



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**HUMAN ACTIVITY ANALYSIS USING DELMIA ERGONOMICS
ON JTKP MILLING LABORATORY**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in *Manufacturing* Engineering Technology (Product Design) (Hons.)

by

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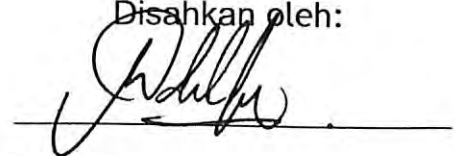
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ABSTRAK

Projek ini bertujuan untuk mengkaji dan mensimulasi beberapa tugas manusia yang berkaitan dengan keupayaan semasa mereka menggunakan mesin pengilangan di JTKP Makmal Teknologi Pemesinan. Pemerhatian akan dijalankan pada 3 orang pelajar lelaki dan 3 orang pelajar perempuan Fakulti Teknologi Kejuruteraan (FTK) dengan kategori ketinggian pada paling tinggi, sederhana dan rendah. Postur kerja mereka semasa melakukan set-up prosedur pada mesin pengilangan akan direkodkan dan diambil gambar. Berdasarkan pemerhatian, susun atur kerja di makmal mesin pengilangan akan direka bentuk menggunakan software CATAIA V6. Satu manikin akan dimasukkan dan diubah berdasarkan data antropometri yang dikumpulkan daripada responden pelajar. Selepas itu, analisis aktiviti manusia akan disimulasi dengan menggunakan analisis DELMIA Ergonomik. Postu kerja akan dianalisis dan dijustifikasi dengan menggunakan kaedah Rapid Upper Limb Analysis (RULA). Berdasarkan skor RULA, Postur kerja yang bersesuaian semasa menggunakan mesin pengilangan akan dicadangkan untuk mengurangkan risiko daripada mengalami Musculoskeletal Disorder (MSD). MSD adalah salah satu penyakit yang disebabkan oleh manual pengendalian tugas seperti mengangkat, menolak dan menarik. Operasi menggunakan mesin pelarik telah dikenalpasti melibatkan beberapa jenis aktiviti pengendalian manual.

ABSTRACT

This project aims to study and simulate several human's task related to human capabilities while using milling machine in JTKP Machining Technology Laboratory. Observation has been conducted on three males and three females students group of Faculty of Engineering Technology (FTK) with the height category in tall, medium and short. The respondents working postures while doing set-up procedures on milling machine had been recorded and photographed. Based on the observation, the working layout in milling machine laboratory was designed using CATIA V6 software. A lifelike manikin was inserted and edited based on the anthropometrics data collected from the respondents. Then, the human activity analysis was simulated by using DELMIA Ergonomics analysis. The respondents working postures was then analyzed and justified by using Rapid Upper Limb Assessment (RULA) method. Based on the RULA scores, the ideal working postures while working on milling machine was proposed to minimize the risk from Musculoskeletal Disorders (MSD). MSD is one of the sicknesses caused by manual handling task such as holding, lifting, carrying, pushing and pulling. Milling machine operations has been identified involve several kinds of manual handling activities.

DEDICATION

Specially dedicated to my family

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First of all, I would like to thank to Allah s.w.t.because let me breath until this day to complete this Bachelor's Degree Project for 2 semesters.

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Mohamad Ikram Bin Mohamad

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CHAPTER 1

INTRODUCTION

1.1 Background

DELMIA V6 ergonomics is the design software that will be used in this project. It can perform the Rapid Upper Limb Assessment (RULA) analysis regarding human posture, record a simulation that can make a manikin move. First of all, ergonomics is the study of human in the working environment. It's come with comfortable, health and safety in a situation. Today, the world with so much technology and machining needs ergonomics because it provides to analyze our body postures when our body is under any ergonomics risk factors.

This project is about the ergonomics human activity analysis working postures of students while using milling machine in laboratory. The layout of the milling laboratory is influence in this analysis because ergonomics is a study of human activity in the workspace. Then, the analysis is focus on working posture of students while using milling machine and the movement of students take a milling tool to set up the machine.

By using DASSAULT SYSTEMES software, CATIA V6 can make the human activity analysis. It's 3D virtual environment software that can make a design in it. To complete the task, RULA analysis is the method to analyzing risk factors to the upper limb. Users can analyze a safety scoring of the working postures by observing colour reading of RULA. **Figure 1.1** shows the example of manikin in CATIA V5.



Figure 1.1: Example of manikin in CATIA V5

1.2 Problem Statement

This research is based on human activity analysis while students using milling machine in laboratory, which can carry out several machine procedures. From several studied many workers on milling machine suffering musculoskeletal disorder which is on the neck, shoulders, trunk and lower back region. It is because they don't have an ergonomics guideline and assessment implemented. Since the guideline also do not have in JTKP Machining Technology Laboratory, therefore the student's activities when operating the milling machine will be observe and analyze.

1.3 Objectives

The main objectives in this project are

- i. To study and simulate several human's task related to human capabilities while using milling machine in JTKP Machining Technology Laboratory.
- ii. To identify and propose the best ergonomics working posture on milling machine aiming to minimize the risk from suffer musculoskeletal disorders.
- iii. To identify relevant collected anthropometric dimensions in human-machine interaction that could be related to awkward working posture.

