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Rated Perceived Exertion of Female Technicians In Aviation Maintenance, Repair And Overhaulin Malaysia

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ABSTRACT
In the Aviation Industry, it's imperative that aircrafts be maintained periodically or in accordance to a predictive schedule. This is to ensure safety of the aircraft is at an optimum level. Majority of the maintenance processes were actuated by aircraft technicians that were trained to perform such tasks. These technicians comprised of male and female individuals which perform similar tasks. This paper delineated the Rated Perceived Exertion of female technicians with regards to the chores and functionalities they performed upon aircrafts.
Keywords: *Female Technicians, Aircraft Maintenance, Rated Perceived Exertion*

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I. INTRODUCTION

The Maintenance, Repair, and Overhaul (MRO) industry is vast and contribute significantly to the aviation field. Aircrafts are flown frequently and this led to wear and tear of the components of the aircrafts. According toChandola and et. al. it's vital for MRO organizations to improve and retain productivity as a stable productivity would entail a normalized profit [1]. They further stated that initiatives were implemented, to mix degree of success, to achieve certain volumes of productivities [1]. Within this contextual frame, we can observe the need to gauge workers physical level since those with optimum physical statures would be able to produce significant outputs. Thus, measuring their exertions, through Rated Perceived Exertion (RPE), is an appropriate approach.

In an MRO organization, the culture of the organization would shape the behavior of the personnel. Jaiswal and et. al. studied the culture and the atmosphere of the organization and if the ecosystem of the organization is favorable, the workers would produce outputs that are desirable [2]. Furthermore, they stipulated that peer pressure which is positive in nature would encourage workers to adhere to rules and procedures [2]. This begets the question whether organizations are able to provide environments where the physical exertions for the workers are optimum and not heavy. Multitude of exertions are detrimental to workers and as such measuring their exertions, as we had done with our RPE, is an appropriate approach.

This was concurred by Harridon which elucidated in great details the factors that affected maintenance workers and one such factor is the physical exertion that embodied the physical functionalities of the workers during operational tasks [3]. Harridon also elucidated that another factor such as the ambience of the workplace, for example inadequate lighting, had affected the productivity of workers [3]. Our RPE is within the track or pathway of unearthing substantial reasons behind the physical uneasiness at the workplace.

Various researchers and scientists had utilized Rated Perceived Exertion (RPE) to measure the exertions of individuals that performed physical tasks or functionalities. RPE uses a scale where the individual would pick a numerical value from the scale, usually from 1 till 10, to represent the exertion that he or she had produced or procreated in relation to the task that was carried out. The value 10 represents extreme exertion while the value 1 represents very least exertion and other values in between are representative of the degree of exertion. Kassiano and et. al. had utilized RPE for their study and it provided them a mean to gauge the physical exertions of their subjects [4]. Kassiano and the team had gone further and made comparison of their RPE data with the planned intensities set by the Personal Trainers of the subjects [4].

II. LITERATURE REVIEW

Workers that actuate Maintenance, Repair, and Overhaul of aircrafts work in various environments and settings. There are instances where workers would crawl through tight and narrow space in order to perform maintenance tasks. This in turn would take a toll upon one's physical being. Bowling and et. al. agreed with this notion and they stipulated that confined spaces would be detrimental to one's productivity and outputs, and as

such, solutions should be established in order to increase the productivity [5]. They further iterated that workers working in such tight environment are prone to unsafe conditions and their physical attributes would be in disparity [5].

Safety in aviation is paramount and mistakes or glitches in maintenance would create technical errors that can be translated into operational incidents which could possibly devoid human lives. Bala and et. al. had compiled a list of causes that contributed to incidents and human error is one of the causes [6]. They also listed technical faults as causes of incidents and these technical faults can be due to human mistakes as well [6]. Hence our approach in investigating the physical conditions of the maintenance workers is vital for the sake of finding solutions in order to improve their physical conditions which subsequently would decrease maintenance errors.

There were numerous cases and instances where human factors played a role in the procreation of aviation accidents. Harridon had denoted several notable accidents which were due to the reduced capabilities of humans and reasons behind this decrease are related to physical deformation of individuals [7]. In his investigation, Harridon elucidated the profound factors, such as lapses of judgements and distractions, which contributed to flight incidents and these factors were plausibly developed in tandem with inappropriate exertions [7].

