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Research paper

Education Level, Working Experiences and Ergonomics Training Effect on Ergonomics Awareness and Practices in Malaysia

Rozlina Md Sirat[1]*, Jafri Mohd Rohani[1], Norhayati Ahmad[1], Awaluddin Mohamed Shaharoun[2] , Habibah Haron[2]

[1] Faculty of Mechanical Engineering, Universiti Teknologi Malaysia, Skudai, Johor, Malaysia
[2]UTM Razak School of Engineering and Advanced Technology, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia
**Corresponding author E-mail : rozlina@mail.fkm.utm.my:*

Abstract

The objective of the study is to identify the effect of three demographics factors: education level, working experiences and ergonomics training on ergonomics awareness (EA) and ergonomics practices (EP). 146 questionnaires were received from Safety and Health Officers (SHOs) in Malaysian manufacturing companies. Exploratory Factor Analysis has been carried out but not discussed in this paper. Ergonomics awareness (EA) represented by four elements: knowledge in ergonomics technical (KET), beliefs on implication of work and need for improvements (BIIWNI), beliefs on the importance of assessment (BIAss) and beliefs on the importance of anthropometrics and suitability to workers (BIASW). Ergonomics practices (EP) were represented by two elements; ergonomics technical (Ergo_Tech) and ergonomics administrative (Ergo_Ad). Analysis were carried out by Levene test, MANOVA, and linear regression (stepwise). It is found that ergonomics training and working experiences as SHO have significantly interact with EA, while only ergonomic training has significantly interacted with EP. Surprisingly, education level of SHOs did not contribute significantly to both EA and EP. It is concluded that ergonomics training should be emphasized in order to get a successful ergonomics practice and it should be considered as a compulsory in order to obtain continuous program (CEP) point for renewal of SHO certificate.

Keywords: *Ergonomics; Awareness; education level; Safety Health Officers (SHO) .*

1. Introduction

In 2020, Malaysia is going to move towards a fully developed country. Manufacturing sector will contribute significantly for the country towards vision 2020. According to Department of Statistics Malaysia 2013[1], 62% was reported to have the occupational accident occurred mostly in manufacturing industries as reported by DOSH (2013) until June 2013 [2].

Manufacturing system started to involve complex automated system [3]. However, in many condition, workers are still essential to operate or do maintenance manually. Certainly, difficulties such as long setting up, insufficient flexibility in maintenance or poor production could appear.

Ergonomics is a hybrid discipline that can solve complex cross-disciplinary problems [4]. Ergonomics awareness helps in ergonomics application and contributes significantly to human well-being and safety due to a comfortable work environment, ergonomically designed tool, human-machine interface design and suitable work method [5] [6]. In fact, its implementation has a significant impact on the industry, organization, management, employees of the system [6] [7] by improving productivity, efficiency of the company [8]. Thus, the awareness of ergonomics is important to SHOs.

The failure in ergonomics practice may give a big implication. It was reported that one-third of workplace injury was caused by musculoskeletal disorder (MSD), and often account for about three-fourth of costs [9]. Seelay (2009) proved the importance of ergonomics through his finding on the cost of MSD and workers compensation that far exceed those for acute incidents such as burns, cuts and fractures [10]. In Malaysia, ergonomics problem, in specific, MSD has been reported as the cause that was on the rise nationwide, attributing it in part to the lack of safe work practice at workplace. It is an upward trend, with 161 cases on 2009, 238 in 2010, increase to 268 cases in 2011 and 449 in 2012. Lee Lam Thye, president of NIOSH (Malaysia) mentioned that this is a jump of almost 18 times compared to 2006. The number of cases could be higher as he believed that many cases are under reported [11].

SHOs are the expert and the representative of employer in initiating the safety and health activities. Before they implement ergonomics at their workplace, they should have the knowledge and attitude in understanding of the importance at workplace. This would be called as awareness as described in Cambridge dictionary ".knowledge that something exists, or understanding of at the present time based on information and experience" [12].

Awareness is very important in ergonomics implementation as the companies will be motivated to develop ergonomics guideline in their companies even though without being mandated to do so by OSHA [13]. This is based on his survey done to furniture industry in US. According to Musonda and Smallwood (2008), awareness should not only based on knowledge but also on the display of attitude and behavior [14]. Thus, the awareness of ergonomics has a broader context to SHOs. However, changing attitude is consid-

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ered as more difficult and time taking as compared to one's knowledge. Attitude change is highly affected by personal traits education, age groups [15], training received [16] including working experiences [17].

