The Mental Workload Analysis on Female Educators During Covid-19 Pandemic Using Nasa-TLX Method

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ABSTRACT

The fate of women workers during the pandemic is quite worrying. The role of women's triple burden in these times is getting heavier. Mental workload is a multidimensional construct that demands attention, performance, and skills of workers according to their work environment. This study aims to find out the mental burden felt by female workers during the pandemic. The subjects of this study were female educators at the University of Balikpapan. Five subjects feel a Very high mental burden on work activities during a pandemic, namely subjects 06, 14, 19, 23, and 25. There are 18 subjects who feel a high mental burden including subjects 3, 4, 5, 7, 8, 10, 12, 13, 16, 17, 18, 20, 21, 26, 28, 29, 30, and 31. Then, 3 subjects felt a moderate mental load, and 2 subjects felt a low mental load. If average, then the mental workload of female educators at the University of Balikpapan is 56.623 categorized as high**.** This study also seeks to investigate the correlation between the perceived workload of the subjects and several factors including age, marital status, education level, address, family size, income, COVID-19 survivor status, and family members who are COVID-19 survivors. The result showed that the number of family members is the only significant factor that influences the mental workload.

1. Introduction

In general, human activity can be divided into two main activity, there are physical (muscle) and mental (brain), although in some aspects both of them still have a close connection just like (Tarwaka, 2010) and (Kahneman, 2020) said. Every human has a different limitation activity of physical and mental. In other words, physical and mental working load experienced by human is also different (Moreno et. al., 2019; Bell et al., 2023). One mental activity can be heavy for somebody, while the other is not, or vice versa (Araújo et al., 2021).

Mental workload is multidimensional construct that needs attention, performance, and working skill according to the working environment (Young et al., 2015). It's simply defined as the difference between workload demand with capacity and maximum capability of the employee's mental workload (Hart & Staveland, 1988). The bigger is the difference of working load demand of the employees'

capability, the bigger overstress, fatigue, and the pressure felt. In contrast, the smaller is the working load compared to the employee's capability will have an impact on the boredom and decreased of interest (Putri et al., 2023).

The fate of the female employees in pandemic era is quite worrying (Bayar et al., 2022). Until the beginning of 2021, there are more than 2.5 millions of employees are working from home, where 902.091 of them are female employee (Pusat Data dan Informasi Ketenagakerjaan, 2021). The decrease of financial capacity also increase the female workload, it can be seen from its role as an educator, housewife, and family financial support (Sari & Fikri Zufar, 2021). It caused the increase of the potential and numbers of violence against women (Peterman, et. al., 2020; Sifat, 2020).

The role of triple burden today is being heavier (Hickey & Unwin, 2020; McLaren et al., 2020). When the school is applying online learning system, women come as a sudden educator for their children. When the company is applying work from home (WFH) system, the service role of the women to their husband and children is increasing. Besides, as an employee, they also have to do their job from the company.

This study aims to know the mental burden felt by the female employees in pandemic era. The subject of this study are the female educators in Balikpapan University. The educators taken as the subject because this is a non-essential sector according to the regulation of Balikpapan's mayor, and East Kalimantan's governor, in other words, not like the essential sectors such as industry and manufacture, the educators working system is following the WFH rules that in a week there are 3 days working at home and the other 3 days working at the office. Then, the educators' job is not really need physical activity like in manufacture industry.

In a study conducted by Nofri, Prastawa dan (Susanto, 2017), NASA-TLX methods used for measuring mental burden of industrial engineering student of Diponegoro university during their study period. The average of mental burden felt by 50 respondents of student are 80.04 (heavy) with dominant scale on the time demand. Other than finding out the mental burden of the student, this study was also trying to find the correlation between IP factor, the length of study, the entrance, and organization activity to the student mental burden. To sum up, every factors is not significantly affect the mental burden felt by industrial engineering student of Diponegoro university.

