

Awareness of Ergonomics Among the Engineering Students

Rosley Jaafar^{1*}, Amirul Akmal², Zuraira Libasin³

^{1,2}Faculty of Mechanical Engineering, ³Department of Computer and Mathematical Sciences,
Universiti Teknologi MARA, 13500 Permatang Pauh Penang Malaysia.

Authors' Email Address: ¹rosley110@uitm.edu.my, ²armieyrul@gmail.com,
³zuraira946@uitm.edu.my

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ABSTRACT

Ergonomics is helpful in both the prevention of occupational diseases and the promotion of health. It plays an important role in increasing work efficiency and productivity, which benefit the organization and the community. The purpose of this study is to find the level of ergonomics awareness among multidiscipline engineering students in Universiti Teknologi MARA (UiTM), Penang Malaysia. A questionnaire was developed and distributed to 246 engineering students and the responses were analyzed using the Statistical Package for the Social Sciences (SPSS) version 15. The results showed that the score of the average mean obtained for ergonomics awareness of ergonomics benefits and the effects if not practiced are 3.70 and 4.23 respectively which are considered high level. It means that they were well aware of ergonomics knowledge as much as possible to avoid getting injuries and health problems in the workplace. Therefore, it is essential to promote ergonomics principles and practices to the students as well as staff in UiTM more effectively. The UiTM Penang branch management can perform the ergonomic task group for staff and association for students to plan, handle, and monitor the awareness of ergonomics educational programs and activities to the staff and students.

Keywords: Ergonomics, awareness, students, Malaysia.

INTRODUCTION

The word ergonomics is derived from the Greek words `ergon` which means `work` and `nomos` which means `rules`, hence, the lateral definition of ergonomics is `the rules of work` (Macleod, 1994). The term Ergonomics is used in Europe and other countries in the world, while the phrase Human Factors or Human Engineering is more commonly used in America. Ergonomics is the field of study that aims to find the design of tools and tasks that can be compatible with human capabilities and limitations. Ergonomics is, therefore, fitting the task to the person either in the workplace or with a consumer product and provides opportunities for business by reducing costs, improving human well-being, quality, and productivity (Macleod, 1994). The disciplines of ergonomics are used to optimize the interaction between the workers and work environment and some of the disciplines are anthropometry, biomechanics, mechanical engineering, industrial engineering, industrial design, and kinesiology.

The International Labour Organization (ILO, 1996) stated that the ergonomics is the study of work concerning the environment in which the workplace is performed and the workers who perform it. Besides, the ergonomics is used to determine how the workplace can be designed or adapted to the workers to prevent a variety of health problems and to increase efficiency. In other words, it helps to

make the job fit the workers, instead of forcing them to conform to the job. The obvious benefits of applying ergonomics in the workplace are healthier and safer working conditions where the employer productivity will be increased. Such factors of working conditions that can affect workers' comfort and health are lighting, noise, temperature, vibration, workstation design, tool design, machine design, chair design, and job design such as shift work, breaks, and meal schedules. For example, work activities that involve poor posture and repetitive movements, such as typing can cause muscle fatigue and injuries to other soft tissue.

Social Security Organization (SOCSO) Malaysia reported that industrial accidents increased by 3.84% from a total of 35 304 cases in 2016 to 36 661 cases in 2017 (Annual report, 2018). Similarly, industrial accidents related to ergonomics hazards also increased by 4.9% from a total of 675 cases in 2014 to 708 cases in 2015 (Darus, 2017). Ergonomics has played an important role to reduce ergonomic hazards and health problems which consequently increase work efficiency and productivity. From the study of ergonomics issues in Malaysia by Loo and Richardson (2012), it was found that ergonomics in Malaysia should be promoted and disseminated to various industries and organizations, hence, the employers and employees become aware of the design concepts of ergonomics workplace and workstation. Generally, it means that the implementation of ergonomics in Malaysia is still below satisfaction level.

The knowledge and awareness of ergonomics should be given to the students before they become workers by practicing ergonomics while in school, college, or university as well as the workplace. The graduate students who completed the ergonomics educational sessions on the awareness of body mechanics relative to laptop workstation design had statistically shown an improvement in ergonomics knowledge (Peter et al. 2014). The study by Zunjic et al. (2015) showed that ergonomics applications can contribute to improving the quality of education of students through the improvement of the educational process and training. According to Kim (2017), ergonomists and ergonomics researchers should promote the importance of ergonomics in the construction industry to protect the employees concerning the menace that weakens workers' body systems during construction activities.

