

University Students' Mental Workload and Sleep Quality due to Online Lecture during Covid-19 Pandemic

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Abstract

Regarding covid-19 pandemic, the government makes a policy of social distancing for Indonesian society which also gives impact to learning methods in university. The learning method which previously conducted inside the class is dismissed for a while and it is replaced by an online learning method which is conducted at home. This drastic learning method change indeed will affect students' mental condition, moreover for students who were not used to conducting such online learning methods. There are complaints regarding online learning methods such as the increase of stress level and feeling sleepy when having online class. The aim of this study is to analyze mental students' workload and sleep quality during online class, so that a recommendation for improvement can be given. Questionnaire of NASA-TLX was used to measure mental workload and a questionnaire of PSQI (Pittsburgh Sleep Quality Index) was used to measure sleep quality. The respondents are 209 Industrial Engineering students of Mulawarman University. The result of the study shows that 58.8% of students experienced high metal workload; 26.3% of students experienced medium metal workload; 12.9% of students experienced very high metal workload; and the rest experienced low and very low mental workload. Meanwhile the majority of students had poor sleep quality. The recommendation to decrease the mental load and the poor sleep quality among students are to increase the readiness level of an organization to face an online lecture situation, maintain good work organization, and maintain good life habits.

Keywords

Mental Workload, Sleep Quality, and Online Lecture.

1. Introduction

Pandemi Covid-19 has become a disruptor in 21th century. This pandemic changed social order in many aspects, one of those is the Indonesian education system. Social distancing regulation given by the Indonesian government for Indonesian society also has an impact on the learning process in university. In-class learning methods should be dismissed temporarily and replaced by online learning methods. Online learning method is a learning method which uses technology such as smart phone, computer or laptop connected to the internet. The duration of this method was conducted equal to the in-class learning method approximately 1-2.5 hours for 1 course. In one day there will be 1-3 courses conducted. Students use smartphones, computers or laptops during this process, and it is conducted in each student's home.

Because there is a drastic change of learning method, some students feel that they are not ready and feel uncomfortable doing it. This is because the students were not used to or even never conducted online-class previously. Recent studies show that 68.66% of students experienced stress with moderate level during online class (Fathimahhayati et al. 2020). Some students even cannot receive the lesson well and feel sleepy during the class. According to Nilifda et al. (2014) in addition to mental workload, sleeping disorder was also frequently found in young adults, especially university students. Poor sleep quality will affect the concentration in studying, increase stress level, memory disturbance, up to academic achievement. Moreover it is because all courses are conducted online using electronic devices such as mobile phones or laptops. In one study among teenagers, using the computer intensively will lead to sleeping disorders and fatigue when they wake up (Punamäki et al. 2007). In addition, there is a correlation of the frequency of using mobile phones to mental health, such as depression and sleeping disorder (Thomé 2018). It happens because electronic devices such as mobile phones and computers expose electromagnetic rays which can lead to human health problems (Kumar et al. 2019).

Based on those problems, it is necessary to analyze students' mental workload and sleep quality when they conduct online lectures during covid-19 pandemic. This study was aimed to give recommendations to decrease several complaints that occur due to online lectures in terms of ergonomic point of view. Therefore both students and lecturers can implement the best and well structured strategy dealing with students' psychological condition during online-learning methods.

1.1 Objectives

Based on the background portrayed, there are several purposes of this study, those are:

- a. To find out how high mental workload experienced by students during online lecture
- b. To find out students' sleep quality during online lecture
- c. To give recommendation to reduce students' mental workload and to increase sleep quality during online lecture

2. Literature Review

The policy of the Indonesian government regarding online lecture is set in the beginning of 2020 when covid-19 pandemic occurred. This policy is still being implemented because the pandemic has not ended yet. In accordance with the Circular of the National Education Minister of Indonesia dated March 9, 2020, all educational institutions carry out online learning from home using electronic devices such as cell phones or laptops. This is intended to prevent the spread of the virus and maintain the safety and health of both students and educators at schools and universities (Kemendikbud 2020).

