

LECTURE HALL CHAIR: AN ERGONOMICS APPROACH

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STUDENT'S DECLARATION

I hereby declare that the work in this project is my own except for quotations and summaries which have been duly acknowledged. The project has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature

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Dedicated to my beloved family and friends

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ABSTRACT

This project is to investigate how students that use Universiti Malaysia Pahang lecture hall chair are having problems such as back pain and find the sources of this problem. I have analysed the chairs at lecture hall and investigate to know the criteria that brought the entire problem to the students. For the first step, I do some literature review about the chair based on an ergonomics approach. I have determined the criteria that should have in a chair and suitable of human body follow on ergonomics type. A suggested of an ergonomics lecture hall chair for students will be carried out after the analysis of survey data that have collected from the students. The survey data would be gained from questionnaires distributed to selected correspondences. After done the investigation, I surely know the non-ergonomics criteria that have in UMP lecture hall chairs. Finally, I will come out the suggestion to improve the comfortable of the lecture hall chairs.

ABSTRAK

Saya telah menjalankan satu projek bagi menyiasat punca-punca mengapa ramai pelajar di Universiti Malaysia Pahang (UMP) mengadu sakit-sakit belakang, tengkuk dan bahu. Saya telah menganalisis kerusi-kerusi di dewan kuliah UMP bagi mengetahui ciri-ciri yang membawa kepada sakit belakang dan sebagainya. Dengan mengenal pasti punca-punca masalah yang berlaku, saya telah mencadangkan langkah-langkah pembaikan kepada kerusi itu. Bagi menjalankan analisis ini, saya telah membuat rujukan terhadap buku-buku yang berkaitan dengan kerusi. Saya mengenal pasti ciri-ciri yang perlu ada pada sesebuah kerusi bagi keselesaan pelajar. Selain itu, saya melakukan bancian terhadap kerusi kuliah dengan mengambail pelajar-pelajar sebagai pemaklum balas. Hasil bancian akan dianalisis bagi mengetahui kemahuan pelajar terhadap sesebuah kerusi. Sesudah penyiasatan berakhir, saya menjangkakan satu keputusan yang baik dimana ciri-ciri yang tidak sesuai pada kerusi kuliah di UMP dikenal pasti bagi membolehkan saya mengutarakan cadangan untuk meningkatkan tahap keselesaan pelajar ketika menggunakan kerusi kuliah itu.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Universiti Malaysia Pahang is one of the universities in Malaysia that offers variety of courses to the students. In order to give students a comfortable ambience, UMP has provided many facilities be it student's accommodation like hostels, cafeteria, lecture hall and many more. But the most used facility when attending the lecture is the chair itself. As a student, we just only know the basic thing about the chair such as the design, the measurement, the feature of chairs and others. But we do not know if the chair is ergonomics and suitable or not for use to sit.

UMP has three or four type of chair that we do not know the ergonomics criteria that have at the chair. Having said that some student who used the chair to sit must have a problem like back pain or fatigue. This problem always happen when student sit for a long time at the chair and do not know how to solve it. They just accept the pain and let go just like that.

During my investigation, I will do some research as my guideline. The information that I find is all about the ergonomics and chair and what is the relationship between it. For the chair at lecture hall, I choose one type of chair as my object to complete my tasks and also as a reference. The information that I get from the chair I compare with the information from my research.

After done the research about the chair and get what is the ergonomics chair, I can list down what non-ergonomics criteria that have at UMP lecture hall chairs. I will come out with the suggestion of the chair that follows the ergonomics criteria for reduce the pain that student got before this.

1.2 PROBLEM STATEMENT

Lecture hall chairs do not fit to all students. They must use their body dimension when selecting a chair so that it does not strain one part of the body while fitting another. When the students used the lecture hall chair, they feel not really comfortable. They got back pain or sometimes their necks feel not comfortable. This study is about to investigate how this problem happen. We are going to come out the non-ergonomics criteria of the lecture hall chairs in UMP with the suggestion to solve the problem. In doing this, we are going to tackle some of the problems associated with the musculoskeletal disorders. Other problems are not tackled in the duration of this project.

1.3 PROJECT OBJECTIVES

The objectives of this study are:

1. To analyze the existing chair for lecture hall in Universiti Malaysia Pahang (UMP) among the students.
2. To suggest improvements by come out with the new idea of an ergonomic chairs.

1.4 PROJECT SCOPE

Without yet considering unforeseeable problems that might crop up later, these are the exclusions and the things known but not attempted to solve:

1. To research the ergonomics criteria that must have in a lecture hall chair.

1.5 THESIS ORGANIZATION

This thesis is consisting of 5 chapters and was organized as follow. For each chapter, there are subtopics in it.

In chapter 1, the introduction consists of describing the lecture hall chair at UMP as one of important facilities that students used. It explains the problem of the chair that students get when used it and introduces the idea of the project. In addition, this chapter also discusses on objective of study, scopes of study and project background.