Meanwhile, Yasmin and Ariyanti (Yasmin & Ariyanti, 2019) were counting the mental burden on the employees of Maintenance BD-Check unit in a manufacture company using Full Time Equivalent method to know the mental burden received by the employees. The result showed the lack of skills and tools availability become the main cause of the employees' mental burden. In line with this study, (Wundavalli, Kumar, & Dutta 2019) made the analysis procedure of mental burden as the main variable in considering the amount of needs and the employee's skill capability.

The other study by (Kar & Hedge 2020) was using the output of NASA-TLX method to give tool design suggestion that could minimizing the physical and mental fatigue on carton industry employees. The result of measurement using NASA-TLX then continue with the survey using Nordic Body Map concluded that there was a musculoskeletal fatigue after work. As an improvement suggestion, a trolly design can be used to make the process of handling material and stacking carton easier.

Other than that, (Giyanti and Fachrizal 2021) was trying to measure the mental workload on elementary school teacher in Covid-19 pandemic time using NASA-TLX method. Some people think that mental workload in pandemic will decrease because of the application of online learning system. Interestingly, the teacher's mental workload in pandemic is quite high, especially to the practical teachers such as in Karawitan subject which needs full interaction learning between student and teacher.

The study by Giyanti dan Fachrizal quite interesting because it shows an unexpected result. Public tend to marginalize the mental burden felt by the employee. The change of working system, the excessive working target even though physically is not really tiring, but it's very impactful to the

mental. Though the mental and physical fatigue drain the same source of energy and affecting the decision making ability and employee's productivity (Tversky & Kahneman, 1986).

This study was conducted to know the general description of the female employee's working load in pandemic era. Without putting aside, the impact felt by the others, we believe that the female employee today bear a heavy burden. This study contributes to give a general description to what the female employee's feel, especially the educator in Balikpapan university, the place that the writer dedicated themselves. The method used was NASA-TLX. According to the previous study, this method can answer each of the aims of the study in measuring the mental workload felt by the employees.

2. Method

The respondents of this study were 31 educators in Balikpapan university with the total working time 8 hours for 5 days. Before the respondents were given the NASA-TLX questionnaire, they were first given a simple survey about gender, age, marital status, education, address, number of family members, monthly income, and Covid-19 survivor status and also the family's Covid-19 survivor status. This questionnaire is closed-ended, without disclosing any names or other important identities. Each subject is given the option to continue the questionnaire filling process or not if they encounter any unpleasant things.

All of those factors would be tested using Ordinary Regression and Crosstab analysis, to see what kind of factors that significantly affect the female employees' mental burden, the educator in Balikpapan university. The methodology used to gain the level of female educator mental workload in Balikpapan university by following the steps of NASA-TLX method by (Sandra G. dan Lowell, E. 1988) as shows from the flowchart Fig. 1.
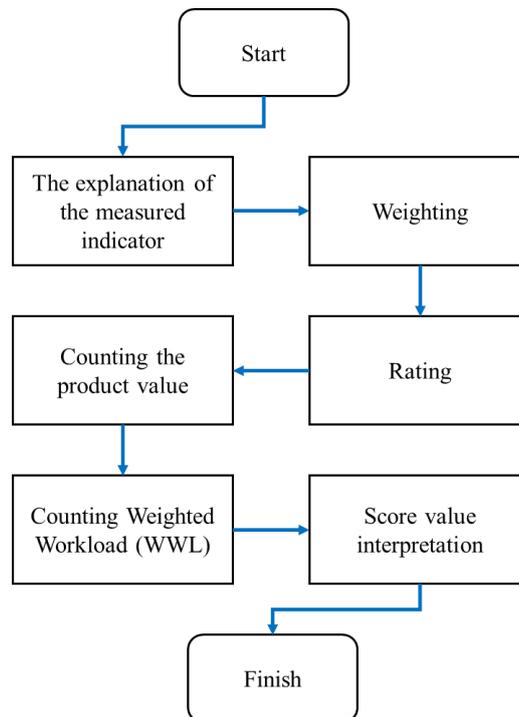

Fig. 1. The flow of mental workload measurement using NASA-TLX method

On NASA-TLX method, there are 6 components of metal burden will be measured, there are mental demand (MD), physical demand (PD), time demand (TD), Performance (P), effort (E), and Frustration rate (FR). As for the details of every component can be seen on Table 1.

