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Ergonomic Safety Approach for Welding Activities of Piping Installation

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Abstract: A case study on the approach of ergonomic safety concept towards work improvement was explored in the welding workshop to complete one of the evaluations, Project Bachelor. The main research objective is to observe discomfort working posture during welding using Questionnaire based on WERA checklist. The proposed method for this study will contribute to new knowledge in the ergonomic research field, especially to knowledge of methods in ergonomic exposure assessment tools. It has had a significant impact on employees' comfort, which has a direct impact on the effectiveness and productivity of their job. The workers have alleged that they experience painful postures and injuries at work. The most prevalent issue that employees usually describe is musculoskeletal disorders (MSDs). This issue arises from workers' awareness of and inattention to the ergonomics of their environment.

Keywords: WERA, MSDs, Ergonomic

1. Introduction

There are various explanations for the concept of ergonomics, but they all have the same meaning. Ergonomics is a scientific discipline concerned with comprehending the interactions of humans and work systems. Ergonomics is derived from the Greek words 'ergon' which means human effort or work, and 'nomos' which means natural law (Sheridan, 2002).[1] Biotechnology, human engineering, and human factor engineering are all terms used to describe ergonomics. It is a multidisciplinary activity that aims to collect data on people's abilities and competencies and apply that data to the design of employment, products, workspaces, and equipment. It also strives to minimize unneeded stress in these encounters, and it normally tries to increase productivity by lowering operator tiredness and discomfort.

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1.1 Background Study

Welding fumes are a mixture of particles formed by the vaporization, condensation, and oxidation of materials that have been passed through an arc. Welding fumes can be harmful to one's health if inhaled, hence they must be kept within regulatory limits. To guarantee that injuries do not occur when using a welding machine, appropriate safety measures should be adopted.

An investigation of the working position in an welding workshop is presented in this case study. The study focuses on the concept of ergonomic safety when workers interact with welding machines. Workers use a range of welding equipment that can be used in several separate locations, including flat, vertical, horizontal, and on top. They can do manual welding, in which the welder is in complete control of the process, or semi-automatic welding, in which the welder uses machinery to accomplish the welding task, such as wire feeders. Although consumers have been informed of the importance of welding safety, injuries and mishaps are unavoidable. Before beginning the welding process, users must adhere to several safety precautions. Welding safety, such as the use of aprons, hand guards, gloves, and other personal protection equipment, is a top priority in the workshop. But does this protective gear work and keep users safe? This is a question that always concerns customers and those who require additional information. It is extremely dangerous if safety is not strictly enforced, and ergonomics are not improved. Accidents and injuries are unavoidable, but safety can be studied to avoid them.

1.2 Problem statement

Current techniques to assess the exposure to the risk factors related to WMSDs still utilize observational methods, mainly because they are inexpensive and practical for use in a wide range of workplaces, whereas using the other methods would be difficult due to the disruption they would cause (Beck and Dressen, 1998; Li and Buckle, 1999a: David. 2005; Brodie, 2008: Takala et al., 2010).[2]

1.3 Research Objective

a) To observe discomfort working posture during welding using Questionnaire based on WERA checklist.

b) To identify physical risk factors during welding activities based on the result of Questionnaire based on WERA checklist.

c) To recommend control measure by reducing ergonomic risk factors and the potential for workplace

2. Methodology

WERA is an observation instrument that includes a spectrum of physical risk factors connected with WMSD, and this study illustrated how it was utilized to investigate ergonomic risk. WERA analysis is commonly used in the workplace to reduce ergonomic risk factors and the risk of harm. Workers can be injured in a variety of workplaces, including building sites and factories. According to the Department of Occupational Safety and Health Malaysia (DOSH) data on occupational accidents for the mortality category as of August 2010, the construction industry accounted for 51% of the victims. Manufacturing is the second most dangerous industry, with 45 percent of victims, after agriculture (26 percent of victims) and transportation (10 percent of victims) (DOSH, 2010) [3]. The materials and methods section, otherwise known as methodology, describes all the necessary information that is required to obtain the results of the study.

