

THE PERSPECTIVES OF PHILOSOPHY OF SCIENCE AND TECHNOLOGY ON THE RELATIONSHIP BETWEEN ERGONOMICS LABORATORY AND STRESS

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ABSTRACT – *The purpose of this study is to look at the perspectives of the philosophy of science and technology of the impact of engineering ergonomic laboratory on stress among students' state of mind in a systematic way. A total of 102 respondents from Universiti Teknikal Malaysia Melaka (UTeM) had been selected for this study. Meanwhile, the selected manufacturing laboratories for this study are of three varieties of areas such as fabrication, robotics and graphic engineering lab. The statistical test for relationship was conducted using a Pearson correlation. As a result, the study shows that there is a significant relationship between ergonomic laboratory and stress among students.*

1. INTRODUCTION

High demand for products in the manufacturing industry had driven the human workers to work faster and adapt to their un-ergonomically designed workstation. Some tasks at assembly workstations require human workers to stand for a prolonged period of time to assemble the products. The impact of long working hours on health has been of major concern since the late 19th century. Also, with the combination of other adverse aspects of work organization such as irregular working hours and intense performance demands are strongly associated with fatigue, stress, decrements in performance, adverse health behaviours, and both acute and chronic physical disorders. Improved methodologies are needed to track the exposure to long working hours and irregular shifts longitudinally. Meanwhile, the Islamic philosophy of science and technology look at ergonomic as a significant issue because in Islam, “Divine” Ergonomic is represented by Allah, the Supreme Engineer.

Ergonomics is a science that addresses human performance factors (human engineering) and how they relate to the job, the workplace, tools, and the environment. Meanwhile, the applied ergonomics aims at ergonomists and all those who are interested in applying ergonomics/human factors in the design, planning and management of technical and social systems at work or leisure. In other word, ergonomics is putting “people first.” The word ‘ergonomics’ derives from the Greek ‘ergon’ (work) and ‘nomos’ (laws) to denote the science of work; ergonomics is a systems-oriented discipline which now extends across all aspects of human activity [1].

This concept of health helps us understand the relationship of causes and effects that is triggered when the issue of stress is due to psycho-physiological changes, which result from the individual’s confrontation with a situation that somehow confusing, annoying and threatening. In short, ergonomics is known as comfort design, functional design, and user-friendly systems, and the practice of designing products, systems or processes to take proper account of the interaction between them and the people who use them. And Islam does not look at ergonomic issue differently because

His Names designate the ergonomic concept in His creations, such as *As-Salaam* (Flawless), *Al-Bari* (Harmony), *Al-Musawwir* (Fashioner), *Al- 'Adl* (The Just) and *Al-Muhsin* (The Beneficent).

There are two important things in ergonomic; firstly, is the ergonomic awareness and secondly, is the application of ergonomics that should be practical. Research has shown that ergonomics is most effective when it is approached as a participatory process of management and employees working together to adapt job tasks, including equipment, tools, environment, and methods [2]. Meanwhile, there is a study conducted on the ergonomic awareness among workers performing Manual Material Handling (MMH) activities. The evaluation of ergonomic awareness on MMH amongst workers in the research area shows that they possess a moderate ergonomic awareness level [3]. Then, there is an increasing weight placed internationally on participatory action-oriented methods in improving ergonomic aspects of work and preventing stress at work. The merits of these participatory methods are widely recognized as means of promoting the initiative of workers and managers applying workable solutions in diversifying work settings. The result of study concludes that the reviewed participatory methods used in both workplace improvement and stress prevention programs confirm the importance of building on local good practices in response to increasingly diversifying ergonomics-related and psychosocial needs [4].

However, on the issue of stress, it relates to human cognition and psychology. It stresses that ergonomics has established a fruitful dialogue with psychology, and with cognitive science, in general [5]. It is supported by two groups of researchers who suggested that ergonomics should integrate the physical and the cognitive dimensions [6] [7]. Another research done had studied the ergonomic workstation factors, in order to explain the work stress outcomes and then found out that when workstations are ergonomically designed, it help the organizations to minimize work stress impacts [8]. This is supported by other research whose experimental study was to investigate the effects of product assembly on operators' performance. Workstations for assembly tasks should be designed so that they are adjustable to operators' comfort in order for them to relieve stress and improve performance [9].