Table 1. Details component of NASA-TLX

Component	Scale	Definition
Mental demand (MD)	Very low - Very high	Mental effort and perception used on particular activity.
Physical demand (PD)	Very low - Very high	Physical effort used on particular activity.
Time demand (TD)	Very low - Very high	Time level used on particular activity
Performance (P)	Poor - Excellent	Stress level and satisfaction related to working activity.
Effort (E)	Very low - Very high	Level of success or satisfaction in completing a job.
Frustation (FR)	Very low - Very high	The comparison between mental and physical needs with self-capability in particular activity.

On weighting process, the respondents would be asked to choose the dominant indicator that impact the mental workload. Every indicator compared in pairs (pairwise comparison). After the weighting process, every respondent would be asked to give a score to every indicator. The result of weighting then being multiplied with the score value that generates the product value. Every product's value was then accumulated to get Weighted Workload (WWL). Lastly, every scores would be interpreted into 5 categories like in Table 2.

Table 2. Score and Category of Mental Workload Based on NASA-TLX

Category	Score
0-9	Very low
10-29	Low
30-49	Moderate
50-79	High
80-100	Very high

3. Results and Discussion

The result of this study was divided in 3 parts. First, the demography data and the factors would be tested for its correlation to the female employees' mental workload. Second, the result data of scoring of every respondent to the NASA-TLX components. The third was the result of pairwise comparison.

3.1. Respondent's demography

This study was conducted with 31 female educator respondents. There were 22 respondents aged 18-35 years old, 7 respondents aged around 36-45 years old, and 2 others about 46-55 years old. From 33 of the total respondents, there were 10 respondents unmarried, 20 respondents married, and 1 other was a widow. And then there were 4 respondents with high school education, 13 respondents were bachelors, and 14 respondents were master degree. For the address, there were 3 respondents living in Balikpapan Kota district, 20 respondents in south Balikpapan district, 3 respondents in east Balikpapan district, and 5 others in north Balikpapan district. For the numbers of family members in a house, there was 1 respondent with the number of family members more than 5 person, 4 respondents with 2 family member, 24 respondents with 3-5 family members, and 2 others living alone. For the income factor, there were 14 respondents with the total income lower than Rp. 3,000,000, 8 respondents around Rp 3,000,000- Rp 5,000,000, 3 respondents were having around Rp 5,000,500 - Rp 7,500,000, 2 respondents around Rp 7,500,500 - Rp 10,000,000 and 1 others was having higher than Rp 20,000,000 income. For the Covid-19 survivor factor, there were 5 respondents as a Covid-19 survivor. And for the family's Covid-19 survivor factor, there were 13 respondents who had Covid-19 survivor family.

3.2. NASA-TLX Measurement

The workload measurement process using NASA-TLX method was done by collecting the respondents' scoring data of each NASA-TLX components. The result of each respondents scores can be seen on Table 3.