2.1 WERA checklist

WERA can be used in five different ways. The first step is to pay attention to the task at hand. To create a general assessment of the ergonomic workplace, observations were made considering the impact of the layout and work environment, as well as the use of equipment and staff behaviour. The questionnaire was based on the WERA checklist to get the data from the respondents. From the questionnaire, it revealed the analysis that we needed. The question is most relatable with the WERA checklist. The question was given to the person that has basic knowledge and advanced knowledge. It gave us the analysis that we had shown on results, and we had discussed it for control measure.

3. Results and Discussion

This study practiced the WERA approach to examine posture welding workshop. The associated risks in the welding workshop was quantified by implementing ergonomic demands and risk assessment techniques based on current research. This study had also provided a solid indicator of WMSDs that may manifest as pain, soreness, or discomfort in linked body locations. When the risk variables of WMSD exposure was examined, the WERA analysis performed is also good quality and dependable. Then, recommendations was made to decrease or eliminate the chance for injury. With using the data from ergonomic assessments, work rotation plan was created to alter the types of physical demands that workers were exposed to in various locations of the welding workshop. This will lower the likelihood of workplace injuries and, hopefully, boost employee happiness. The WERA tool is a basic and quick-to-use method that may be used to evaluate a variety of tasks in the workplace and is useful. Physical risk factors connected with WMSDs in the workplace can be identified using the WERA tool.

3.1 Tables

Table 1 shown the frequencies and percentages of respondents' profiles, where there were four classifications which were age, gender, marital status, race, and education level of the respondent. As the table shown, there were more female respondents than male respondents. The number of male respondents consisted of 48 (96%), while the female respondents consisted of 2 (4%). Next, there were more than half of the survey respondents that were from the age of 31-35 years old which was 21 (42%), followed by respondents aged 20-25 years was 17 (34%) and 26-30 years consisted of 11 (22%) and only one respondent 1 (2%) was 40 years of age or above. For Marital status, there were more respondents from married people over the single and divorce which was 30 (60%) and followed by single 16 (32%) and lastly from divorce 4 (8%). Furthermore, for respondents' education level, more than half was from Diploma which was 46 (92%) and followed by secondary school 3 (6%). Meanwhile, for the bachelor/Master/PHD consisted of 1 (2%). Lastly for the race of respondent, more than half consist of Malay 46 (92%) and followed by Indian 2 (4%). Meanwhile, 1 (2%) from Chinese and other race.

Table 1 Respondent's Profile

Classification		Frequency	Percentage %
Age	20 - 25 years old	17	34
	26 - 30 years old	11	24
	31 - 35 years old	21	42
	36 - 40 above	1	2
Gander	Male	48	96
	Female	2	4
Marital Status	Single	16	32
	Marriage	30	60
	Divorce	4	8
Education Level	Secondary School	3	6
	Diploma	46	92
	Bachelor/Master/PHD	1	2
Race	Malay	46	92
	Chinese	1	2
	Indian	2	4
	Other	1	2

Table 2 shown the frequencies and percentage of respondent social lifestyle where there were eight classifications which were working experience, working duration, smoking/vape, alcohol, duration physical activity, leisure time with hobby and duration with hobby. As the table displayed, 3-5 years of working experience were the most with 27 (54%) and were followed by 1-3 years, which were 12 (24%) and 11 (22%) for 5 years above working experience. Moving to the next point which was the working duration. From the table, it shown that most respondents were working from 8-12 hours with a frequency of 31 (64%). Meanwhile, the rest of 18 (36%) of respondents were classified in 0-8 hours and 12 hours and above. The differences between working hours 0-8 hours and 12 hours above were only 4 (8%). After that, table 4.2 also stated the frequency for respondents that smoke/vape. The number of respondents that smoke/vape were quite higher than those who do not smoke/vape. The total of respondents who smoke/vape were 35 (70%) while the rest 15 (30%) were the respondents who do not smoke/vape.