More studies show that women are endangered by insensitivity of ergonomic problem. A study found out that more women get Musculoskeletal Disorders (MSDs) than men. This higher rate is due to job and physical differences between men and women. Thus, ergonomics is significant to increase the comfort and the productivity of the female workers and at the same time avoiding stress due to MSDs [10]. Meanwhile, a study which focus on university students has emphasizes that there is a relationship between stress and learning qualities among university students. Stress can be triggered by challenges that arise in the new stage of a student's life, as well as the demands in the campus, the gruelling routine and that includes the adaptation to the university environment, thereby raising, physiological symptoms like flu, gastrointestinal disorders, headache, hypertension, as well as psychological anxiety, pessimism, fatigue and others[11].

School children also have ergonomic issues and a study investigated the effects of postural discomfort on school children due to heavy school backpack. The results indicate that the prevalence of postural complaints among school children is considerably high [12]. Another research has evaluated the ergonomic deficiencies in Nigerian workstations. The results of the investigation showed that chair height, chair arm/ back, temperature and desk height returned high error of 72%, 66%, 47% and 46% respectively, indicate poor furniture and uncontrolled temperature in the workstations, an indication that majority of employers in this part of the world do not bother with workers' welfare in terms of working facilities provided for them. Instead, employers are more concern about profit margins [13].

In order to find a flexible solution for these complex problems of society, one study tried to find the knowledge gaps and research challenges in the contemporary ergonomics. It is found that ergonomics has significantly contributed to the design improvements for all kinds of systems with people, work systems, and product/service systems and will continue to demonstrate its value more successfully to the industry stakeholders. In the first conclusion, the paper hypothesizes that, there is a complex relationship between ergonomics and stress which significantly affects the learning quality of student at laboratory [14].

Ergonomic is not an alien field in Islam. Actually, Islam stresses on the importance of ergonomic in human life and Allah even has shown it in His creations. Then, it is important to see the Islamic philosophy of science and technology's perspective on ergonomics and stress by identifying the suitable Names of Allah, as described by many Islamic scholars who believe that these manifestations of Names of Allah should be applied as follows: Firstly, *As-Salaam* (Flawless) is this state of being free of all faults, errors, danger and trouble. Then Muslim engineers must seek Allah's aid and support in their works in developing technology from fault, error or bring danger and trouble to others; either endangers himself, other mankind or the universe. Secondly, is *Al- Bari* (Harmony) and He is The One who orders His creation with perfect harmony and therefore, the servants of Allah must be harmoniously beneficent.

Thirdly, is *Al-Musawwir* (Fashioner) and Allah is the Perfect Artist who gives everything its most unique and beautiful forms. Thus, the servants of Allah must make things beautifully, manifest in all that Allah has created, because no beauty is possible in opposition to the beauty created by Allah or other than it. The next Name of Allah is, *Al- 'Adl* (The Just) wherein He is the Absolute Justice. Justice is the opposite of tyranny. Tyranny causes pain, destruction and disturbance. Justice secures peace, balance and order and harmony. In short, ergonomic things fulfil the idea of 'just' because it fits people physically, emotionally and cognitively. Lastly is the name of Allah *Al-Muhsin* (The Benevolent) wherein, Allah is the possession of all quantitative knowledge. A good servant who is aware of this attribute would ponder over things he intends to do, whether they are right or wrong [15] [16][17][18].

This study concentrates on a variable namely; ergonomics and its correlation with an associate factor which is stress. This study is related to The Occupational Safety and Health Act 1994 that aims to secure the safety, health and welfare of person at work, to protect others against safety or health risks in connection with the activities of persons at work, and to promote an occupational environment for persons at work, which is adapted to their physiological and psychological needs. The main objective of the study is to examine ergonomics and its relation to stress. Specifically this article is written to determine the relationship between ergonomics and stress. In that case the hypothesis as follows: The combination of ergonomic factors has a significant effect on stress at work.