2. Literature Review

Ergonomics is considered as a separate body of knowledge from safety and there is no measurement on the influence of ergonomics towards safety culture or vice versa [1]. Some researchers summarized that attitude may affect behavioural intentions, which represents a plan of action that is arrived at through conscious or aware on the importance [18] [19]. Davidson et. al. (1985) found that 'intention was better predictors of behaviour' [20]. It gives the meaning that a more positive the attitudes, the more positive the consequences that are associated with a specific behaviour. Some examples have been given on how the perceptions of employers and managers in safety may influence the perceptions of risk and therefore actions to control them [21]. This is called as behaviour intention in which this methodology is used to measure attitude of their case study object in aviation field in their research [22].

According to some researchers, safety attitudes and safety behaviour were affected on each other to develop a safety culture [23]. At the same time, poor safety behaviour may adversely develop a low safety practice [24]. Among attitude theorist, it is commonly mentioned that attitudes can be determined by 'beliefs' [18] and assumed that beliefs are in some sense the building blocks of attitudes [25]. This attitude on how they look the importance of safety subsequently may shape a culture [19] [23] [24] [26].

The challenging of implementing ergonomics has been mentioned by Yeow and Sen (2002) [27] and Shaliza et. al. (2009) [28]. They concluded that the lack of information or education or training may hinder them for carrying out the ergonomics programs in the industries. Education is significant demographic to be studied [29] [30]. Some researchers studied on the combination of education and training as the factors considered in a critical success factor for practice [30] [31]. Personal experience was considered to be studied in human behaviour [30]. Dawal et. al. (2009) mentioned that work experience may give some influences to the ergonomics practice [32].

The objective of this study is to identify to what extent the level of formal education, working experience as SHO and training can significantly affect the level of ergonomics awareness and practice. This is to distinguish the contribution of formal education, working experience and training to the awareness and practices of ergonomics. Hence, this would give some knowledge on root cause of ergonomics awareness and practice regarding their background..

3. Methodology

The responsibility of SHO is very high as he/ she is the person assigned by employer to ensure the highest OSH standards at workplace are implemented. He/ She should constantly advise employer on the importance of ergonomics and the practice [18]. Thus the awareness of SHO should be high and it not just related to education and training, but also related to knowledge and experience of handling the risk [34] (Harvey et al., 2001). It is also known as cognitive, affective and conative (behavioural) in which can be described as attitudes [35] [36].

Three demographics information were selected to identify the influences to the awareness and practices in this paper: education level, current experience as SHO and training received on ergonomics.

146 questionnaires were successfully returned. Exploratory Factor analysis has been done but not discussed in this paper. Ergonomics awareness and ergonomics practice were studied as the dependent variables. Ergonomics awareness represents by 4 elements: knowledge in ergonomics technical (KET), beliefs on implication of work and need for improvements (BIIWNI), beliefs on the importance of assessment (BIAss) and beliefs on the importance of anthropometrics and suitability to workers (BIASW), while ergonomics practices represents by two elements; ergonomics technical (Ergo_Tech) and ergonomics administrative (Ergo_Ad).

Analysis were done by Levene test, MANOVA, and linear regression (stepwise) (Field, 2009) in order to identify the homogeneity if the standards deviation of dependent variables is the same in the population, to identify the significant model which is better at predicting the ratio and percentage of contributions of the three significant demographic factors to EA and EP respectively [17].

4. Results and Discussions

Analysis was done to the demographics data and the result is summarized in Table 1. Based on the result, most of the respondents are from electric and electronics (23.3%), followed by chemical part, petroleum, coal (17.1%), metal, machine and equipment product (17.1%). The highest formal education level they obtained mostly was degree (45.9%), followed by diploma (29.5%) and PMR/ SPM (14.4%). More than 80% respondents have more than five years in working experience at their companies and almost 60 % of them have more than 5 year experience with current job as SHO. For the ergonomics training, less than 40% choose ergonomics training more than one day course. This is important to be studied since SHO can choose whatever training regarding OSH and in this situation, researcher can identify the seriousness of SHO in considering ergonomics as an important training besides to get Continuous Education Program (CEP) point.