The students are potentially sitting incorrectly at their chairs, desks, and computer workstations either in the classroom or at home while studying for more than eight hours each day. Sitting while studying for extended periods can create muscular discomfort. The ergonomics awareness program will help the students to become aware of the effects of ergonomics risks while performing their daily activities. If the ergonomics applies to their study environments, it can reduce stress and eliminate injuries and disorders associated with the overuse of muscles, bad posture, and repeated tasks. Hence, the students can maintain better posture, physical well-being, and study well.

Ergonomics awareness is the early step to implement ergonomics effectively. The effort to implement ergonomics without awareness may be tough and can affect students' performance, productivity, illness, injuries, and cost. Therefore, the purpose of this study is to investigate the level of ergonomics awareness among the multidiscipline engineering students in Universiti Teknologi MARA (UiTM), Penang Malaysia where no previous study has been done yet.

METHODOLOGY

This is a cross-sectional study which was aimed to study the level of ergonomics awareness of engineering students. They were final year undergraduate multidiscipline engineering students of Mechanical Engineering, Civil Engineering, Chemical Engineering, and Electrical Engineering at Permatang Pauh campus of UiTM, Penang Malaysia. They were selected as respondents in this study due to the assumption that they have already spent three years in the university and will be graduating soon and getting a job. Thus, they have had a lot of knowledge to become future engineers with the advantages of having ergonomics knowledge. Besides, some of the faculties may offer ergonomics as a subject, as a chapter in a certain subject or none at all in their syllabus contents. Hence, the results of

the study will indicate whether they have ergonomic awareness or not and can also help the faculty to take necessary action.

The total number of engineering students involved as a population size, $N = 634$ students, and this study used a systematic random sampling technique. The required sample size, $S = 240$ students which is determined from the `table for determining sample size from a given population` and no calculations are needed if using the table (Robert & Daryle, 1970). The research instrument in this study was a questionnaire containing the items to obtain feedback from the respondents whether they were aware of the benefits of ergonomics and the effects if not practicing it. The questionnaire was distributed by the researcher to the respondents to be completed and 246 volunteered respondents answered and returned the questionnaire. In this study, the Likert scale used was from 1 to 5 with 1 being strongly disagree, 2 disagree, 3 unsure, 4 agree and 5 strongly agree. The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 15.0 and presented in descriptive statistics such as percentage, frequency, standard deviation and mean. This method was used to measure the level of ergonomics awareness of the students.

RESULTS AND DISCUSSIONS

The percentage of variables of gender, age, and faculty to their demographic information is listed in Table 1. According to descriptive statistics, it was found that about 86% from the total of 246 respondents of engineering students are male and about 14% are female. It is normal for any engineering courses where the percentage of male students is very high compared to female students. Most students (39%) are 23 years old. The four types of age levels were selected because some of the undergraduate students came from diploma programmes and not graduated on time. Among the respondents, the majority (37.8%) of them were in civil engineering, 26.83% in electrical engineering, 23.17% in mechanical engineering, and 12.2% in chemical engineering.

Table 1: The demographic information of the respondents

	Variable	Frequency	Percentage
Gender	Male	212	86.18
	Female	34	13.82
	Total	246	100.00
Age	22 years	55	22.36
	23 years	96	39.02
	24 years	77	31.30
	25 years	18	7.32
	Total	246	100.00
Faculty	Mechanical Engineering	57	23.17
	Civil Engineering	93	37.80
	Electrical Engineering	66	26.83
	Chemical engineering	30	12.20
	Total	246	100.00

Table 2 shows the distribution of the responses based on their knowledge of ergonomics benefits. It was found that the score of the average mean and standard deviation obtained are 3.70 and 0.98 respectively. The result shows that their knowledge on the benefits of ergonomics is at high level. Statement no 2 recorded the highest mean score of 3.75 while statement no 1 had the lowest mean score of 3.63. Even though both results show high level but 27.2% to 32.9% of the respondents were unsure when answering all the questions. Based on a study by Groothuis and Whitehead (2002), it is found that if the researcher's willingness to pay to study, the don't know responses are similar to no responses. Therefore, the results mean that their ergonomics knowledge is at very low level.