It can be seen or observed that it is imperative to measure the exertions that were produced by individuals working upon aircrafts. RPE fits well into this scenario where it could measure the exertions via perceptions of the individuals. Lea and et. al. had investigated the reliability of RPE and they concluded that RPE is appropriate to be utilized to gauge the exertions of individuals in the domain of physical resistance whether in the workplace and other venues [8]. Lea and the team also studiedtherelationship between RPE and other parameters such as heart rate, blood lactate, blood pressure, and others and they found out that these parameters were in someway related to RPE values [8].

A study by Jaiswal and et. al. indicated that the MRO working environment contributed to the outputs of the workers and it's vital to facilitate a working environment which is feasible and favorable to the workers [9]. Any conditions which are considered detrimental would somehow induce more exertions from the MRO workers and subsequently this would lead to the decrease of productivity and values of output. We are concerned with regards to this and hence our research is significant in trying to understand the values of exertions of female MRO workers.

There are several shades or nuances of measurement to gauge the exertions procreated by individuals or aviation workers. Harridon had studied the strains produced by aviation workers and the results were interesting in the sense that we can represent the scenarios of health and physical beings of the individuals working in the aviation field [10]. With these data we can, in some manners, comprehend the causes of discomforts of workers that toiled in the aviation industry and possible solutions could be developed.

According to Ritchie, RPE is a substantial tool of measurement that could be used to represent the exertions of individuals [11]. Although it is subjective in nature, the form and substance of RPE had made it a popular choice among researchers to gauge physical activities of individuals and to form comparisons among selected subjects [11]. We had embraced the abilities and attributes of RPE to measure our subjects or respondents and we were not apprehensive in utilizing it.

III. RESEARCH METHODOLOGY

Figure 1 shows the methodology of our study or research. For our study we had chosen, in arbitrary fashion, two locations in Malaysia that housed aircraft maintenance organizations. The locations that were chosen were Kuala Lumpur International Airport (KLIA) and Subang Airport. Both of them are located in the Klang Valley and both of them are prominent in lieu with their reputation of maintaining high number of aircrafts and within a frequent time frame. We had, in our liberty, decided to collect data or actuate survey with regards to female technicians that are involved in the maintenance, repair, and overhaul of aircrafts at the two locations mentioned earlier. This is also to supplement and add to the body of knowledge pursuant to females in the aviation industry.