Online system adaptation has its own challenges because students are required to carry out the learning process from home. In fact, not all students are used to learning through Online. In addition, many teachers and lecturers still do not understand learning methods using internet technology or social media, especially in the countryside (Watnaya et al. 2020). Several universities have similar problems where they do not have the readiness and ability to utilize technology for the online learning method. Another problem is that the policy of temporarily closing educational institutions has an impact on students, especially those who live in areas with limited infrastructure and other supporting facilities, which can hinder the learning process.

Online learning has several advantages and disadvantages. The advantages of online learning include practicality and flexibility, a closer approach, a pleasant learning experience, more personal, time and cost saving, easy to document, environmentally friendly and supports physical distancing. Whereas the disadvantages of online learning are that it requires self-discipline and time management skills, loss of social interaction, not suitable for all topics, lack of practice-based learning, and technological dependence (Nurokmat 2021). In addition, online learning also possibly results in some negative impacts on students and teacher or lecturer, both in terms of physical, mental, emotional and social health (Halupa 2016). Research by Alawamleh et al. (2020) show that there is a lack of motivation, understanding of the material, a decrease in communication quality between students and their instructors and feelings of alienation caused by online classes.

Musculoskeletal complaints also occurred to students during online lectures. Based on research conducted by Fathimahhayati et al. (2020) on students conducting online lectures using cell phones, pain was found in the left and right shoulders (95%), upper neck (82.14%), and back (72.62%). As many as 86% of students also experienced visual fatigue, with the majority of symptoms of headache (71.55%), sore eyes (68%), and dry eyes (60.34%). Doing too much computer work can also result in musculoskeletal disorders in the shoulders, arms, hands (Edlink, 2012 as written in Bodin et al. 2019); and headaches (Lima and Coelho 2018). Eyes that continue to see VDT (Visual Display Terminal) can cause visual problems that have ocular symptoms: itchy, watery, dry, and sore eyes; visual symptoms: blurred eyes and systemic symptoms: headaches, shoulder pain, neck pain, and back pain (Shrestha et al. 2011).

Meanwhile, from a psychological perspective, the research findings of Irawan et al. (2020) regarding the psychological impact of online learning during the Covid-19 pandemic show that students are getting fed up with online learning after the first two weeks of learning from home. In addition, there is considerable anxiety in research subjects whose parents have low income, because they have to buy an internet package to be able to participate in online learning. There are also mood swings that occur due to too many assignments and are considered ineffective by students. This is similar to the research conducted by Fatimah and Mahampang (2020) regarding the effect of online learning on the mental health of students in Indonesia during the Covid-19 pandemic. The results showed that online lectures had a

positive and significant effect on mental health, age had a positive and insignificant effect on mental health, and gender had a negative and insignificant effect on mental health. The E-learning process which is carried out continuously is expected to reduce the mental health of students. Various symptoms of decline in students' mental health are known from the number of students who experience high levels of anxiety, have a high sense of worry. In addition, most students are also known to feel depressed due to the large number of assignments given by the teacher or lecturer which also causes them to lack time to rest.

Apart from the effect on mental health, the time spent by students in front of electronic screens due to online lectures also increases and has an impact on sleep health (Khare et al. 2021). Research by Khare et al. (2020) stated that 53.6% of students reported that screen time increased during the lockdown period, because besides being used for entertainment needs, cellphones and laptops were also used to conduct online lectures. As many as 56.6% of students reported having trouble sleeping during the lockdown period. The increasing use of cellphones and laptops has disrupted the regulation of the hormone melatonin, which plays a role in regulating sleeping hours, which can cause insomnia for device users. This can happen because electronic objects that shine brightly and directly on eyes can interfere with the work of the brain and damage the body's biological clock system. This light can trigger or stimulate the brain to wake up, delay the desire to sleep, and interfere with hormonal regulation. These phenomena can cause a person to experience insomnia (LPM Sinovia 2020). A study also shows that when students are not at school, for example, on vacation or studying at home, they are physically less active and have longer time to use cell phones, and feel bored due to using gadgets, and even have levels of heavy and light stress (Brazendale et al. 2017).