The results of the total percentage shown were taken from level 4 and 5 in Table 2. The respondents (57.7%) knew that the purpose of practicing ergonomics during their study is to increase the comfort of the workplace and environment. Hence, students can focus on their studies. It was observed that 64.3% of the respondents believed that practicing ergonomics can increase productivity, efficiency, and quality of work. Generally, 60.6% of the respondents knew that if ergonomics is implemented in their life, the level of health will be improved. It indicates that they did not have frequent health problems such as fever, headache, backache, eye strain, etc. If the students practice ergonomics in their study environment, it can reduce the risk of accidents in the workplace (59%) and stress and emotional disorders (58.5%). The students will be happy, enjoy their learning time, and get very good examination results.

Table 2: Ergonomics benefits (percentage)

Statement	1	2	3	4	5	Mean	Standard deviation
The practice of ergonomics is to increase the comfort of the workplace and environment during the study.	3.7	5.7	32.9	39.4	18.3	3.63	0.97
Ergonomics practices can increase the productivity, efficiency, and quality of work.	2.8	5.7	27.2	42.3	22.0	3.75	0.96
Ergonomics practices can reduce the risk of accidents in the workplace.	3.7	6.5	30.9	36.2	22.8	3.73	1.01
Ergonomics practices can improve the level of health among students.	2.8	4.5	32.1	37.8	22.8	3.73	0.96
Ergonomics practices can reduce stress and emotional disorders such as depression, irritability, etc.	3.7	6.1	31.7	37.4	21.1	3.66	0.99
Average						3.70	0.98

Some of the findings of this study can be similar and may not be similar to the findings of other researchers as good information and observation. The study by Muhammad et al. (2013) showed that the level of ergonomics awareness is very low in Pakistan among medical students and physiotherapists due to their unfamiliarity with the benefits of ergonomics practiced in the workplace. According to the study by Shrivardhan et al. (2014), dental students in India scored a high attitude of awareness and behavior toward ergonomics in dental practice. The findings of a research by Oladeinde et al. (2015) showed that the awareness of ergonomics was poor among medical laboratory scientists in Nigeria and also poor knowledge of benefits of ergonomics application and risk factors for the development of Musculoskeletal Disorders (MSD). Hence, they will have great implications for safety and health in the workplace.

The results of a study by Sarika and Atithya (2016) confirmed that the housekeeping employees at the hotels in India were exposed to a variety of ergonomics risk factors and have high risk of injury. In addition, because of not following the ergonomics principles, it had caused issues of absenteeism, fatigue, low productivity and high turnover of the housekeeping staff. The dental professional and undergraduate students in Saudi Arabia should learn the dental ergonomics and strictly implement it in their daily practice in the clinics to provide a comfortable working environment (Alyahya et al., 2018).

Analysis of the effects if ergonomics is not practiced in the workplace was rated based on items as shown in Table 3 with the score of average mean result 4.23 and a standard deviation of 0.78. The results show that the studied group has a high level of awareness of the effects if not practicing ergonomics in the workplace. The mean result of each item is not much different which is between 4.15 to 4.30. It means that they do not want to get injured and bad health due to those factors in the workplace.

The results of the total percentage shown were taken from level 4 and 5 in Table 3. From the results, more than 86% of the respondents agreed that the incorrect way of sitting and lifting items can result in back pain. It was observed that 89% of the respondents were aware of the fatigue while doing work at the workplace because of discomfort body position between chairs and desks and incorrect position between the eyes and computers (83.3%). Similarly (86.5%) the lighting in the workplace which is either too strong or insufficient can result in fatigue and pain in the eyes. The respondents (86.2%) agreed that the uncomfortable tables and chairs can reduce the productivity and quality of their study. The high percentage results indicated that the respondents were well aware of the effect if ergonomics principles are not practiced in the workplace.

The knowledge and practice of good body posture in the workplace are important to provide a comfortable body position as well as increase efficiency and productivity. Anything that makes the students uncomfortable including chairs, desks, lighting, temperature, and noise levels can affect the emotion and focus of the study. According to the study by Rakhshaan et al. (2012), more than 50% of the computer users in Pakistan knew the importance of the height of the chair to keep them in a comfortable position. This knowledge is also shown in the result of the study by Muhammad et al. (2013) in which 82% of the respondents agreed that good body posture and ergonomics equipment (65.33%) can increase productivity. A study conducted by Manjunatha and Mohan (2016) which investigated an individual workplace intervention of workplace evaluation among workers in the factory in India, found that the productivity was increased by reducing shoulder and wrist injury and fatigue.