The next point is whether the respondent consumes alcohol or not. According to the table, most of them did not consumes alcohol. The differences between respondents who did not consumes alcohol and those who did were 46 (92%). From 50 respondents, only 36 (72%) from them perform physical activity. while the other 14 (28%) did not practice physical activity.

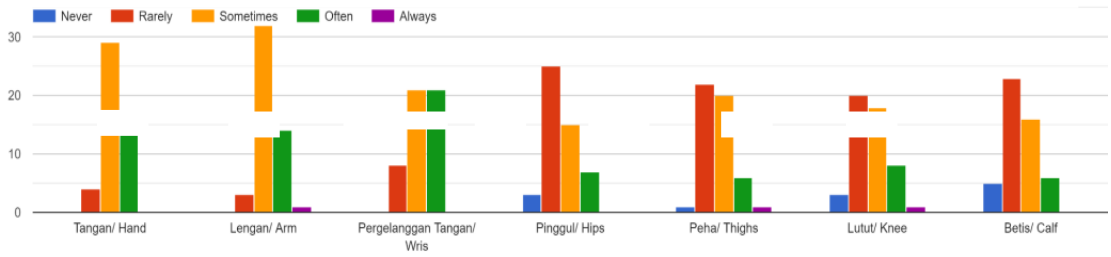
From the data collected for the duration of physical activity practiced a day, it shown that the number of respondents who did physical activity for 15-30 minutes and 30 minutes - 1 hour were equal, which was 18 (36%) each. The other 14 (28%) were categorized as those who did not practice physical activity. Then, the table also stated whether the worker spent their leisure time with a hobby or not. From the two options, the respondents who did not spend their leisure time with a hobby were slightly higher than the other which was 27 (54%). In contrast, those who spend their leisure time with their hobbies were 23 (46%). From these respondents, 9 (18%) respondents spent almost 15 to 30 minutes doing their hobby while 13 (26%) respondents have been doing their hobby for 30 minutes to 1 hour and 1 respondent (2%) doing it more than an hour.

Table 2 Social Lifestyle

Classification		Frequency	Percentage %
Working Experience	1 - 3 Years	12	24
	3 -5 Years	27	54
	5 Years Above	11	22
Working Duration	0 -8 Hour	7	14
	8 – 12 Hour	32	64
	12 Hour Above	11	22
Smoking/ Vape	Yes	34	68
	No	16	32
Alcohol	Yes	34	68
	No	16	32
Physical Activity	Yes	35	70
	No	15	30
Duration Physical Activity	15 to 30 Minutes	17	34
	30 Minutes to 1 Hour	18	36
	No Answer	15	30
Leisure time with Hobby	Yes	23	46
	No	27	54
Duration with Hobby	15 to 30 Minutes	9	18
	30 Minutes to 1 Hour	13	26
	More than 1 Hour	1	2
	No Answer	27	54

3.3 Figure

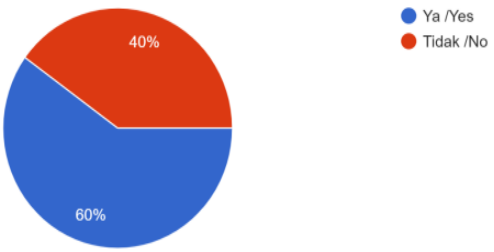
During last working week, which part of the body that experienced pain or discomfort?