Chapter 2 which is the Literature Review discuss on ergonomics history and also pillar of ergonomics. Besides that, the previous studies and researches on ergonomics chair and related aspects also included. The sources for the literature review are library books, journal and internet.

Chapter 3 is about methodology of the research in chair. This includes all the methods used to complete this thesis such as the data collection method, survey instruments with analysis the data and other particular procedures. Justification on each of question in the questionnaire is also stated in this chapter.

Chapter 4 will discuss on analysis of collected data from questionnaire. Each of the answer includes in the questionnaire will be analyzed and the data will be used in comparison of chair in lecture hall at UMP. This chapter also discusses the suggestion to solve the problem of the chair based on an ergonomics approach. The suggested specifications for the solution of the problem based on how to create a good chair without any problem that have to face. The suggested solution of the chair will be validated by the ergonomics expert.

Chapter 5 will discuss based on the results from the analysis of the lecture hall chairs in UMP. The conclusion that will be making is about the objectives for this project whether it achieved or not and the contribution of the study for student's life. The limitations about the project also will be stated in this chapter follow by the recommendations to improve the performance of the lecture hall chairs.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, it will discuss about the previous researches that have been done about the related issues with this project. The definition of each term is also included. Ergonomics, musculoskeletal disorders, chair are among the interested terms in this chapter. The source of the literature review is from journals, articles and books. Literature review is done to provide information about previous research and the relevant that can help to smoothly run this project.

2.2 ERGONOMICS

2.2.1 History of Ergonomics

Ergonomics came about as a consequence of the design and operational problems presented by technological advances in the last century. It owes its development to the same historical processes that gave rise to other disciplines such as industrial engineering and occupational medicine (R.S. Bridger, 2003).

Christensen (1987) points out that the importance of a "good fit" between humans and tools was probably realized early in the development of the species. As the example, the selected of pebble tools and made scoops from antelope bones in a clear display of selecting/creating objects to make tasks easier to accomplish. After World War II, the focus

of concern expanded to include worker safety as well as productivity. Research began in a variety of areas such as:

- i. Muscle force required to perform manual tasks
- ii. Compressive low back disk force when lifting
- iii. Cardiovascular response when performing heavy labour
- iv. Perceived maximum load that can be carried, pushed or pulled

According to M.R.Lehto and J.R.Buck (2008), the field got its name in summer of 1949 when a group of interests' individuals assembled in Oxford, England to discuss the topic of human performance. The group consists of anatomists, physiologists, psychologists, industrial medical officer, industrial hygienists, design engineers, work study engineers, architects, illuminating engineers, and anyone who is concerned some aspect of human performance. Then it is decided that they would coin new word ergonomics, which couples *ergos*, the Greek word for work and *nomos*, meaning natural laws. Sometime later, the term human factors were coined in U.S for a society of similar purpose.

2.2.2 Definition of Ergonomics

Ergonomics comes from the words that have many definitions that we can derive to know what textually the ergonomics. But the definition that has been used worldwide is actually from the International Ergonomics Association (2000).

Table 2.1 shows the recent studies of ergonomics. It's explain more detail about the definition of ergonomics based on the resources that that I have read before.

Table 2.1: Definition of Ergonomics

No	Author/ Resources	Year	Definition
1	International Ergonomics Association	2000	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
2	Scott Openshaw and Erin Taylor	2006	Ergonomics is a science focused on the study of human fit, and decreased fatigue and discomfort through product design. Ergonomics applied to office furniture design requires that we take into consideration how the products we design fit the people that are using them.
3	S.N.Cenghalur, S.H.Rodgers, T.E.Bernard	2006	Ergonomics is a multidisciplinary activity striving to assemble information on people's capacities and capabilities and to use that information in designing jobs, products, workplaces and equipment.

By the definition, we can conclude that ergonomics is actually a science of discipline to obtain working environment that is fit for people to work. It is also making the job to be fit to the worker. That is why it is stated in definition that ergonomics is also designing jobs

and work related material. Meaning that we are trying to create a job that basically does not effect the human health (Bao and Spielholz, 2008).

For the conclusion, ergonomics occupies the ‘no man’s land’ between engineering and medicine, architecture and health and safety, computer science and consumer product design. It is the only scientific subject that focuses specifically on the interaction between people and machines.

2.2.3 Principles of Ergonomics

Over the past few decades a number of basic principles have emerged from the field of ergonomics. While many of these principles may appear simple, one should not underestimate the power of new fundamental ideas applied systematically. In their basic form, these principles must follow in order that the design work can be fit to the worker. The principles are comfort, safety, ease of use, aesthetics and productivity/ performance (Dul, and Weerdmesster, 2001).

For the first principle is comfort. It’s known to be one of the desired criteria in designing a product. People in the world today always want the comfortable in all things. It’s being the first elements when their want to choose something that related to their body. The comfortable environment when performing tasks tends to motivate the works to work hard. Furthermore, it can relax the workers and release the stress that can cause ergonomics failure among the workers. The environment in which work is performed can directly and indirectly affect not only the comfort and health of people, but also the quality and efficiently of the work being done (Dan MacLeod, 1994).