Table 3: The effects if ergonomics is not practiced (percentage)

Statement	1	2	3	4	5	Mean	Standard deviation
Inappropriate way of lifting items can result in back pain.	0.4	2.0	7.3	47.2	43.1	4.30	0.73
Incorrect way of sitting can lead to back pain.	0.4	1.6	11.4	41.9	44.7	4.29	0.76
Discomfort body position between the chairs and desks while performing work can result in fatigue, and lethargy.	0.4	1.2	9.3	52.8	36.2	4.23	0.70
Incorrect eyes position while looking/facing the computer can result in fatigue, sore neck, and headache.	1.6	3.3	11.8	45.1	38.2	4.15	0.87
Uncomfortable tables and chairs in the workplace can result in a decrease in productivity, efficiency, and quality of the study.	0.4	2.4	11.0	50.8	35.4	4.18	0.75
Lighting less or too light on the study area can result in fatigue and pain in the eyes.	0.4	2.4	10.6	46.7	39.8	4.15	0.87
Average						4.23	0.78

Dockrell et al. (2015) found that 52.8% of the health science undergraduate university students in Ireland, the most frequently reported sites of pain and discomfort caused by computer use were their neck and upper back. The study by Dolen and Mohd Elias (2016) showed that the university students in University Putra Malaysia had knowledge scores of 74.1% and practice scores of 70% on laptop ergonomics and prevalence of musculoskeletal symptoms (MSS) and the prevalence of MSS among the students was 67%. Hence, ergonomics awareness programs on musculoskeletal pain and healthy postures while using laptops are needed to minimize the prevalence of musculoskeletal symptoms. The results from a study by Abd Rahim and Mohd Tamrin (2016), indicated that the prevalence of

discomfort was high among the university students in University Putra Malaysia and suggested to use the suitable furniture that fits the body dimension of the students to avoid increasing the risks of MSD.

The majority of the employees in small and medium enterprises companies in Malaysia are unfamiliar with the concept of ergonomics which easily exposes themselves to ergonomics hazards. It is therefore recommended that the ergonomics awareness among the employees and employers of the companies to emphasize the safety of the machines and equipments use should be increased (Siong et al. 2018). High incidence of musculoskeletal injuries among surgeons is one of the factors deterring medical students in North Carolina America from surgical careers and they need an ergonomics intervention program to improve surgeon longevity and maintain the surgical workforce (Amanda et al. 2019).

The practice of the ergonomics principles can solve many problems of musculoskeletal discomfort and musculoskeletal disorders to health students such as headaches, back pain, neck pain, eye strain, fatigue, stress, and sleep disturbance. Any organization management must have established goals to achieve ergonomics principles, and the key element of any ergonomics program is training to increase knowledge of ergonomics and improve skills and abilities in reducing the ergonomic hazards (Haval, 2017). The proper ergonomics educational programmes before undergraduate students reach graduation or even earlier are required to increase the awareness of ergonomics among university students for their future jobs.

CONCLUSION

When a worker understands and learns about ergonomics, it helps to improve the working environment; consequently, the workers can work comfortably and use a minimum amount of energy effectively. This study highlighted the awareness of ergonomics among engineering students in Universiti Teknologi Mara, Penang Malaysia, and the results showed that they possess a high level of awareness of ergonomics benefits in which the mean score is 3.70. The mean score obtained from the awareness of the effect if not practicing the ergonomics in the workplace is 4.23 which is also a high level. The university management has an effective role to maintain the results because of different students for each semester. The initiatives of educating engineering students, as well as all students about ergonomics awareness and ergonomics intervention are needed to improve students' working posture, work performance, comfort level, and health performance. By conducting the survey, it has helped to encourage university management to know the level of ergonomics awareness of engineering students and should be studied for none engineering students. One of the recommended approaches to be adopted in enhancing ergonomics awareness is the orientation program to all students. It is important to help all graduated students in UiTM Penang to practice the ergonomics principles in their career in any job and organization.

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