Table 1: Demographics of respondents from manufacturing companies

	Variable	Frequency	%
Classification of industries	Electrical and electronic	34	23.3
	Chemical or apart, petroleum, coal	25	17.1
	Metal, machine and equipment product	25	17.1
	Rubber or plastic based	17	11.6
	Automotive and accessories	13	8.9
	Food/ drinks	13	8.9
	Wooden product including furniture	7	4.8
	Beverages and cigarettes	6	4.1
	Others (printing and publishing; paper and paper based product; textile, cloth and leather)	6	4.1
Highest Formal Education	PMR/ SPM	21	14.4
	Diploma	43	29.5
	Degree	67	45.9
	Post degree	15	10.3
Past work experience	< 5 years	29	19.9
	6 - 15 years	29	19.9
	16 - 25 years	58	39.7
	> 25 years	30	20.6
Experience with current job as SHO	< 5 years	57	39.0
	6 - 15 years	39	26.7
	16 - 25 years	43	29.5
	> 25 years	7	4.8
Average ergonomics training received in past three years	< 1hour	23	15.8
	1 - 4 hours (half day course)	40	27.4
	5 - 8 hours (one day course)	30	20.5
	9 - 12 hours (one and half day course)	20	13.7
	More than one and half day course	33	22.6

As an information, under regulation of the Occupational Safety and Health (Safety and Health Officer) Regulations 1997 [37], SHO need to have 30 CEP point in order to renew his/ her SHO certificate annually. Yet it depends on awareness of SHO to determine what type of training that important to be taken in enhanc-

ing his/ her knowledge. Thus, ergonomics may or may not include in their application of training

Root causes in terms of education level, working experiences and ergonomics training received that may influence the ergonomics awareness was studied. Multivariate test (MANOVA) was used to see whether the model was significantly better at predicting the ratio [38]. Before doing MANOVA test, Levene test was used to assess the homogeneity if the standards deviation of dependent variables was the same in the population [39]. The analysis was to find the test to be nonsignificant so that the ANOVA test can be performed. Thus, Table 2 demonstrates the non-significant of the test ($p > 0.05$). So we concluded that the SD was identical in the groups and homogeneity requirement was met. ANOVA test can be performed.

Table 2: Levene's Test for Equality of Error Variance

	F	df1	df2	Sig.
EA	1.678	12	133	.084
EP	1.088	12	133	.379

Table 3: Multivariate test

Effect		Value	F	Sig.
A4	Pillai's Trace	.125	1.328	.250
	Wilks' Lambda	.878	1.323(a)	.252
	Hotelling's Trace	.136	1.318	.254
	Roy's Largest Root	.112	2.242(b)	.093
A5	Pillai's Trace	.118	1.256	.283
	Wilks' Lambda	.885	1.241(a)	.290
	Hotelling's Trace	.127	1.226	.298
	Roy's Largest Root	.089	1.780(b)	.161
A6	Pillai's Trace	.141	1.515	.179
	Wilks' Lambda	.860	1.544(a)	.170
	Hotelling's Trace	.163	1.572	.161
	Roy's Largest Root	.159	3.178(b)	.030
A7	Pillai's Trace	.373	3.434	.001
	Wilks' Lambda	.647	3.589(a)	.001
	Hotelling's Trace	.516	3.740	.001
	Roy's Largest Root	.449	6.734(b)	.000

Table 4: Test of Between Subjects Effects

Source	Dependent Variable	Mean Square	F	Sig.
A7	EA	4570.206	6.614	*.000*
	EP	3956.276	4.103	*.018*
A5 * A7	EA	1511.413	2.187	*.039*
	EP	1933.186	2.005	.058
A5 * A6	EA	2802.051	4.055	*.026*
	EP	2116.337	2.195	.126

(Key: A4: Education level; A5: past working experiences without OSH; A6: past working experiences as SHO; A7: ergonomics training hour received)

Multivariate test from Table 3 and test of between- subject form Table 4 show that only training has significant main effect to the

Table 5: Test of Between Subjects Effects (detail)