Table 3. Weighting result of the respondents

Respondent	MD	PD	TD	OP	EF	FR	Total
SBJC-01	1	3	5	4	2	0	15
SBJC-02	1	2	5	4	3	0	15
SBJC-03	2	3	3	4	0	3	15
SBJC-04	1	0	3	5	3	3	15
SBJC-05	3	3	1	2	2	4	15
SBJC-06	3	1	4	0	4	3	15
SBJC-07	2	3	5	4	0	1	15
SBJC-08	1	3	5	4	1	1	15
SBJC-09	2	2	4	2	3	2	15
SBJC-10	2	1	3	5	4	0	15
SBJC-11	5	4	1	1	1	3	15
SBJC-12	1	0	3	4	4	3	15
SBJC-13	2	2	4	2	3	2	15
SBJC-14	3	1	4	0	4	3	15
SBJC-15	4	3	2	1	0	5	15
SBJC-16	5	3	3	1	0	3	15
SBJC-17	1	3	4	1	3	3	15
SBJC-18	1	2	5	3	4	0	15
SBJC-19	3	2	4	2	1	3	15
SBJC-20	4	2	3	4	2	0	15
SBJC-21	1	1	4	5	1	3	15
SBJC-22	4	4	2	1	2	2	15
SBJC-23	3	1	5	4	0	2	15
SBJC-24	1	2	2	3	3	4	15
SBJC-25	1	3	0	5	2	4	15
SBJC-26	5	4	3	0	1	2	15
SBJC-27	3	3	2	1	1	5	15
SBJC-28	5	3	3	0	1	3	15
SBJC-29	2	1	5	3	4	0	15
SBJC-30	2	1	5	3	4	0	15
SBJC-31	5	0	2	4	2	2	15

After that, the respondents were asked to score the related statement of each NASA-TLX components to see which component that mostly impact the employee. The scoring result of every respondent can be seen on Table 4.

After gaining the pairwaise comparison weighting value and every respondent's score, the next step was finding the weighted workload (WWL) value by multiplying the weighting result with the respondents scoring and then sum up each of component's value. To see the final score of the respondent's workload (product value), so the WWL value was divided by 15. The recapitulation of the respondents' workload final score and the categorization can be seen on Table 5.

Based on the measurement of the female educator mental workload in Balikpapan university using NASA-TLX method, the result obtained as showed on Table 5. There were 5 subjects that felt the very high mental burden on working activity in times of pandemic, they were subjects 06, 14, 19, 23, and 25. And then, there were 18 subjects felt the high mental burden, they were 3, 4, 5, 7, 8, 10, 12, 13, 16, 17, 18, 20, 21, 26, 28, 29, 30, and 31. Then, there were 3 subjects felt moderate mental burden, and there were 2 subjects that felt low mental burden. If averaged, the female educator's employee mental workload in Balikpapan university was 56.623 or categorized as high.

Table 4. The scoring of NASA-TLX components of every respondent

Respondent	MD	PD	TD	OP	EF	FR
SBJC-01	20	40	30	10	10	10
SBJC-02	10	10	10	80	10	10
SBJC-03	50	50	50	50	50	60
SBJC-04	60	20	60	60	80	90
SBJC-05	60	80	80	80	80	80
SBJC-06	90	90	70	100	100	90
SBJC-07	50	50	40	60	30	70
SBJC-08	80	80	60	60	90	50
SBJC-09	50	50	50	50	50	50
SBJC-10	50	50	40	50	70	70
SBJC-11	50	50	50	60	50	20
SBJC-12	50	30	40	80	30	70
SBJC-13	50	50	50	50	50	50
SBJC-14	90	90	70	100	100	90
SBJC-15	80	30	30	30	60	30
SBJC-16	50	60	50	50	50	60
SBJC-17	50	60	50	50	50	60
SBJC-18	70	70	50	70	60	90
SBJC-19	90	90	90	90	90	80
SBJC-20	70	50	40	70	50	70
SBJC-21	60	60	60	60	60	60
SBJC-22	50	50	50	50	20	50
SBJC-23	90	80	80	80	90	100
SBJC-24	0	0	0	0	0	0
SBJC-25	100	90	80	80	80	80
SBJC-26	70	60	50	0	50	30
SBJC-27	0	100	100	0	0	0
SBJC-28	70	60	80	90	80	90
SBJC-29	50	50	50	50	50	50
SBJC-30	50	50	50	50	50	50
SBJC-31	70	50	70	60	60	50

3.3. The Demography Variable Correlation with The Repondents Workload

To know the correlation of the variable education, address, number of family member, monthly income, Covid-19 survivor experience and family's Covid-19 survivor experience with the female educator mental workload at the university of Balikpapan, so the Ordinary Regression and Crosstab analysis was conducted to know the correlation value of every significant variable to the mental workload. The correlation of every variables with the subject mental workload is shown on Table 6.