Considering the human factor, when students do online lecturing activities they carry out a cognitive process in processing information. This human cognitive stimulates human performance to work optimally. This cognitive function can be used as a reference to ensure the safety of the work environment with existing workloads (Kim 2016, Mardhia et al. 2020). By conducting research on the analysis of mental workload and sleep quality of students during online lectures during the Covid-19 pandemic, it is hoped that students and teachers/lecturers can apply the best and neatly structured strategies in organizing students' psychology and managing rest periods during online learning so that the negative effects of online lectures can be reduced.

3. Methods

This study is categorized as descriptive research. Descriptive research is one type of research in which the purpose is to present a complete description of the social setting or be intended for exploration and clarification of a social phenomenon or reality, by describing a number of variables related to the problem and the unit under the study among the phenomena being tested.

Measurement of mental workload was carried out using the NASA-TLX (National Aeronautical and Space Administration Task Load Index) questionnaire developed by Hart and Staveland (1988). Meanwhile the measurement of sleep quality was carried out using the PSQI (Pittsburgh Sleep Quality Index) questionnaire developed by Buysse et al. (1989). The NASA LX questionnaire measures mental workload through 6 (six) indicators, namely mental demand (MD), physical demand (PD), temporal demand (TD), own performance (OP), effort (EF), and frustration (FR). In workload category, the workload score category is divided into five categories, namely very low with a score scale of 0 to 20, low with a score scale of 21 to 40, moderate with a score scale of 41 to 60, high with a score scale of 61 to 80, and very high with a score scale of 81 to 100. Meanwhile the PSQI questionnaire consists of 19 questions consisting of 7 components, namely sleep quality, sleep latency, sleep duration, sleep efficiency, sleeping disorder, the use of sleeping pills and activity dysfunction during the day. From these 7 components, the total score will be from 0 to 21. If the total score is less than 5, the respondent is in the good category (Good sleep quality) and if it is more than 5 then it is in the bad category (Poor sleep quality).

4. Data Collection

Respondents in this study were 209 students of Industrial Engineering Department, Engineering Faculty, Mulawarman University, consisting of 2017, 2018, 2019, 2020 batches. The four batches were selected because they were active students who had been undergoing online lectures during the covid-19 pandemic for more than 9 months, since March 2020. The age of respondents that participated in this research is between 17 – 24 years old, consisting 121 males and 88 females.

In this study, the NASA TLX and PSQI questionnaires were written in Indonesian and then distributed to respondents online via google form. To avoid misunderstanding in interpreting the questionnaire, during filling out the questionnaire, respondents were assisted through a ZOOM meeting. In addition, to support the results of the study, interviews were also conducted with several respondents regarding mental workload and sleep quality experienced throughout the period of online lectures. The data collection was carried out for approximately one month, from November 2020 to December 2020. The distribution of the number of students per batch is shown in Table 1.

Table 1. Number of students per batch

| Batch | Number of Students |
|--------------|--------------------|
| 2017 | 51 |
| 2018 | 49 |
| 2019 | 53 |
| 2020 | 56 |
| Total | 209 |

5. Results and Discussion

5.1 Numerical Results

The results of measuring mental workload based on six indicators are shown in Table 2.

Table 2. Indicators of mental workload

| Batches | MD | PD | TD | OP | EF | FR |
|----------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 2017 | 233.3 | 65.3 | 157.6 | 128.2 | 162.5 | 219.6 |
| 2018 | 237.0 | 67.0 | 192.0 | 142.5 | 194.4 | 208.5 |
| 2019 | 219.9 | 82.0 | 177.3 | 135.8 | 213.6 | 213.8 |
| 2020 | 223.9 | 69.3 | 146.5 | 125.2 | 182.9 | 201.1 |
| Total | 914.1 | 283.6 | 673.4 | 531.7 | 753.4 | 843.0 |
| Average | 228.5 | 70.9 | 168.4 | 132.9 | 188.4 | 210.8 |