1.4 Workscope

The scope of this project covers on:

- i. Using DELIMA V6 ergonomics software to study and simulate human activity.
- ii. Observe and analyze the laboratory work on milling machine by recording it in video and photo.
- iii. Study and analyze on Rapid Upper Limb Assessment (RULA) ergonomics analysis.
- iv. Research and study the recommendations from National Institute for Occupational Safety and Health (NIOSH).
- v. Observe on three male and three female students group of Faculty of Engineering Technology (FTK) with the categories of height in tall, medium and short while doing set-up procedures on lathe machine.

1.5 Summary

This chapter describes the introduction of this research. The basic knowledge of DELMIA has been presented. Posture is important to worker person that use a milling machine. It will applied to CATIA to get a data of the posture. The problem statement has been reviewed. This problem statement describes the main reason why this project has been chosen. The objectives of this project have been stated. These objectives are the things that will be achieve throughout this research. Fourthly, the workscope has been discussed. This will help to guide the process of the study for better understanding. Lastly, all benefits of this study have been discussed in the project significance section.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This section will present the research that have been conducted by several people regarding to the DELMIA in workstation. This research contains more than one journal or articles. The main objective of this section is to find out all journal and articles that relate with this project such as DELMIA and ergonomics.

2.2 Laboratory area

Laboratory area is the area to make the product using tools such as Department of Manufacturing Engineering Technology (JTKP) milling laboratory and JTKP lathe laboratory. Both of these laboratories are making a product using sharp and hard tools. It can cause accident. In this area there are many protocols to make it very safety and all human in this area must wear a safety requirement properly. Many production works in industrial workplaces are effective if performed in standing position.

The important rationale to perform jobs in standing is [1]:

1. The worker requires large degree of freedom (d.o.f) during making the process jobs, especially operating large machine and big size of work pieces, reaching of materials and tools, and pushing and pulling of excessive loads. For example, a worker that works at a conventional milling machine need a large dof of working orientation when he rotate a handle at the milling table to mill the work pieces. This job does not approve the worker to make the milling process in sitting position.

2. The workstation does not allow the worker to perform the jobs in sitting position. For example, standing position is usually practiced by a lathe operator because the design of lathe machine does not give sufficient space for the operator to position his legs in sitting position. Other than that, it may be the worker prefers to stand instead of sitting even though the processes jobs can be performed in sitting position, and/ or the workstation is not equipped with sitting facility.

2.2.1 Laboratory machining area

The workstation area in this project is the milling lab. Laboratory or work station that use Advanced Manufacturing Technology (AMT) have a lack of ergonomics guidance. So, it systems have been move in equipment evaluation and selection. This is because of insufficient or information is not complete and this is partly due to a high percentage of cases with AMT accident is not recorded and reported [2].

This machining area that using machine are like lathe machine, milling machine and welding machine. It's different to other lab that has no machine uses like a CAD lab which is only using computer software in the lab to simulation. So, it has some different rule in machine lab and software lab because of a surrounding area. Only lab coat is similar and allowed to both lab area.

Table 2.1: Comparison between Machine lab and Software lab



| <p style="text-align: center;">Machine Laboratory (Source: Macias1, A. (2009). Ergonomic Evaluation of Work Stations)</p> | <p style="text-align: center;">Software Laboratory</p> |
|--|---|
| <div style="text-align: center;">  </div> <ul style="list-style-type: none"> • This laboratory is using machine so many body posture can be detected | <div style="text-align: center;">  </div> <ul style="list-style-type: none"> • This laboratory is using software and a body posture that can be detected is a few |

Table 2.1 shows the different type of laboratory that has been used. Machine laboratory is more movement and more posture compares to the laboratory that using software.

2.2.2 Occupational Safety And Health Act (OSHA) 1994

The purpose of OSHA is to ensure the safety, health and welfare at work of all employees and visitors, to formulate safety and health policy, extra protection for the disabled. The employee should take these duties to ensure the reasonable safety and health measure for himself and other person. Then, to co-operate with his employer or any other persons in the discharge of any duty. They must use and wear at all times and any protective equipment or clothing provided by employer. Other is to follow with any

guides or measure on occupational safety and health instituted by his employer [3].

There are scopes of OSHA 1994:

1. Manufacturing, Mining & Quarrying, Construction, Agriculture, Forestry and Fishing, Utilities (Electricity, Gas, Water, Sanitary Services)
2. Transport, Storage & Communication.
3. Wholesale & Retail Trades.
4. Hotels & Restaurants.
5. Public Services & Statutory Authorities.
6. Finance, Insurance, Real Estate and Business Services.

In workplace, there must be inspection by a safety and health committee at least once in every 3 months to ascertain if there is anything prejudicial to the safety and health of persons employed therein. They should discuss the observations and keep proper records and make suggestion to the employer on the remedial measures. The employer shall convene the inaugural (first) safety and health committee meeting at workplace for inaugural meeting. Safety and health policies and proposals shall make by the employer (represented by OSH Pro-tem committee) during meeting.

2.2.3 Occupational Safety And Health Master Plan For Malaysia 2015 (OSH-MP 15)

In the context of OSH, specifically, the development experiences of those countries, therefore, represent valuable wisdom that Malaysia would do very well to learn and benefit from, in view of Malaysia's own current robust push towards full economic and industrial development. This Occupational Safety and Health Master Plan for Malaysia 2015 (OSH-MP15), therefore, have been formulated bearing in mind these considerations. If they are not properly monitored and controlled, the activities are hazardous to the safety and health of workers and others. An injury, disease or fatality caused by these work hazards does not just affect an individual worker alone. While the economic costs may be borne by his employer, his insurance firm or the Social Security