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The Mental Workload Analysis of Staff in Study Program of Private Educational Organization

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The Mental Workload Analysis of Staff in Study Program of Private Educational Organization

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Abstract. The mental workload affects productivity workers to accomplish the task. Staff has many tasks that not only main task but additional task. The additional task is from superior in the same place or the other place. The SOP for duties and distribution of task is not clear so the fatigue can affect to productivity. The method to measure mental workload is NASA-TLX. NASA TLX has six indicators: mental demand, physical demand, temporal demand, performance, frustration, and effort. The analysis not only based on result of NASA TLX but also using statistic test. The result is performance indicator is high that described the staff not satisfied with their job has done. The staff not satisfy but the effort has been taken out is very high. The result of Mann Whitney is not different with two group of the period long term of working which divided in < 7 years and >7 years. The result of correlation test is if the staff make more effort, the satisfaction for their tasks has been done is bigger. The regression test produces an equation but cannot be used to calculation or prediction the staff mental workload. Because regression coefficient is not significant (not usable). The solution is staff must divide the task. Dissatisfaction can reduce motivation and the members cannot perform well.
Keywords: NASA TLX, Mental Workload, Staff, Productivity

1. Introduction
The working hours, mental, and frustration when facing certain tasks can be considered as risk factors for work stress [1]. The demands of task must be arranged so that someone is not too loose or even the task is to burden. The arrangement is to ensure long term safety, health, comfort, and efficiency of productivity [2].

Physical fatigue, mental fatigue, and emotional reaction such as headaches, indigestion, and irritability can be caused by excessive workloads [3]. Workload is a factor between education level and cognitive decline because of the people who has low education level more often have monotonous jobs with only little challenge and cognitive so that low mental workload demands are related to cognitive abilities [4]. The decrease of level of work productivity can caused by fatigue condition experienced by workers in long term period [5].

The components that affect workers productivity include individual factors that including age (25%), gender (15%), period long term of working (10%), the remaining is influenced by workload and fatigue (50%) [6]. The external factor that has affect to productivity based on environment work such as stress of work (23,5%), motivation (25,5%), nutrition (25,5%), and workload (25,5) [7]. The evaluation of workload is as key to research and develop human machine interface, as well as to find levels of comfort, satisfaction, efficiency, and security in the workplace [2].

University has an organization. The organization divided to some faculty based on majors. The faculty divided to some study of program based on concentration program. The organization has system and standard operation procedure (SOP) to arranging the mechanism administration process. Staff has task to arranging administration that has correlation to educational. Every study of program has staff to handle the administration.

In existing condition SOP to arranging administration that has related to education. The process to doing that tasks have been clear. However, the staff not only doing administrative work as their main tasks, but also do additional work. The type of additional work is short term and support educational activities such committee of event, etc. The additional work not only from superior in their place, but also from superior in other place where still same faculty or in higher level in university. The additional work not only one and has different duty in at once time. The SOP of staff task is not clear to doing additional work, so the fatigue can affect to productivity.

The result of the literature study and observation is indicating the existing condition of staff must be analysed. Because that can be affect to their administrative work or additional work. The method to measure mental workload is NASA-TLX. NASA TLX is the most widely used method and provided good results [8].

2. Methodology

Observation is important to find solution from the problem staff. Not only observation, but also ask the staff about their tasks in that time. The literature study to find about method that can be produce the result of workload.

Collecting data using NASA TLX that has six indicators [8]: (1) Mental demand (MD) is measuring activities mental and perceptual to see, remember, and find. Not only that but also to classify the tasks into difficult, simple, or complex. The rating is low to high (2) Physical demand (PD) is measuring the number of physical activities that needed (example: pull, push, rotate, etc.). The rating is low to high (3) Temporal demand (TD) is measuring time pressure that felt during work whether the work can be done slowly, or quickly so that is feels tiring. The rating is low to high (4) Performance (P) is the success of workers in carrying out their duties and how they are satisfied with the results of their work. The rating is perfect to failure (5) Frustration (FR) is how many workers feel insecure, desperate, offended, or disturb when doing their work. The rating is low to high (6) Effort (EF) is amount of hard work that workers need to achieve the required level of performance. The rating is low to high. NASA TLX has steps [8]: (1) Weighting is a section to respondents choose one indicator to cause a mental workload (2) Rating (3) Scoring is multiplying the rating and weighting for each indicator (4) Weighted workload (WWL) is sum of score all indicators (5) Average of WWL (6) Interpretation score in Table 1.

Table 1. The Interpretation Score of NASA TLX [8]

Workload	Value
Low	0-9
Medium	10-29
Somewhat high	30-49
High	50-79
Very high	80-100

Processing data using score of NASA TLX and test statistic. Test statistic that used in this research is Mann Whitney test, correlations and regression test. Analysis to this research is based on result of NASA TLX and test statistic. Flow chart of research in Figure 1.
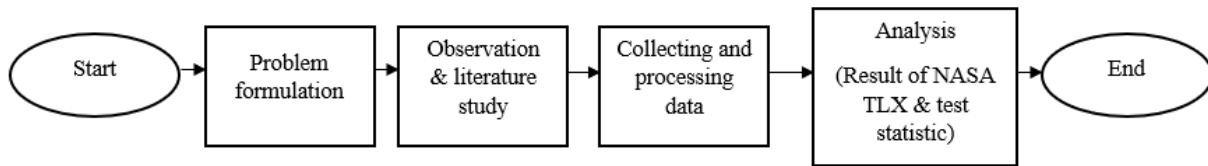
Figure 1. Flow Chart of Research

3. Result and discussion

Total of respondent is 13 that profile can be find in Table 2. Collecting and processing data using NASA TLX has the result in Table 3.