Table 2 shows that the Frustration and Mental Demand components are the highest components compared to other components. Based on the results of interviews with respondents, the cause of the high components of Frustration and Mental Demand is due to a lot of assignments, constantly changing class schedules, there was a difference in how to study online so that respondents have to adjust quickly. In addition, respondents found it was difficult to understand course material from online explanations and had difficulty working on group assignments because they did not meet in person. Some students also did not have adequate devices so that it was difficult to be able to take online lectures, especially students who live in remote areas and have unstable internet connection who find it very difficult to take this course. A bad internet connection was indeed one of the reasons for not delivering the material well, either from the lecturers or for the students. Intermittent sounds can increase emotional levels, increasing frustration levels. The distribution of mental workload scores for each batch can be seen in Table 3.

Table 3. Distribution of mental workload levels for each batch

| Category of Mental Workload | Batch 2017 (number of students) | Batch 2018 (number of students) | Batch 2020 (number of students) | Batch 2020 (number of students) | Total number of students |
|-----------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|--------------------------|
| Very low | 1 | 0 | 0 | 0 | 1 |
| Low | 2 | 0 | 0 | 1 | 3 |
| Medium | 15 | 11 | 10 | 19 | 55 |
| High | 29 | 31 | 33 | 30 | 123 |
| Very High | 4 | 7 | 10 | 6 | 27 |
| Total | 51 | 49 | 53 | 56 | 209 |

The total score and the average score of the sleep quality of students using the PSQI method can be seen in Table 4 and Table 5.

Table 4. PSQI scores for each batch

| Score PSQI | Number of Students | | | | Total | % |
|------------|--------------------|------------|------------|------------|-------|--------------|
| | Batch 2017 | Batch 2018 | Batch 2019 | Batch 2020 | | |
| 7 | 0 | 3 | 3 | 1 | 7 | 3,3% |
| 8 | 7 | 4 | 5 | 6 | 22 | 10,5% |
| 9 | 7 | 5 | 7 | 9 | 28 | 13,4% |
| 10 | 1 | 7 | 7 | 8 | 23 | 11,0% |
| 11 | 13 | 10 | 6 | 5 | 34 | 16,3% |
| 12 | 7 | 7 | 7 | 9 | 30 | 14,4% |
| 13 | 7 | 4 | 8 | 6 | 25 | 12,0% |
| 14 | 4 | 3 | 5 | 4 | 16 | 7,7% |
| 15 | 2 | 6 | 4 | 3 | 15 | 7,2% |
| 16 | 1 | 0 | 0 | 4 | 5 | 2,4% |
| 17 | 2 | 0 | 0 | 0 | 2 | 1,0% |
| 18 | 0 | 0 | 0 | 0 | 0 | 0,0% |
| 19 | 0 | 0 | 1 | 1 | 2 | 1,0% |

Table 5. Average PSQI scores for each batch

| Batch | Average |
|-------|---------|
| 2017 | 11 |
| 2018 | 11 |
| 2019 | 11 |
| 2020 | 11 |

From Table 5, it can be seen that all batches have an average score of 11. It is also known in Table 4 that the smallest value is seven and the highest value is 19. There is no respondent score less than five. This shows that all respondents are categorized as poor sleep quality because the total PSQI score is more than five.

5.2 Graphical Results

Based on the results of data processing, it was found that 58.6% of students of the Industrial Engineering Department at Mulawarman University experienced a high mental workload, 26.3% of students experienced moderate mental workload, 12.9% of students experienced a very high mental workload, and the rest experienced a low mental workload and very low mental workload. The results of the average measurement of mental workload for each batch are shown in Figure 1.