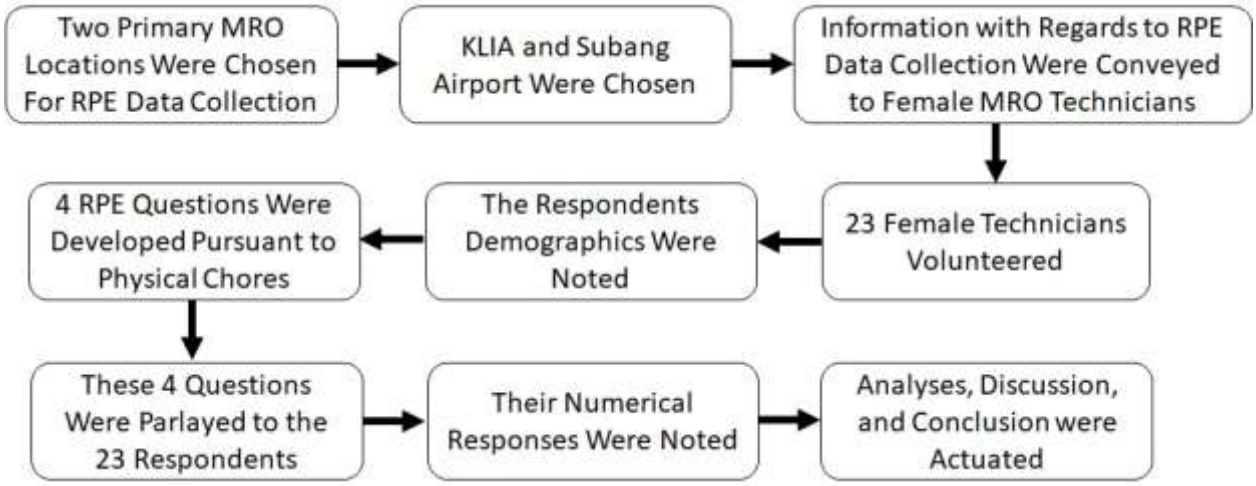

Figure 1 : The Methodology of the Research

Our intention to collect the data and actuate the survey was conveyed to the female technicians at the mentioned locations and 23 female technicians volunteered to be surveyed. The demographics of these volunteers or respondents were then taken and noted. Four questions related to RPE were developed and these questions were in relation to the physical chores or functionalities of the MRO technicians. The questions developed were based upon the heuristics of our combined experiences and fields of expertise. These 4 questions were given to the 23 respondents and their numerical responses were recorded. Their responses were values ranging from 1 till 10 where 1 represents the very least exertion and 10 represents very high exertion. Values in between 1 till 10 are values which represent the progression of intensity of the exertion. We then analyzed and discussed the results that were obtained and conclusions were then procreated. Our intention for measuring the RPE of individuals was also based upon a study by Harridon which denoted that inappropriate physical exertion, due to insufficient training, would create issues that are detrimental to any organizations [12].

IV. RESULTS AND DISCUSSION

The demographics of our respondents are shown in Table 1. We also collected data pertaining to the physical exercise regime of the respondents and these are shown in Table 2. Figures 2 till 5 denote the RPE values of the exertions of the respondents based upon the 4 questions given to them. The question in Figure 2 captured the RPE values of the individuals in relation to their chores of installing of instrument panels. While the question in Figure 3 captured the RPE values of the individuals in relation to their chores of replacing defective parts. Figure 4 indicates the RPE values of the respondents in relation to their tasks of performing engine ground run. And Figure 5 parlays the values of RPE of the individuals based upon their chores of inspecting completed tasks.

Table 1 :Demographics - Age of the Respondents

Age	Number of Individuals	Percentage of Total Respondents
Less than 20 years old	2	9
$20 \leq$ Age < 30	19	82
$30 \leq$ Age < 40	2	9
$40 \leq$ Age	0	0
	Total Number of Respondents = 23	Total =100%

Table 2 : Frequency of Exercise of the Respondents

Frequency of Exercise	Number of Individuals	Percentage of Total Respondents
Once per week	5	21.7
2-3 times per week	8	34.8
4-5 times per week	2	8.7
6 times per week	0	0
none	8	34.8
	Total Number of Respondents = 23	Total =100%