Source	Dependent Variable	Mean Square	F	Sig.
A4	KET	.473	.700	.556
	BIIWNI	.805	.800	.499
	BIASW	.656	.585	.627
	BIAss	1.206	1.367	.262
A5	KET	1.046	1.550	.200
	BIIWNI	1.524	1.515	.210
	BIASW	1.131	1.009	.411
	BIAss	1.748	1.982	.109
A6	KET	1.568	2.323	.084
	BIIWNI	1.592	1.582	.203
	BIASW	1.951	1.740	.169
	BIAss	1.850	2.098	.110
A7	**KET**	**5.322**	**7.885**	**.000**
	BIIWNI	**6.094**	**6.059**	**.000**
	BIASW	**4.738**	**4.225**	**.005**
	BIAss	**5.811**	**6.589**	**.000**
A4 * A5	KET	.633	.938	.463
	BIIWNI	1.028	1.022	.413
	BIASW	.580	.517	.762
	BIAss	.929	1.053	.396
A4 * A6	KET	.937	1.389	.242
	BIIWNI	1.565	1.556	.187
	BIASW	1.497	1.335	.262
	BIAss	.698	.791	.560
A5 * A6	KET	1.018	1.508	.201
	BIIWNI	**2.444**	**2.430**	**.046**
	BIASW	.901	.803	.552
	BIAss	.787	.893	.492
A4 * A5 * A6	KET	1.062	1.574	.215
	BIIWNI	1.975	1.964	.166
	BIASW	.346	.309	.581
	BIAss	1.206	1.368	.247
A5 * A7	KET	1.133	1.679	.101
	BIIWNI	**1.979**	**1.967**	**.049**
	BIASW	1.831	1.633	.113
	BIAss	.647	.734	.702
A4 * A5 * A7	KET	.351	.520	.597
	BIIWNI	1.151	1.145	.325
	BIASW	.448	.399	.673
	BIAss	.056	.064	.939
A6 * A7	KET	1.289	1.910	.076
	BIIWNI	**2.292**	**2.279**	**.034**
	BIASW	1.692	1.508	.174
	BIAss	1.017	1.153	.343

Key: A4: Formal education; A5: Past working experience without OSH; A6: Past working with OSH; A7: Ergonomics training received

EA and EP. It shows that ergonomics training hour received by SHOs interacted significantly to ergonomics awareness [$F(EA) = 6.614$, $p<0.05$] and to ergonomics practice [$F(EP) = 4.103$, $p<0.05$]. While, interaction effect of two combination variables (past working experience and ergonomics training received) (PWE and Tr) exist significantly with ergonomics awareness [$F(EA) = 2.187$, $p<0.05$]. However, the interaction between those two variables to the ergonomics practice did not significantly exist ($p>0.05$). So as the interaction between the combination of past working experience (A5) and OSH experience (A6) were significantly exist ($p<0.05$) towards ergonomics awareness [$F(EA) = 4.055$, $p<0.05$] but not significant to ergonomics practice [$F(EP) = 2.195$, $p>0.05$]. In detail, multivariate test as shown in Table 5 proved that training influenced significantly the four significant variables of EA, which is knowledge in technical (KET), beliefs on implication of work and need for improvements (BIIWNI), beliefs on the importance of assessment (BIAss) and beliefs on the importance of anthropometrics and suitability to workers (BIASW).

A more detail analysis is done to investigate the correlation and regression value in order to see the percentage of the contribution to the awareness and the practice respectively.

Table 6 illustrates the correlation and regression of demographics data and EA and EP. Training contributed 22.8% and working experience as an SHO gave 2.9% to awareness. On the other hand, in EP, only training gave the impact with 13.9% while the others (education, working experience in company/ies, working experience as an SHO) have no impact to the practice. While Table 7 illustrates the VIF and tolerance result. VIF values are all good (below 10) [40] [41] and the tolerance statistics are well which is above 0.2 [42].

Table 6: Correlation and regression value of independent and dependent variable for EA

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.478(a)	.228	.223	
2	.507(b)	.257	.247	2.140

a Predictors: (Constant), A7 Average of training received in past three years

b Predictors: (Constant), A7 Average of training received in past three years , A 6 Past working Experience with current job as SHO