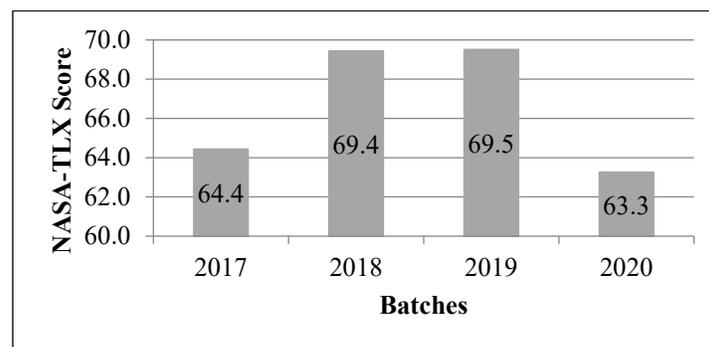


Figure 1. Level of mental workload

In Figure 1, it can be seen that the 2020 batch has the lowest mental workload score compared to other groups. This is because the batch of 2020 is still classified as new students who are still fresh and enthusiastic about carrying out lectures. However, the demands of adapting to the campus life and the lack of communication among classmates and lecturers are obstacles in the 2020 batch. The considerable credit load, which was an average of 20 credits (1 credit equals to 50 minutes of learning), can cause their mental burden to be in high category, especially if lectures are conducted online where they have not ever done it at all.

Furthermore, the 2017 batch also has a low mental workload score compared to 2018 and 2019 batches. This was because the 2017 batch is in its final year, which is dominated by students whose credit load was not too much, less than 15 credits. Meanwhile, 2018 and 2019 batches were dominated by students whose credits were 19 to 24. The large number of credit loads was followed by the number of course schedules and assignments in each course; moreover, there were 3 practicums that add to the mental workload of students in 2018 and 2019 batch so that the majority of the mental workload in this batch is in high category.

As 94.7% of respondents felt that the mental workload on online lectures was higher than offline lectures because they could not maximally catch course material and had difficulty in communicating and collaborating between friends and lecturers. Moreover, respondents still find that it was difficult to adapt to online lectures so that it affected their mental workload, especially in the Mental Demand and Frustration components. Indonesians do tend to do direct learning compared to e-Learning, because Indonesian characters prefer to communicate directly compared to writing or learning virtually (Basuki 2007).

Meanwhile, in the students' sleep quality measurement using the PSQI method, it was found that all respondents had poor sleep quality because the total score was more than five. The respondents on the credit load of 19-21 credits and 22-24 credits have a high total score, an average of 11 to 14. According to Nilifda et.al. (2014) apart from mental workload, sleep disorders are often found among young adults, especially university students. With poor sleep quality, it can result in reduced learning concentration, increased stress, memory problems, and decreased academic achievement. The cause of reduced sleep quality is due to several things such as complex lecture schedules. The decrease in the quality of sleep in students results in a decrease in learning concentration and health problems. This can lead to not achieving optimal academic achievement because the learning process is disrupted.

Based on the survey results, 67% of students said that online lectures affected the quality of their sleep. Some of them think that their sleeping duration depends on the number of lecture assignments and the level of difficulty, when there are lots of assignments in a short period of time is also affected because they have to complete them all. Online lectures trigger more intense use of electronic devices such as smartphones or laptops so that respondents are exposed to a lot of radiation from the screen throughout the day because they have to do learning activities and do assignments. The habit of being exposed to a smartphone or laptop screen also affected sleeping hours. The study conducted by Khan et al. (2016) found that students who just take a break to consume entertainment or interact via electronic devices more than 4 times per week have a greater tendency to experience sleep latency of more than 1 hour compared to those who use the device less than 3 times. Exposure to computer screens with LED lighting at night has also been shown to disrupt normal sleep cycles and suppress melatonin. This is one of the dominant factors in the pandemic era regarding the quality of sleep of the respondents. Physical activity is also very lacking where you can usually walk or do activities on campus, but when studying online, physical activity decreases dramatically because you are only at home and busy with college assignments.