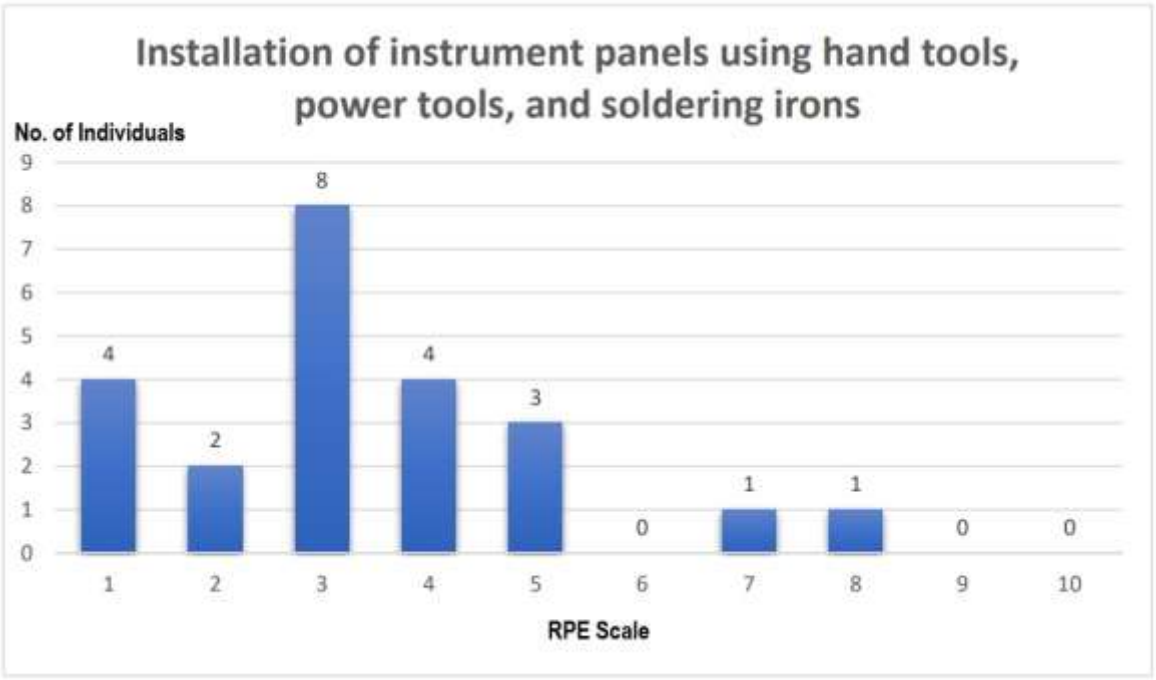

Figure 2 : RPE Values for Installation of Instrument Panels

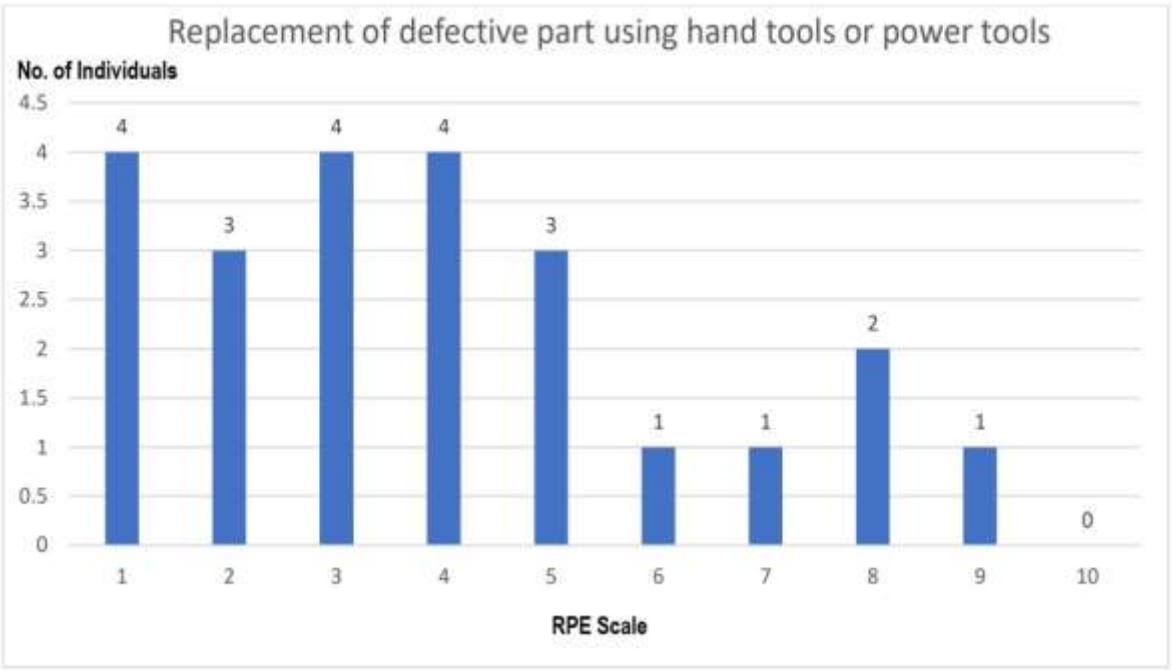

Figure 3 : RPE Values of Replacement of Defective Part

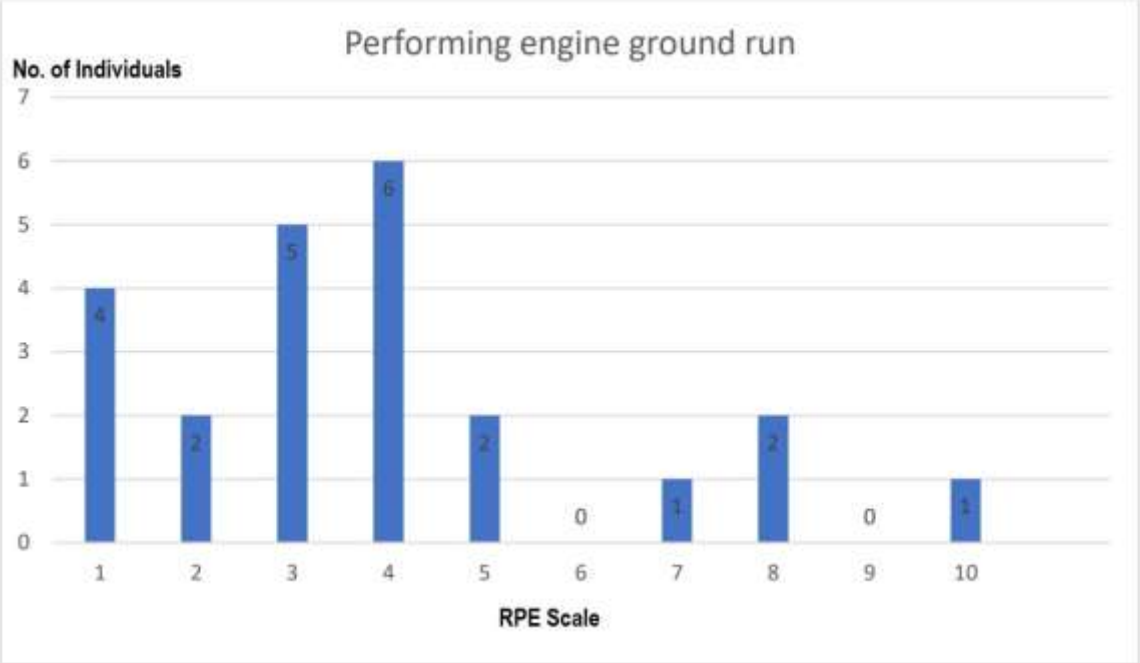

Figure 4 : RPE Values of Performing Engine Ground Run

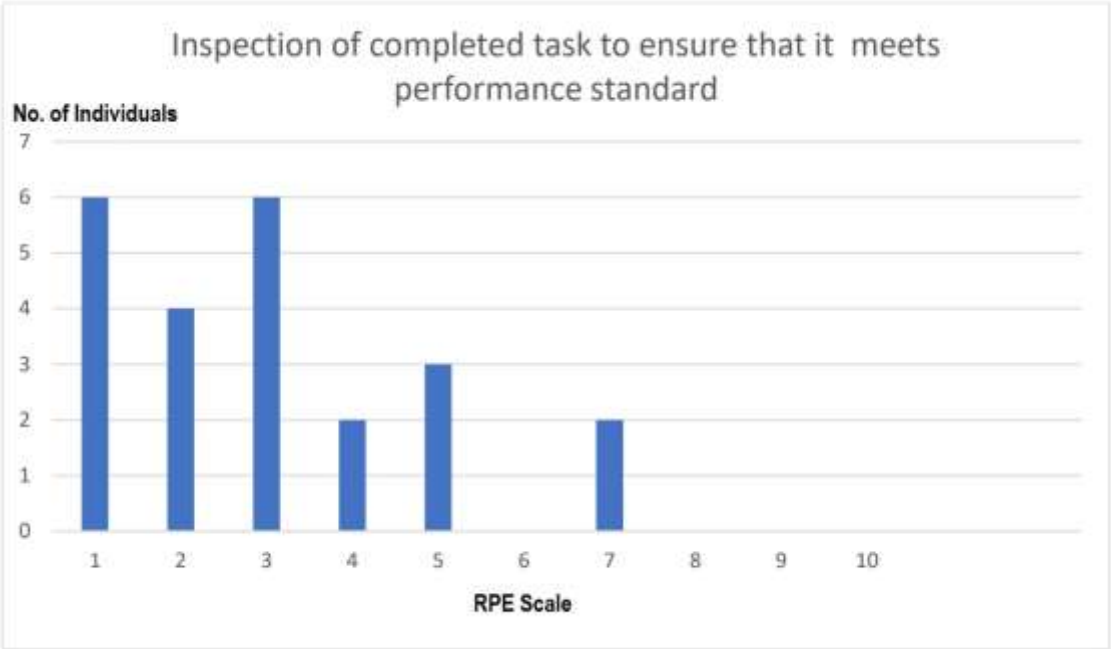

Figure 5 : RPE Values of Inspection of Completed Task

Most of the respondents are between the age of 20 till 30 as indicated by the demographic data that we obtained. This is seemingly the ripe age of their physical fitness and thus perhaps this explain the low RPE values (values 1 till 5) for most of the questions or situations posed to them. And if we peer upon the data in Table 2, more than 60% of the respondents are frequently exercising within a time frame of one week. This may also explain the low RPE values of most respondents as shown in Figures 2 till 5.

In Figure 2, only 2 respondents responded with values above 5 with regards to their exertions. This is a minority and this bode well with their organizations as the majority could perform well in this particular task since most were not exerting much in the actuation of this particular task. There is also the notion that the tools utilized in this task were not significantly heavy and are appropriate to be used constantly without being detrimental to the users. A study by Kittusamy and Buchholz indicated that individuals that are exposed to vibrations are at risk to gain depreciation upon their health [13]. Tools, especially power tools, that were utilized

by the respondents were perhaps propagating vibrations to the respondents, but within the contextual of Figure 2, the vibrations are plausibly not high as most respondents did not produce high exertions.

