Ergonomics Assessment for Assessing Thermal Comfort at Learning Facilities in UTeM

Thesis submitted in accordance with the requirements of the National Technical University College of Malaysia for the Degree of Bachelor of Engineering Manufacturing (Process)

By

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May 2007
DECLARATION

I hereby, declared this thesis entitled "Ergonomics Assessment for Assessing Thermal Comfort at Learning Facilities in UTeM" is the results of my own research except as cited in references.

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ABSTRACT

Thermal comfort is the crucial matters in order to get the best convenient thermal environment in the learning facilities; library and classroom. However the condition can be measure by two methods: which are by obtaining the response from the occupants of the learning facilities through questionnaire and by assessing the actual condition with the thermal comfort monitor. Frankly, there were a library and seventeen of classrooms in Industrial Campus of Universiti Teknikal Malaysia Melaka (UTeM). Conversely in achieving this study, there is no authority to be implemented as this study just able to recommend the present condition by increase or decrease the temperature of the ventilation equipment whenever it is cold. The recommendation improvement is depend on the UTeM right either to be approve or via versa. After the completing the both method, can be observably obtain that a few classrooms including the library grasp the thermal discomfort condition via the predictive mean vote (PMV) and high of predictive percentage dissatisfaction (PPD). Mutually the terms of PMV and PPD is obey to the thermal environment standard ISO 7730.
ABSTRAK

Kajian ini menunjukkan beberapa keputusan satu kajian luar mengenai penyiasatan keselesaan alam sekitar di perpustakaan dan bilik-bilik darjah. Penyaman udara adalah biasa dalam pejabat-pejabat walaupun tenaga yang tingginya penggunaan disebabkan oleh panas dan cuaca lembap Malaysia. Satu kajian di tanggapan dan sukatan terma keselesaan dikendalikan atas buah kelas dan sebuah perpustakaan dalam industri kampus di Universiti Teknikal Malaysia Melaka (UTeM). Fungsi utama satu bangunan pejabat yang secara mekanik mengalirkan udara adalah untuk menyediakan satu persekitaran sihat dan selesa untuk penghuni-penghuninya. Pusat kualiti udara yang tertutup dan baik sebuah bangunan boleh dikekalkan oleh membiarkan dalam udara segar bersih dalam satu jumlah mencukupi untuk orang ramai hidup di dalam. Lima puluh peratus (50%) penghuni adalah perempuan dan 50% adalah lelaki. Keselesaan terma yang miskin boleh mengurangkan semangat produktivi pekerja dan pelajar. Data yang sungguhpun diukur adalah mengikut piawai ISO 7730 bagi mendapatkan nilai PMV dan PPD. Namun begitu, untuk memperbaiki keadaan sebenar, terpulang kepada pihak universiti untuk mengambil kira kos rendah, sederhana dan tinggi.
DEDICATION

Specially to my dearest mum,
I will always love and always by your side.

Not forgetting,
My siblings, my sister and brothers
Thanks for all your support.

Last but not least,
Thanks to all my friends whoever assist me in completing this project
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CHAPTER ONE
INTRODUCTION

This chapter intents to provide comprehensive background information and it is ordered to reveal the inventiveness of the study. Descriptive information is also given on: background and problems, research requirements, potential benefits from the study, study outline and structure of the thesis.

1.1 BACKGROUND AND PROBLEMS

Nowadays there were several learning centers published in Malaysia. Out of 19 public universities had been discovered all around in Peninsular and East Malaysia. In short, the opportunity of learning is widen to the future. UTeM is one of the public universities which is the first technical university in Malaysia. It was abbreviation of Universiti Teknikal Malaysia Melaka. This technical university consists of 5 faculties which are Electrical Engineering, Electronic and Computer Engineering, Mechanical Engineering, Manufacturing Engineering and Information Technology.

Ergonomics or human factors is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance.

The thermal comfort associated with study environment in learning facilities needs to be managed efficiently since poor study environment can affect the students’
performance. The environmental factors include air temperature; air velocity and relative humidity have to take into consideration to enhance the comfort level in study environment. Naturally, human such as students want to feel comfortable; they like to study in an environment that is neither hot nor cold and neither very humid nor very dry. The students may experience thermal discomfort if the learning facilities either too hot or too cold. Although the thermal discomfort may not directly harm the students, but it does affects the performance of students. Students maybe less consideration, sleepy and feel tired when the process of learning is running. In order to study in a good condition, should be considering of the study environment first. In the best condition, student will concentrate and give full of attention to the teachers/lecturers without disturbance. As the sample of this topic, library and classroom at Academic Building in Industrial Campus had been chosen.

Nevertheless the college authorities can increase productivity in a variety of ways. For example: The most obvious methods involve automation and computerization which minimize the tasks that must be performed by students. Recently, less obvious techniques are being studied that involve ergonomic design and student comfort. A comfortable employee, the theory maintains, can produce more than a counterpart who struggles through the day. In fact, some studies claim that measures such as raising workplace temperature can have a drastic effect on office productivity. Experiments done by the Japanese Shiseido Corporation also suggested that productivity could be increased by means of perfuming or deodorizing the air conditioning system of workplaces.