Figures 1 Question on Body Parts

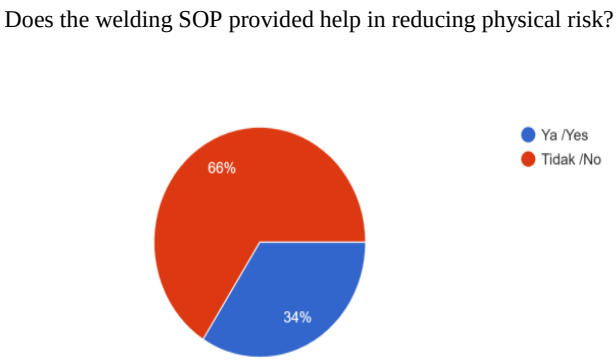
I had referred to questions based on a Google Form that I had made based on the WERA checklist, which questions were for throughout the last working week, For Figures 1, which displayed part of the body experienced pain or discomfort. I used a Likert scale step, which was by giving them 5 answer options, which were never, rarely, sometimes, often, always. When there were enough 50 respondents, I identified that the first was for the respondent to choose sometimes with a total of 29 people followed by often 17 people and rarely 4 people, here that sometimes was the highest answer than the other answers with a total of 29 of 50 respondents chose their hand sometimes will feel pain and discomfort to do welding activities. Ergonomics deals with the exploration of human physical and mental capabilities during working and adjusting the working load. By using ergonomic arrangement of the workplace, it is possible to adapt work to a human's physical and mental characteristics and to reduce or prevent adverse effects on health (More people than ever before, and at younger ages than ever before, are complaining of back, neck, shoulder, and limb pain. While not the main cause of these problems, poor posture is frequently a significant factor. You may lessen the number of pains and discomforts you encounter by maintaining active, powerful muscles through excellent posture.

Are you exposed to the risk of vibration while performing welding activities?



Figures 2 Question on Vibration

WERA analysis checklists have stated about the vibration. The risk assessment's purpose was to assist you in making decisions about the steps that must be taken to protect the health and safety of your employees who were exposed to vibration risk. Working with vibrating tools might make your fingertips less sensitive and numb. As a result, workers may be less adept at performing accurate tasks and using the tools. The tingling and numbness usually went away after 10 to 30 minutes, but if they persisted for a long period after using the instrument and continue the entire time, it may be a sign of harmful vibration exposure.



Figures 3 Question on SOP

SOP stands for standard operating procedure. To increase productivity, ensure that routine tasks are completed in accordance with quality standards, and standardize processes, a SOP guideline provided guidance on how to do so. The implementation of SOPs supports compliance with international standards like ISO standards and enables the application of best practices in each industry. As a result, it is possible to reduce consumption, reduce issues, and boost productivity. The ability to provide your users with more quality service is one of the key benefits of developing a SOP. With procedures to make decisions and respond to every impediment, operations become an efficient, quicker, and more agile machine.

4. Conclusion

Recently, workers in a variety of industries have started to pay more attention to and consider ergonomics. It had a significant impact on employees' comfort, which has a direct impact on the effectiveness and productivity of their job. The workers have alleged that they experience painful postures and injuries at work. The most prevalent issue that employees usually describe is musculoskeletal disorders (MSDs). This issue from workers' awareness of and inattention to the ergonomics of their environment.

In this research, the first research objective of this study was to observe discomfort working posture during welding using Questionnaire based on WERA checklist. Aside that, this research was to identify physical risk factors during welding activities based on the result of Questionnaire based on WERA checklist. From the question, the worker had their own discomfort of part their body. By the recommendation, the workers will have awareness about their body part and the new knowledge. This research also provided with recommendation for control measure by reducing ergonomic risk factors and the potential for workplace.

4.1 Recommendation for Schedule Rotation

The best ergonomic solutions will often improve productivity. By designing a job to allow for good posture, less exertion, fewer motions, and better heights and reaches, the workstation becomes more efficient. Employees at work 8 to 12 hours each day and then take a 30- to 1-hour break. Their working hours can be managed by superiors to prevent physical risks. They expend a lot of energy when working, requiring a little more time for rest. Additionally, rotating projects among workers on a rotating schedule can minimize dangers to their health. The use of ergonomics shows your business' attention to safety and health as essential values. An improved safety culture for your business is the result of the preceding four ergonomics advantages working together. The best human performance for your organisation will result from promoting a safety and health culture at work. Healthy employees are your most important asset.

4.2 Recommendation for Control Risk

Additionally, I've highlighted physical risks that could make the area unergonomic. Some staff prefer to move pipes using their own strength. Some employees are affected by problems with joint discomfort because of this circumstance. One recommendation that stands out is that managers set weight limits by mandating that employees are not permitted to move pipes with human strength greater than 5 kg. By following this restriction, employees will only utilize machines to lift the pipe.

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