Pertaining to Figure 3, the respondents mostly did not produce high exertions while replacing defective parts. Only one respondent exerted a value 9 for this particular task. This is quite alarming as this is not the norm and it is considered as an outlier since a majority of the female individuals were not experiencing any predicaments. It is perhaps imperative for the organization to peer upon this issue as safety is at stake. Those who exert high exertions are susceptible to performance degradation since constant high energies are utilized for the task which would render them lethargic and unable to concentrate effectively. This subsequently would lead to mistakes or errors while actuating the maintenance tasks and thus decreasing the integrity of the aircraft. Several incidents occurred due to this situation and it is vital to rectify the issue to prevent future maladies that perhaps would involve human lives.

Figure 4 shows the exertions of the respondents in lieu with the task of performing an engine ground run. Only 4 respondents gave values above 5 with regards to their exertions in this denoted task. This is equivalent to 17.39% of the total respondents and thus represented a minority. According to Essendon Fields, engine ground run consists of the flickering of switches and knobs to start and run the engine [14]. Hence, exertions within this realm are collectively low but the high pitch of noise from the engine may contribute to the increase of exertions of several individuals of the study. Those actuating the run are also subjected to a period of sedentary and this immobilization could also be a factor that contribute to the increase of exertions.

Figure 5 indicates the exertion level of the respondents in tandem with the task of inspecting the completed works. It can be seen only 2 respondents gave exertion values above 5. This is plausibly due to the fact that the chores of inspecting do not utilize much energy and the intensities of such chores are minimal. Demographics had shown that 34.8% of the respondents were not actively participating in any form of physical exercises each week. This may have contributed to the values above 5 in relation to Figure 5.

V. CONCLUSION AND RECOMMENDATION

We had surveyed the exertion levels of female aircraft technicians that performed maintenance, repair, and overhaul upon aircrafts at two prominent MRO locations in Malaysia. We had in our disposal 23 female respondents that voluntary agreed to take part in this survey. The denotations or measurement of the exertions of the respondents were actuated using RPE which is a well-accepted mean to gauge exertions of individuals. The demographics that we had collected had shown that most of the respondents were young and a majority of them had implemented some form of physical exercise regime each week. This may explain the favorable RPE values that we had obtained which indicated that a majority of the individuals were able to perform the maintenance tasks or chores with ease since their exertions were mainly minimal. We are however concern with the RPE values that were high in all 4 situations that were conveyed to the participants of this survey. Although they are in a minority group, this issue serves as a reminder that safety is at stake. A high RPE value stipulates that the individual had exerted high force or energy which cause uneasiness to the individuals. This subsequently would lead to degradation of their outputs and work performances and thus could possibly affect the integrity of the aircrafts that are being maintained or overhauled.Hence, we recommend the MRO organizations or the employers to take heed of our data and analyses and seek to establish proper and profound solutions to mitigate the issues or predicaments.

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