5.3 Proposed Improvements

Mental load is defined as a person's cognitive ability to a certain workload, when a person feels that the workload given exceeds the cognitive capacity, it is considered that the mental load experienced is high. Based on the results of the study, it was found that the mental workload of students during online lectures was at a high level, as well as poor sleep quality of students. One possible effort to reduce mental workload and sleepiness during e-learning is to increase the readiness level of an organization to face an online lecture situation (Borotis and Poulymenakou 2004). Kaur and Abas (2004) suggest that policy makers must participate more actively in the implementation of online lecture programs so that it will create a learning environment supported by information technology. Availability of equipment plays an important role because online lectures require appropriate equipment, and most importantly a stable internet connection. Several studies have discussed the use of several platforms used to conduct online learning during the Covid-19 pandemic. The applications used were Zoom, Google Classroom, Google Meet, and Whatsapp are

considered to be effective, but there are obstacles in the form of an inadequate internet connection problem. Student readiness also needs to be considered because this online lecture requires students to be able to control their own learning (Hartley and Bendixen 2001). Meanwhile, Sadik (2007) considers that there are three factors that need to be considered to support online lecture readiness, namely competence, experience and attitude of lecturers. Knowledge, skills and experience are very important in implementing online lectures.

To improve students' poor sleep quality, it is recommended to have a healthier sleep pattern, such as sleeping at least 7 to 8 hours to fulfill the need of sleeping, maintaining a healthy diet and avoiding foods that contain alcohol and caffeine as well as not smoking, caffeine found in coffee or tea has been shown to cause disturbed sleep patterns. Cigarettes can also be a stimulant for human nerve centers that make it difficult to sleep. Avoid smoking and alcoholic beverages two hours before bed. Adequate exercise is also a solution for better sleep quality, especially when respondents are accustomed to studying online, so they don't move and exercise. Exercise can help promote restful sleep at night. However, avoid exercising near bedtime, because it will make it difficult for the body to fall asleep (Cana et al. 2020).

5.4 Validation

High mental workload among students of the Industrial Engineering Study Program at Mulawarman University is in line with the study of Widyanti et al. (2020) where the mental workload of Bandung Institute of Technology students is also higher when doing online lectures compared to offline lectures. To overcome this, Widyanti et al. (2020) proposes to implement blended learning, so that lecturers are not monotonous in carrying out online learning. Lecturers must be able to make the learning process more interactive, for example by utilizing other multimedia technologies.

Research by Khare et al. (2020) also stated that during the lockdown period, many students experienced sleep problems. Khare et al. (2020) suggest that authorities and decision makers should always consider factors such as unavailability of smartphones or computers by students, poor networks, connectivity in remote areas, and poor electricity supply. Excess screen time is also associated with prolonged sitting time, posture and screen exposure which can have a detrimental effect on the sleep health of an individual.

6. Conclusion

Based on this study, it can be concluded that the average mental workload of students while doing online lectures during the Covid-19 pandemic was in the high category. Meanwhile, the sleep quality of students was categorized as poor sleep quality. The recommendations to reduce students' mental workload and improve sleep quality are to increase the level of readiness of an organization to face an online lecture situation in terms of equipment, internet networks, as well as from the side of the lecturers and students themselves. Future research can examine differences in mental workload in more specific activities such as practicum or special courses

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Biographies

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Risky is a student of the Industrial Engineering Study Program at Mulawarman University. He started his basic education at Elementary School (SD) Negeri 013 Palaran in 2005. In 2011 he continued his education at Middle School (SMP) Negeri 14 Palaran. In 2014 he continued his education at State Senior High School (SMA) 10 Samarinda. In 2018 he continued his education at Mulawarman University. While studying at the University, he was active in student organization activities, such as the Industrial Engineering Student Association (HMTI), the Student Legislative Organization (BEM), and the Kalimantan Zone Indonesian Industrial Engineering Student Association (IMTII Kalimantan Zone). He has also been an assistant to the Industrial Practicum I and Industrial Statistics while studying at the Industrial Engineering Department, Faculty of Engineering, Mulawarman University.

Suwardi Gunawan is a lecturer in the Industrial Engineering Department, Mulawarman University, Indonesia. He teaches the courses of management strategy, product design and facility design. In addition to teaching at industrial engineering of Mulawarman University he also teaches courses of ergonomics and work faal in public health faculty of Mulawarman University. The social works ever conducted were as a keynote speaker in small industrial training, webinar of millennial generation role in online creative industry. He has published journal and conference papers in the field of ergonomic and occupational health and safety.