Technopreneurship (FPTT). Thermal comfort analysis and indoor air quality analysis were conducted to appraise the indoor environmental quality of the buildings. Both analyses were conducted in the form of physical measurement and subjective assessment. Physical measurement in classroom were carried out with relevant instruments. Meanwhile, subjective assessment was carried out with distributing questionnaire in google form in order to obtain occupants' feedback. Followed by regression analysis which is to estimate the values of the dependent variables by using values of independent variables such as operative air temperature, PMV index, relative humidity, air velocity in order to identify their strength relationship. Based on the findings of this study, technical design improvisation are proposed with the goal to improve the indoor environmental quality in the buildings. This research will be helpful for those who endeavour to enrol research in this similar field.

ABSTRAK

Tahap kepuasan dan keselesaan di bangunan adalah aspek yang paling diperlukan oleh penghuni yang perlu diberi perhatian. Pengurusan kualiti persekitaran dalaman yang baik dapat menghasilkan peningkatan terhadap kesihatan dan kesejahteraan penghuni. Oleh itu, dengan menentukan faktor-faktor yang melibatkan kualiti persekitaran dalaman seperti parameter keselesaan termal dan parameter kualiti udara, pelbagai penyakit dan emosi penghuni yang tidak stabil. Kajian ini menilai kualiti persekitaran dalaman berfungsi sepanjang proses penilaian pasca penghunian iaitu untuk mengumpulkan prestasi maklum balas bangunan yang sedang digunakan. Objektif utama penyelidikan ini adalah untuk mengenal pasti tahap kepuasan dan persepsi penghuni terhadap bangunan akademik di kampus teknologi UTeM terutamanya di Fakulti Kejuruteraan Mekanikal (FKM) dan Fakulti Pengurusan Teknologi & Teknologi (FPTT). Analisis keselesaan termal dan analisis kualiti udara dalaman dilakukan untuk menilai kualiti persekitaran dalaman bangunan. Kedua-dua analisis dilakukan dalam bentuk pengukuran fizikal dan penilaian subjektif. Pengukuran fizikal di kelas dilakukan dengan instrumen yang relevan. Sementara itu, penilaian subjektif dilakukan dengan menyebarkan borang soal selidik dalam bentuk google untuk mendapatkan maklum balas penghuni. Diikuti dengan analisis regresi iaitu menganggarkan nilai pemboleh ubah bersandar dengan menggunakan nilai pemboleh ubah bebas seperti suhu udara operasi, indeks PMV, kelembapan relatif, halaju udara untuk mengenal pasti hubungan kekuatannya. Berdasarkan penemuan kajian ini, improvisasi reka bentuk teknikal dicadangkan dengan tujuan untuk meningkatkan kualiti persekitaran dalaman bangunan. Penyelidikan ini akan bermanfaat bagi mereka yang berusaha untuk mendaftar penyelidikan dalam bidang serupa ini.

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SYMBOLS	DESCRIPTION
^{o}C	Degree Celcius
m	Metre
s	Seconds
%	Percentage
m/s	Velocity
ppm	Parts-per-million
cfm	Cubic feet per minute
R^2	Coefficient of determination

LIST OF ABBREVIATION

ABBREVIATION	DESCRIPTION
AV	Air Velocity
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers
CO	Carbon Monoxide
CO_2	Carbon Dioxide
FKM	Faculty of Mechanical
FPTT	Faculty of Technology Management and Technopreneurship
IEQ	Indoor Environmental Quality
IAQ	Indoor Air Quality
LEED	Leadership in Energy and Environmental Design
MS	Malaysian Standard
PM	Particular Matter
POE	Post Occupancy Evaluation
PMV	Predicted Mean Vote
PPD	Predicted Percentage of Dissatisfied
RH	Relative Humidity
TSV	Thermal Sensation Vote
UTeM	Universiti Teknikal Malaysia Melaka

CHAPTER 1

INTRODUCTION

1.1 Background

In the era of rapid growing technology, people tend to chase after the term of satisfaction and comfort level in their respective occupied building. Aspects of comfortability to use and utilize serves as it must be fit for purpose as its demandable priority of occupants. The question is how efficient is the building performance that tally with occupants' satisfaction?