Table 7:Contribution of independent variable (training and past working experience as SHO) to dependent variable (EA)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	VIF
		B	Std. Error	Beta			
1	(Constant)	3.60	.159		22.6	.000	
	A7	.315	.048	.478	6.52	.000	1.00
2	**(Constant)**	**3.31**	**.201**		16.4	.000	
	A7	**.301**	**.048**	.457	6.29	.000	1.02
	A 6	**.167**	**.071**	.171	2.35	.020	1.02

a Dependent Variable: EA

Based on stepwise method in regression analysis (Table 7), it shows that correlation between independent variable (A7) and dependent variable (EA) was 47.8%, while the combination of training and past working experience with current job as SHO was 50.7%. That means correlation between past working experience as SHO and EA was 4.9%. It is proved that training is important to ensure the SHO renew and update all knowledge and information to the latest. Thus, the training need more encouraged and effort to enhance awareness. By referring to the result as shown in Table 7, the regression equation:

EA= 3.312 + 0.301 (A7) + 0.167 (A6)

or EA= 3.312 + 0.301 (Training) + 0.167 (Experience as SHO)

Then, an analysis to the EP is done. Table 8 illustrates the result on the three demographics data to the two factors of EP. EP represented by Ergo technical and ergo administrative.

Table 8:Tests of Between-Subjects Effects for EP

Source	Dependent Variable	Mean Square	F	Sig.
Intercept	Ergo_Tech	872.792	875.2	.000
	Ergo_Ad	845.827	684.0	.000
A4	Ergo_Tech	.265	.3	.849
	Ergo_Ad	1.305	1.1	.375
A5	Ergo_Tech	.309	.3	.818
	Ergo_Ad	.620	.5	.683
A6	Ergo_Tech	.322	.3	.809
	Ergo_Ad	.913	.7	.533
A7	**Ergo_Tech**	**5.694**	**5.7**	**.001**
	Ergo_Ad	**6.945**	**5.6**	**.001**
A4 * A5	Ergo_Tech	1.248	1.3	.293
	Ergo_Ad	1.038	.8	.545
A4 * A6	Ergo_Tech	1.416	1.4	.230
	Ergo_Ad	1.011	.8	.542
A5 * A6	Ergo_Tech	.625	.6	.680
	Ergo_Ad	.572	.5	.802
A4 * A5 * A6	Ergo_Tech	6.217	6.2	.015
	Ergo_Ad	3.380	2.7	.103
A4 * A7	Ergo_Tech	.428	.4	.914
	Ergo_Ad	.334	.270	.980
A5 * A7	Ergo_Tech	1.723	1.7	.089
	Ergo_Ad	1.700	1.4	.208
A4 * A5 * A7	Ergo_Tech	1.762	1.8	.163
	Ergo_Ad	.239	.2	.901
A6 * A7	Ergo_Tech	1.834	1.8	.096
	Ergo_Ad	2.250	1.8	.100
A4 * A6 * A7	Ergo_Tech	5.711	5.7	.005
	Ergo_Ad	1.363	1.1	.339
A5 * A6 * A7	Ergo_Tech	1.293	1.3	.259
	Ergo_Ad	.668	.5	.465
A4 * A5 * A6 * A7	Ergo_Tech	.	.	.
	Ergo_Ad	.	.	.

Note: A4: Formal education; A5: Past working experience without OSH; A6: Past working with OSH ; A7: Ergonomics training received

Only training is found to have correlation with ergonomics practice. Refer to Table 9, correlation between contribution of independent variable (A7) and dependent variable (EP) was 37.3%. That means that training also gives significant impact to EP. The contribution of training received by SHO to their practice can be illustrated from the equation extracted from Table 10:

EP = 3.374 + 0.291 (A7)

or EP = 3.374 + 0.291 (Training)

Table 9: Correlation and regression value of independent variables and dependent variable for EP

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.373(a)	.139	.133	1.0380	2.046

a Predictors: (Constant), A7 average of training received in past three years

b Dependent Variable: EP

Table 10: Contribution of independent variable (training) to dependent variable (EP)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics
		B	Std. Error	Beta			VIF
1	(Constant)	3.374	.205		16.4	.000	
	A7	.291	.062	.373	4.72	.000	1.00

a Dependent Variable: EP

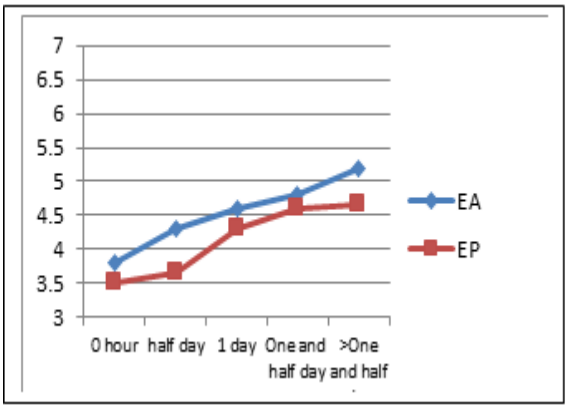


Fig. 1: Line graph of EA and EP based on average training received by SHO annually