Ergonomic Assessment can be define as an intensive review of a particular work station for the purpose of determining any necessary modifications to maximize the productivity of the employee by eliminating hazards which ma cause injury. For this situation, ergonomic assessment is the preeminent solution to the thermal comfort condition in UTeM learning facilities. An employee may experience discomfort or difficulty in performing the essential functions of their job due to inadequate equipment used to perform their job. The employee may request an ergonomic assessment based on
the medical information or based on both the medical information and any discomfort or pain associated with performing their job tasks. The medical information should be submitted to the Department of Management and Budget, Safety and Health Unit, along with a request, in writing, for an ergonomic assessment.

The Safety and Health Unit will then schedule an ergonomic assessment through the Michigan Accommodation Center, which is a part of the Michigan Rehabilitation Services, Department of Career Development. The purpose of the assessment is to help the department in preventing work injuries through job site modifications. Such ergonomic improvements can result in fewer injuries, reduced absenteeism, decreased turnover, increased efficiency, improved work quality, higher morale, and lower workers’ compensation costs.
1.2 STUDY REQUIREMENTS

In affording due to the problem stated, it is essential to adopt ergonomic assessment approach in order to manage the suitable thermal conditions in UTeM learning facilities. Specifically the project tries to achieve the objectives of:

1.2.1 To determine the response of students regarding to the current thermal comfort at learning facilities in UTeM.

A list of questionnaire has been set regarding to the issue. The questionnaire is set into two portions; one is for the conditions in the classrooms while another one is specifically to the condition in the library.

1.2.2 To assess the actual condition of thermal comfort at learning facilities in UTeM.

The specific experiment is to get the actual condition of learning facilities in UTeM is not comfortable to the students of the thermal comfort. This can be proven of the result of the questionnaires given.

1.2.3 To verify whether the current condition complies with standard/ specification

The existence of a comfortable living environment is necessary for a healthy and productive life. The state of comfort depends on a wide range of factors some of which are not quantifiable, such as psychological well-being. In quantifiable terms, thermal comfort can be said to be related to a set of environmental conditions such as air temperature, radian temperature humidity, air movement, etc., which are, in turn, dependent on personal variables such as clothing and
activity. For given clothing values and activity ranges, there are environmental conditions under which most people feel comfortable.

1.2.4 To make recommendations for the improvement of thermal comfort at learning facilities in UTeM.

Recommendations are needed to determine a conducive environment of study in the best thermal comfort regarding to the portions stated which are in the library moreover in the classroom.
1.3 SCOPE AND LIMITATIONS OF STUDY

This section is intended to describe the scope and limitations of carried out study. The scope of the study is specifying to the learning facilities in UTeM. The main constitution of the learning facilities of the Industrial Campus in UTeM is library and classrooms.

![Diagram](image)

**Figure 1.3: Flow of the scope for the thesis**

The recommendation for the improvement of thermal are proposed by redesign, etc. The proposed solutions may found to be an effective solution to enhance the thermal of staffs and students. Nevertheless, the implementation of the proposed solutions is depended on UTeM willingness to deploy the solution. In addition, UTeM is free to make decision whether to accept the proposed solutions. More over, the study has no direct access and authority to enforce the proposed solutions to UTeM even though the effectiveness can be proved.
1.4 POTENTIAL BENEFITS FROM THE STUDY

The potential benefits discovered from the problem statement are towards the students and staffs (including the lecturer and librarian). The thermal comfort condition is studied concerning of the thermal discomfort at the certain area due to the scope. The study will evaluate the temperature in the classroom and library campus. However for the potential benefits can be summarized as:

i. The information of the thermal comfort condition will be documented. This issue is important due to the study environment.
ii. The study will be beneficial for the future study related to study environment in learning facilities and it will be widen.
iii. The study of thermal comfort is using the proper equipment for thermal comfort assessment and will be highlighted.
iv. Other than that, the study will give a beneficial technique on how the assessment is being done which related to thermal comfort.
1.5 STUDY OUTLINE

The three-stage of study approach can be summarized as follows:

1.5.1 To assess and analyze thermal comfort at learning facilities in UTeM

The first stage is important in evaluating the problem statements. The main problem is about temperature condition in building of learning facilities. The thermal comfort of the learning facilities influenced the study environment which also effecting to the students performance. While in the library engaged to the librarian an also the students.

1.5.2 To determine the level of thermal comfort at learning facilities in UTeM

Due to the problem statements, which concerned of temperature, thermal comfort device, named QUEST is utilized. The thermal comfort device is able to take the data of air temperature, air velocity and relative humidity. From the data obtained, the indexes of PMV and PPD could be classified.

1.5.3 To propose the solution regarding to the problem statements.

In order to get the optimum study environment at learning facilities in UTeM several solutions have to be proposed. Regarding to the problem statements, there were three points of solution. They are low cost solution, medium cost solution and high cost solution. Concerning of the problems, low cost solution is by construct pane, as the air could flow easily. In addition curtain is bed in to the windows to avoid sunlight get through the building. For the medium cost solution, ventilation shall be installed to the building. While the high cost solution, air-conditionable is added to the building. However, the allotment of educations funds is effective and whether the upgraded facilities can improve teaching effectiveness and learning behaviors in the education. Conversely to the normal thermal comfort position, just maintain the thermal.