Post Occupancy Evaluation (POE) is the process of obtaining feedback performance in use. Being mandatory in majority of public buildings, it's rapidly recognised. This process also acts as a weapon in correcting past mistakes in terms of design where this is conducted after occupancy of occupants. In many cases, designed buildings' performance not up to the planning and expectation. These may bump on the results such as over costs and poor performance, occupant's wellbeing and business efficiency. Among the benefits from POE is it helps to identify successful design features to repeat (Watson,2003), identify problems to migrate or reduce, improve building environment performance (Vischer,2002; Hewitt et. al,2005).

Meanwhile. Indoor Environmental Quality (IEQ) encompasses the conditions inside a building—air quality, lighting, thermal conditions, ergonomics and their effects on occupants or residents. Strategies for addressing IEQ include those that protect human health, boost quality of life, and minimize stress and potential injuries. Better indoor

environmental quality can enhance the lives of building occupants, increase the resale value of the building. Moreover, it also reduces liability for building owners.

The common endeavour of human being across the globe and through the timeline of human is to create a comfortable indoor environment at any circumstance to satisfy people. The overall comfort of indoor air environment constantly plays a critical role for human not only because of human comfort but also it has critical and major influence on human life (Costanza et al. 2007) There are several factors that influencing indoor environmental quality. There is thermal comfort, indoor air quality, lighting, acoustic condition and so on. By reviewing what occupants' experience and how they response to their needs by use and occupy building, information of building conditions can be collected.

In this research, the main elements that have focused are thermal comfort and indoor air quality in order to evaluate the indoor environmental quality in both buildings of Faculty of Mechanical and Faculty of Technology Management & Technopreneurship (FPTT) from UTeM's Technology Campus. According to the results obtained from the study, proactive measures to improve the indoor environmental quality will be recommended.

1.2 Problem Statement

Classrooms in each faculty plays a vital role in students' university life. These learning space must perfect in terms of the physical atmosphere where students' learning process can take place uninterruptedly. According to the previous observations, it is noticed that some of the students are being affected by health and also performance (Salleh et al., 2013). Some even felt hot and inconvenient while learning in classroom, where they tend to feel weak. Since there are several aspects may contribute to the impacts faced by the students it is best to conduct this research based on these questions to get a clear vision on this issue.

1. Do occupants satisfy with current indoor environmental quality of academic building in technology campus of UTeM.?
2. Do the learning process of students are being affected due to poor environmental conditions?
3. How to improve indoor environment quality in academic building and implement them in practical?

1.3 Objectives

1. To determine occupants' satisfaction and perception level on academic building in technology campus of UTeM.
2. To suggest and recommend ways to improve indoor environment quality in academic building.

1.4 Scope

Due to the rapid development of the university, the Technology Campus is utilised to accommodate the Faculty of Mechanical Engineering and the university's latest Faculty of Engineering Technology which was admitting its first batch of students in September 2011 and Faculty of Technology Management & Technopreneurship (FPTT).The premise has a land area of 119,200 sqm and was made as the industrial campus to sustain the increasing number of students. The industrial campus was equipped with laboratory facilities, library and a more organised administrative office. In this study, the focus of evaluating the indoor environmental quality is towards both Faculty of Mechanical Engineering and Faculty of Technology Management & Technopreneurship (FPTT) since it

is the new building in UTeM's Technology campus. Sample of the classes are only air-conditioned classrooms and number of classrooms are 4. For Faculty of Mechanical Engineering classroom 4 have been taken as sample and for Faculty of Technology Management & Technopreneurship (FPTT) classroom 5, 8 and 11 were selected as sample. The measurement of data includes physical and subjective measurements. Physical measurement in classroom were carried out with relevant instruments. Meanwhile, subjective assessment was carried out with distributing questionnaire in google form in order to obtain occupants' feedback. The focus of the study is to evaluate the IEQ and suggest effective ways to improve them.

1.5 Significance of Research

There are multifarious benefits can be obtained by conducting this research of POE and IEQ in campus technology of UTeM. First and foremost, it is important to carry out this research in order to monitor satisfaction level of occupants especially students during lecture hours. By collecting the data, we can improve user requirements in terms of comfortability.

Furthermore, it is also work as a strategic space planning design by management as a tool to work on management procedures to improve design of building which contributes to positive and negative feedback from occupants. Thus, it is fundamental to conduct this research were all the data collected can be interpreted into table and carry out a comparison between lecture rooms. Upon submission of the data obtained and suggestion provided from the research management will have a clear idea to come up with various solution that currently exist.

According to the recommendation, management also can plan for the budget that needed to be spent to execute relevant actions. For example, collection of funds from