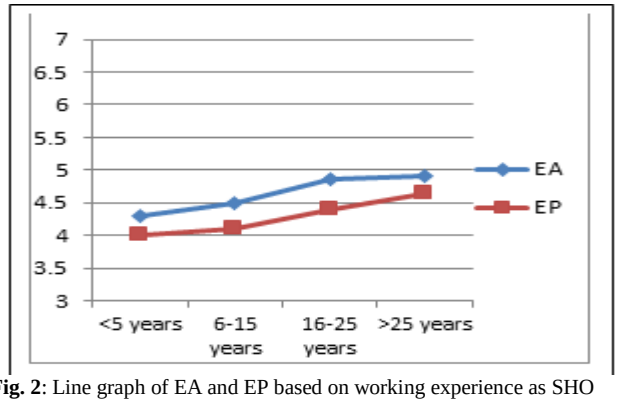


Fig. 2: Line graph of EA and EP based on working experience as SHO

Figure 1 shows the relationship between ergonomics training received annually by SHO in past three years and ergonomics aware-ness and practices. The higher the training hour received,

the higher the awareness and the practice. However, the practice is not as higher as the ergonomics awareness. For working experience as SHO (refer Figure 2), it can be seen that the more experience of SHO, the more awareness will be gained. However, for ergonomics practice, the line cannot be used to represent the population as the significant value is more than 0.05.

In overall discussions, four factors were pinpointed to relate the SHOs' background and their perceptions. There were education, past working experience in company /ies before involving in OSH, working experience after involving as SHOs and training hour received annually for past three years. The study found that only training hours obtained give a significant effect to the both awareness and practice. It gives 22.8% implication to EA and 13.9% implication to EP. The other factors are not significant factors to contribute in the awareness level and practice level. However, past working experience, was capable to increase ergonomics awareness besides the training. At the same time, combination of past working experience before involving in OSH and after involving as SHO also capable to increase ergonomics awareness. Nonetheless, ergonomics practice only capable to influence both beliefs and practice. The conclusion that can be done is that even though training is identified to be the most significant factor to increase the ergonomics awareness and practice, it is also the most significant constraint they faced at the workplace. However, a significant awareness and practice depends on the program, skill training, awareness training that employers provide for the workers [42]. The finding revealed that the ergonomics training hours received by SHOs is believed to have significant impact to the all factors of ergonomics awareness in this study. It supports that training is a systematic modification of behaviour through learning which occurs as a result of instruction, education, development and planned experience [43]. It is important in which the purpose is more directly applied to work of a particular type.

This is why an SHO need to have OSH training consistently especially ergonomics which is always ignored by SHO in determining what training should be gained to fulfil CEP point. It is acceptable due to the fact that even people who do continue to do the same job for a long time, still are required to update their skills regularly as the old skill are rapidly left behind by the advance of the new technology [43] [44]. Even though education seems to be significant by some researchers [45] [46], in this study it shows that education referring to formal education level such as PMR, SPM, degree or post degree did not give any significant influence to the ergonomics practice and safety culture practice. In the other hand, it supports statement from Torrington and Chapman (1993) [47] that education is more to the academic disciplines such as engineering, psychology, sociology and mathematics. It is capable to develop balanced understanding in which it developed the mentality of the per-son, consequently the management thought. Indirectly, the effect of education level may impact work commitment [48].

5. Conclusions

Ergonomics training is very important to be highlighted in SHO master plan in order to ensure a successful implementation of ergonomics. It is proved that the more training obtained by SHO, the more awareness and practice they are. Education level is not necessarily can give influence to the ergonomics awareness and practice. So as the working experience for both before become SHO and after being as SHO. For the future work, SHO should emphasize the training and put it as a compulsory education program in their CEP point for renewal requirement as SHO. They should think what type of ergonomics training they should obtain to enrich their knowledge, enhance their attitudes on the importance and eventually boost the practice.

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