2. METHODOLOGY

The study is located at Universiti Teknikal Malaysia Melaka. Three manufacturing labs were selected for this study and they are fabrication, robotics and graphic engineering labs. The sample utilized in the present study is obtained through a proportionate stratified random sampling method. Engineering manufacturing students were selected for this research. Data for the present study was collected via questionnaire distributions. The questionnaires were developed based upon an extant research related

to ergonomics and work stress. The items use a 5-point Likert scale, ranging from (1) strictly disagree to (5) strictly agree. The questionnaire consisted of positive and negative statements, with the negative statements being recoded accordingly.

3. RESULT AND DISCUSSION

Descriptive results have focused on these two variables namely ergonomic and stress in laboratory work. The respondents' profile is illustrated as in Table 1. The respondents of this study consisted of engineering faculty students from UTeM. Initially, a total of 102 students were systematically selected. It shows the distribution of demographics profile of respondents. Demographical analysis shows that out of sample of 150. Based on demographics analysis, the personal details are classified as gender, year of study and type of laboratory they studied in. Based on the results, the majority of the respondents are males students which consist of 54% or 55 respondents, while the minority respondent are female which consist of 46% or 47 respondents. Respondent are first year students with value 42% as a majority of the overall 102 respondents in this result. This followed by 36% of respondents (37 respondents) among third year students. Lastly, 22% of respondent (22 respondents) are second year students. Whereas, the number of students according to the selected laboratory observed that 42% respondent or 43 students are from fabrication laboratory. Meanwhile 37% respondent or 38 students are from robotic laboratory and lastly 22% or 21 students are from engineering graphic laboratory. The correlation between laboratory ergonomic and stress were tested.

Table 1 Distribution of respondents' profile (n= 102)

Variable	N	%
<i>Sex</i>		
Male	55	53.9%
Female	47	46.1%
<i>Laboratory</i>		
Fabrication	43	42.2%
Robotic	38	36.3%
Engineering graphic	21	21.6%
<i>Years of study</i>		
Year 1	43	42.2%
Year 2	22	21.6%
Year 3	37	36.3%

Note: SD = Standard Deviation

Meanwhile, Table 2 shows the relationship between the studied variables. The findings indicate that there is a significant relationship between laboratory ergonomics and stress. Correlation coefficient ranges between .50 to 1. Overall Correlation coefficient indicates medium to large relationship is based on to Cohen Hoberman Inventory of Physical Symptoms (CHIPS) and widely used by most researchers [19]. The findings support H1 and show that the human variable health and body postures has a significant relationship with workplace stress outcomes

Correlation is a technique which measures the strength of association between two variables the results show there is positive correlation among the variables of study. Correlation is significant

at 0.01 levels (2 tailed). Thus, there is a strong relationship between ergonomic slackness and stress problem among students.

This significant relationship supports one study. The ergonomic workstation reveals that 38.4% of the changes in workplace stress outcomes are due to the relationship between stress and ergonomic factors, which include human; machine; work area; and environmental factors. Among the four major components, only human ($\beta = 0.459$) and environment ($\beta = 0.287$) factors are significantly related to stress, while machine and work areas are not significantly related to workplace stress outcomes [20].

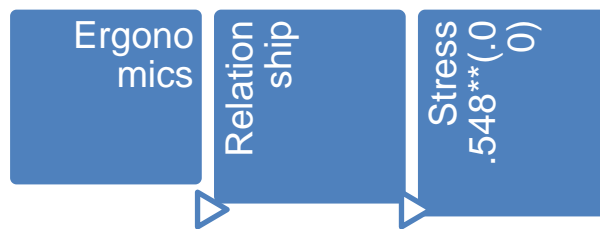


Table 2: Relationship between ergonomic and stress

4. CONCLUSION

According to NIOSH book of guideline On Occupational Safety and Health, the working posture and task should be designed to avoid strain and damage to any part of the body such as the tendons, muscles, ligaments, and especially the back. The workers also should be able to maintain an upright and forward facing posture. The work should be arranged so that it may be done either in seated or standing positions [21]. According to the Islamic perspective, if a man follows the guidance given in the foundation of Islamic philosophy on science and technology, then there will be no issue of ergonomic factors or stress problems [22]. However, since man is not perfect that those aspects are unavoidable, minimum impact is still possible.

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