MEASUREMENT OF THERMAL COMFORT AT CLASSROOM: A CASE STUDY IN UTeM

STANLEY YONG THAU FOONG

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Measurement of Thermal Comfort at Classroom: A Case Study in UTeM

Report submitted in accordance with the partial requirements of the
Universiti Teknikal Malaysia Melaka for the
Bachelor's Degree of Manufacturing Engineering
(Manufacturing Management) With Honours

By

Stanley Yong Thau Foong

Faculty of Manufacturing Engineering
May 2008

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APPROVAL

This report submitted to the senate of UTeM and has been accepted as partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management). The member of the supervisory committee is as follow:

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DECLARATION

I hereby, declared this report entitled "Measurement of Thermal Comfort at Classroom: A Case Study in UTeM" is the results of my own research except as cited in the references.

Signature	:	……
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ABSTRACT

Thermal comfort is a condition of mind which expresses satisfaction with the surrounding thermal environment. A person's perception of thermal comfort is affected by air temperature, mean radiant temperature, air velocity, relative humidity, metabolic rate for work activities and clothing insulation. Thermal comfort in classrooms has to be considered seriously because of the negative influence on learning and the potential for energy conservation through careful temperature control. In recognition the importance of thermal comfort in classroom, the objectives of study are to determine the response of occupants regarding to thermal comfort at classroom in UTeM, measure the actual thermal comfort at classroom in UTeM, and propose the solutions in order to improve or maintain the thermal comfort at classroom in UTeM. Determination of occupants' responses was obtained through observation method associated with a questionnaire. Measurement of actual thermal comfort in classroom is performed via direct technical measurement associated with a thermal comfort monitor to determine the PMV and PPD. Meanwhile, the thermal comfort improvement was proposed based on engineering controls and administrative controls. The results of occupants' responses show that BK 12 in morning and afternoon sessions and BK 5 at evening session are the most dissatisfied classrooms. However, the results of direct technical measurement show also that the BK 12 in morning and afternoon sessions and BK 5 at evening session are the most dissatisfied classrooms. When compared between each other, the direct technical measurement has confirmed the findings of occupants' responses at morning session, but it is not at afternoon and evening sessions as they show the negative correlations.

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ABSTRAK

Keselesaan terma adalah suatu tafsiran minda seseorang yang menyatakan kepuasan hatinya terhadap terma di persekitarannya. Ia adalah berpunca daripada suhu udara, suhu pancaran persekitaran, halaju angin, kelembapan, kadar metabolisme untuk aktiviti kerja, dan penebatan pakaian. Di dalam bilik kelas, keselesaan terma perlu dipertimbangkan kerana suhu yang tidak selesa akan memberi kesan negatif kepada proses pembelajaran. Setelah menyedari kepentingan keselesaan terma di dalam bilik kelas, kajian ini dijalankan adalah untuk mencapai objektif: menentukan maklum balas penghuni (pelajar dan pensyarah) terhadap keselesaan terma di dalam bilik kelas di UTeM, mengukur secara langsung keselesaan terma di dalam bilik kelas di UTeM dan mencadangkan cara penyelesaian untuk penambahbaikkan atau mengekalkan keselesaan terma di dalam bilik kelas di UTeM. Maklum balas penghuni adalah diperolehi melalui kaedah pemerhatian dengan menggunakan borang soal selidik. Pengukuran sebenar keselesaan terma di dalam bilik kelas adalah dilaksanakan menggunakan pengukuran teknikal secara langsung iaitu menggunakan alat pemantau keselesaan terma supaya nilai Predicted Mean Vote (PMV) dan Predicted Percentage Dissatisfied (PPD) dapat ditentukan. Keputusan maklum balas penghuni menyatakan bahawa bilik kelas BK 12 pada sesi pagi dan tengahari dan bilik kelas BK 5 pada sesi petang adalah bilik kelas yang paling tidak selesa. Keputusan pengukuran teknikal secara langsung juga menyokong bahawa bilik kelas BK 12 pada sesi pagi dan tengahari dan bilik kelas BK 5 pada sesi petang adalah yang paling tidak memuaskan. Melalui perbandingan, penyelidik mendapati pengukuran teknikal secara langsung telah mengesahkan keputusan maklum balas penghuni pada sesi pagi. Walau bagaimanapun, ianya tidak sama pada sesi tengahari dan petang setelah kajian statistik (Analysis of Variance) menunjukkan terdapat hubungkait yang negatif.

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DEDICATION

For my beloved mother and father.

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ACKNOWLEDGEMENTS

I would like to take this opportunity to acknowledge those who have helped me throughout my final year project in any ways. I owe the success in this project to them. First and foremost, my deep appreciation to my supervisor, Mr. Isa bin Halim for his excellent supervision, invaluable guidance, trust, advice and constant help, support, encouragement, and assistance towards me throughout this project.

My heartiest gratitude to the Universiti Teknikal Malaysia Melaka (UTeM), because providing me the place, time, and equipments, for giving me the opportunity to carry out my case study in this project and the full support in everything I'm doing now.

Finally, I would like to say thanks to my family whose endless encouragement and support gave me added strength and inspiration to carry out this project to the best of my ability. At the same time, I would like to thank my friends for haring their ideas and comments in order to accomplish my project.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

ANOVA	-	Analysis of Variance
ASHRAE	-	American Society of Heating, Refrigerating and Air Conditioning Engineers
BK	-	Bilik Kuliah
CATI	-	Computer-Assisted Telephone Interview
CPU	-	Central Processing Unit
DB	-	Dry Bulb Temperature
Dr.	-	Doctor
FAN	-	Field Area Network
G	-	Globe Temperature
HI	-	Heat Index
Hrs.	-	Hours
HVAC	-	Heating, Ventilating, and Air Conditioning
IPTA	-	Institusi Pengajian Tinggi Awam
ISO	-	International Organization for Standardization
LAN	-	Local Area Network
NIOSH	-	National Institute for Occupational Safety and Health
No.	-	Number
NWBT	-	Natural Wet Bulb Temperature
PD	-	Percentage Dissatisfied
PhD	-	Doctor of Philosophy
PMV	-	Predicted Mean Vote
PPD	-	Predicted Percentage Dissatisfied
RH	-	Relative Humidity
RTD	-	Resistance Temperature Detectors

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