Table 2. Respondent Profile

Gender	Category			Total
	Age			
	21-30 year	31-40 year	41-50 year	
Female	4	6	1	11
Male	1	1	0	2
	Period the long term of working			
	$\leq$ 7 year	> 7 year		
Female	6	5		11
Male	1	1		2

Table 3. The Result of Interpretation Score

Category	Total	Average
MD	2025	155,8
PD	600	46,2
TD	3800	292,3
P	3860	296,9
EF	3360	258,5
FR	695	53,5
Average of WWL	73,5	
Interpretation of score	High	

   MD has average score 155,8 that described the staff need high mental and perceptual activities. Because the staff must do some of administration to educational in different type such as schedule, letter, etc. Besides that, must doing additional work which not only one and has different duty in at once time. PD has average score 46,2 that described the staff not doing activities that must moving. The staff just doing their tasks while sitting and not moving around. PD score has the lowest score. TD has average score 292,3 because time pressure to accomplish their task in fast time not only their main tasks but also their additional work. TD score is in second rank in six categories.

   P has the highest score (296,9) that described the staff not satisfied about the result. Because the P value is interpreted as good if it is close to a value of 0 or the average total is small. FR has 53,5 that described the staff not has feel insecure, desperate, offended, or disturb when doing their work. EF has average score 258,5 that described the staff must accomplish all the tasks in at once time. That needs the big effort.

The interpretation all six indicator is the staff not satisfied about the result (P indicator) but the the EF indicator that is taken out is high. Not only the EF but also the TD indicator has high score that described high time pressure.

The Mann Whitney Test [9] using two group of the period long term of work: (1) ≤ 7 years (2) > 7 years. The result is sig. 0,518 which bigger than probability score (0,05). Interpretation result is not having differences score between two group. Each group has the same mental workload in NASA TLX method.

Correlation and regression test have a goal to knowing about how big the relation between EF, TD, PD, FR, MD and P indicators. The correlation test has result in Table 4. The MD and FR has significant result because score significant <0,05. The score is -0,621 that indicates the bigger frustration make mental demand is smaller. Because of frustration so the needs to finding, remember, etc. is smaller.

Table 4 Correlations of EF, MD, PD, TD, FR and P Indicators

		P	**EF**	**MD**	**PD**	**TD**	**FR**
Pearson Correlation	P	1.000	-.393	-.092	.055	-.334	-.180
	EF Score	-.393	1.000	.210	-.196	-.360	-.144
	MD	-.092	.210	1.000	.328	-.293	-.621
	PD	.055	-.196	.328	1.000	-.117	-.407
	TD	-.334	-.360	-.293	-.117	1.000	.411
	FR_Level	-.180	-.144	-.621	-.407	.411	1.000
Sig. (1-tailed)	P	.	.092	.382	.429	.133	.278
	EF Score	.092	.	.245	.261	.114	.319
	MD	.382	.245	.	.137	.166	.012
	PD	.429	.261	.137	.	.352	.084
	TD	.133	.114	.166	.352	.	.081
	FR_Level	.278	.319	.012	.084	.081	.

Regression test has resulted a formulation that calculations from Table 5. The formulation is in equations (1).

$$Y = 658{,}317 - 0{,}676\,X1 - 0{,}176 X2 - 0{,}359 X3 - 0{,}431 X4 - 0{,}311 X5 \qquad (1)$$

The definition from equation: (1) Y = P (2) X1 = EF (3) X2 = MD (4) X3 = PD (5) X4 = TD (6) X5 = FR. Significant test to testing the equation . The significant test using t-test two sides that has hypothesis: (1) H_0 = Regression coefficients is not significant (2) H_1 = Regression coefficients is significant. The result of significant test is H_0 that means regression coefficient is not significant (not usable). This is verified the equation cannot be used to calculation or prediction the staff mental workload.

Table 5. Coefficients of Regression Significant Test

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	658.317	152.273		4.323	.003
	Effort Score	-.676	.350	-.603	-1.934	.094
	MD	-.176	.278	-.227	-.632	.547
	PD	-.359	.743	-.153	-.483	.644
	TD	-.431	.260	-.531	-1.662	.140
	FR Level	-.311	.475	-.252	-.656	.533

The result from NASA TLX is P indicator has the biggest score. The biggest score is not good because the good P indicator is having smallest score near to zero. Score E and TD indicator indicating employee need high time and effort to finish their task but they are not satisfied. Solutions of the problem and the result is dividing the task. The important elements in the functioning of social system of any kind and size is the distribution of tasks and division [10]. The distribution ensured orderly carried out and available resources are optimally used. The staff will be satisfied with the task distribution. has effective function [10] said the dissatisfaction can reduce motivation and the members cannot perform well.

4. Conclusion

Performance indicator has the highest score that means the staff not satisfy with their task has been done. They do the tasks with high effort and time pressure. Analysis with statistic test not producing significant formulas. The formulas can not usable to prediction the productivity staff. The other of analysis statistic test has result that two groups period the long term of working has not difference. Every staff has the same mental workload to doing their task. Beside that, the higher score of FR make score MD is smaller. The SOP for every staff must be clear. If there is more than one staff then should be clear division of task. Who does internal affairs and who does external affairs. Or who does main task and who does additional task.

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