The next principle is safety. Safety is very important since it is an element that everyone is looking for when performing a task. Ergonomics promote safety in designing the task for workers. Job that is safe are relevant and practical to be use in the world. Safety also includes the working environment and also the working tools. It is important that work areas be designed with enough space to both get the task done and have easy access to everything needed. So, the safety of our body to do the task is completely save without any dangerous because there is no any obstruction between a person and the items needed to

accomplish the task. For working tools, they need to be safe to be handled. That is why a lot of tools that move around is been equip with safety measurements. Some tools for example the lathe machine is equip with emergency stop button and also automatic emergency stop button. The emergency stop button is important in case something bad happen and the machine needs to stop immediately.

The other principle is ease to use. These principles basically related with the working accessories and tools equipment. To make it easy, we must keep tools or everything in easy reach. Long reaches can strain the body and make work more difficult, plus waste time. An easy way to make tasks more user-friendly is to keep frequently used items such as knobs, switches, tools and parts within easy reach. Basically, different of jobs required different type of tools but one thing that is must consider and it is almost same for all tolls is the fact that it needs to be ease of use.

The fourth principle is aesthetics. Aesthetics of beauty is commonly about things like clothes, cars, houses and many more. All people like things that is beauty and being beautiful. Something that is beauty has the elements that people like. The elements will make people feel comfortable and suitable to use it. Due to the fact beauty things is wanted in the world, ergonomics implement this part for the needs to produce jobs that can be fit to the workers. Aesthetics values or beauty are usually associated with tools that are related to the job. Even chair needs to be aesthetics in order for it to be selling as well as to be like. Making the workplace full of aesthetics value will cause the workers feels less stress when doing job. It can also be thought as psychology measure in attracting one's interest.

Last but not least, productivity and performance are also one of the ergonomics principles. Productivity is correlated with performance. If a performance of a worker is good, so as the productivity. We can say the performance is directly proportional to the productivity. Performance of a workers lies within the working aspects including the ergonomics itself. In order to produce productivity and performance, ergonomics will design job that will be fit to the workers according to the basic needs.

From all the principles that have state above, it's very important to ensure that the worker will produce good result in their work if all the principles are combined in a single task. It does also can avoid the worker from injuries and disease such as MSD and many more. From the research that has been done, this principle is very good to known to be effective in solving problems of ergonomics at work.

Table 2.2 shows some of my research about ergonomics. Mostly it comes from journals and books. Some of from article I don't stated because it doesn't completes with criteria that I want to list down.

Table 2.2: Recent Studies of Ergonomics

Year	Title	Author	Content
2002	Does ergonomic equal safety	Jonathan Tyson	Revise the connection of ergonomics and safety.
2006	Ergonomics experiment for thumb keyboard design	Xiong Yunfei	Study on how to improve the already made products, implement ergonomics principle on the product.
2007	The effects of job performance on effectiveness	Emin Yahya	Evaluate performance on effectiveness, team working benefits of improving performance
2007	Ergonomics: Making the job fit	Laura Hill	Ergonomics usage in designing jobs for workers.

2.3 MUSCULOSKELETAL DISORDER (MSD)

The design of tools and workspaces can have a profound effect on the posture of the body. Of particular interest is the posture of the shoulders, elbows and wrists and its relation to pathological musculoskeletal changes. Musculoskeletal disorder, means a broad range of conditions of varying degree associated with the upper extremities (hand and arm) such as inflammation or trauma mostly of the tendon, muscle-tendon junction or surrounding tissue; inflammation of tissue of the hand, compression of the peripheral nerves serving the upper limb, and include temporary fatigue, stiffness of the muscles comparable to that unaccustomed exertion.

Brogmus et al. (1996) analysed trend in MSD from the 1980s to the 1990c using data from the Liberty Mutual group workers' compensation claims and US Bureau of Labor Statistics. The analysis of both data sets confirmed a steady increase in cases and claim, with MSD rising from 1% of the total claims in 1986 to 4% in 1993.

The MSD is actually a class of disorders that basically amount of wear and tear on the tissue surrounding the human joints. Every joint in the body can potentially affect, but the lower back and the upper limbs are the areas of most concern. MSD also because of having the repetitive work and also lifting. This causes fatigue and failure among the human tissue (D.Macleod, 2006). This means that working style that involve movement and repetitive work are potentially causing MSD. This is because the body is doing the same task the same way and the affected area would be the same. When an area is been subjected to the same force every day, the area would become less efficient due to the fatigue experience by the body. For example, the hand when it is subjected to the same force every day will become weak. A person might also experience pain and also soreness around the affected area.

Every year it has people that have reported in case of MSD. That mean, the percentage of workers to get MSD is higher. When the workers get this MSD, it can effect the productivity and efficiency. MSD may progress in stages from mild to severe.