According to the ordinal regression analysis, the variable that affect significantly to the mental workload felt by the female educator at the university of Balikpapan was just the marital status. It is in line with the study (Sari & Fikri Zufar, 2021) stated that the stress level of the housewife was bigger in times of pandemic. To see the influence value of marital status variable to the mental workload of the female educator at the university of Balikpapan Crosstab test was conducted. From the test, value symetric measures obtained was 0.741, it means that the effect of marital status variable to the mental workload felt by the female educator at the university of Balikpapan was 74.1%.

Table 5. The recapitulation of final score on every respondent's workload

Respondent	MD	PD	TD	OP	EF	FR	WWL	rtWWL	Category
SBJC-01	20	120	150	40	20	0	350	23.3	Low
SBJC-02	10	20	50	320	30	0	430	28.7	Low
SBJC-03	100	150	150	200	0	180	780	52.0	High
SBJC-04	60	0	180	300	240	270	1050	70.0	High
SBJC-05	180	240	80	160	160	320	1140	76.0	High
SBJC-06	270	90	280	0	400	270	1310	87.3	Very high
SBJC-07	100	150	200	240	0	70	760	50.7	High
SBJC-08	80	240	300	240	90	50	1000	66.7	High
SBJC-09	100		200	100	150	100	650	43.3	Moderate
SBJC-10	100	50	120	250	280	0	800	53.3	High
SBJC-11	250	200	50	60	50	60	670	44.7	Moderate
SBJC-12	50	0	120	320	120	210	820	54.7	High
SBJC-13	100	100	200	100	150	100	750	50.0	High
SBJC-14	270	90	280	0	400	270	1310	87.3	Very high
SBJC-15	320	90	60	30	0	150	650	43.3	Moderate
SBJC-16	250	180	150	50	0	180	810	54.0	High
SBJC-17	50	180	200	50	150	180	810	54.0	High
SBJC-18	70	140	250	210	240	0	910	60.7	High
SBJC-19	270	180	360	180	90	240	1320	88.0	Very high
SBJC-20	280	100	120	280	100	0	880	58.7	High
SBJC-21	60	60	240	300	60	180	900	60.0	High
SBJC-22	200	200	100	50	40	100	690	46.0	Moderate
SBJC-23	270	80	400	320	0	200	1270	84.7	Very high
SBJC-24	0	0	0	0	0	0	0	0.0	Very low
SBJC-25	100	270	0	400	160	320	1250	8.3	Very high
SBJC-26	350	240	150	0	50	60	850	56.7	High
SBJC-27	0	300	200	0	0	0	500	33.3	Moderate
SBJC-28	350	180	240	0	80	270	1120	74.7	High
SBJC-29	100	50	250	150	200	0	750	50.0	High
SBJC-30	100	50	250	150	200	0	750	50.0	High
SBJC-31	350	0	140	240	120	100	950	63.3	High

Table 6. The correlation of every variable with the subject mental workload

No	Variable	Significance
1	Age	0.841
2	Marital status	0.026
3	Education	0.568
4	Address	0.581
5	Number of family	0.663
6	Income	0.806
7	Covid-19 survivor	0.849
8	Family of Covid-19 survivor	0.909

4. Conclusion

From the result of this study showed that the mental workload of the female employee at the university of Balikpapan in times of pandemic is majority high. The number of family members factor become the dominant factor that affect the female mental workload. In other words, the female triple burden in times of pandemic as a housewife, their children aducator, and as a financial support were also affecting when they were working.

Conflicts of Interest: The authors declare no conflict of interest.

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