

The Effect of Mental Workload, Stress, and Learning Motivation on Student Learning Achievement during Online Courses

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Abstract

Educational institutions have fully implemented online learning during the 2020 school year due to the COVID-19 pandemic. The significant change in the learning model drives students to make some adjustments. This situation needs reviewing to see the indication of the effects that may arise as a result of online learning. This research aims to measure those possible indications, such as mental workload, stress level, and learning motivation and their effects on learning achievements. For this research, the focus is on students of a university in Surabaya. Based on an initial questionnaire distributed, 50% of the respondents stated that the delivery of material through online learning is considered less effective and that 66% of the respondents stated that online learning affects their stress level. This measurement seeks to give an overview that will help educational institutions better develop online learning methods for future terms. The methods used to measure these indications are the DRAWS, SLSI, and MSLQ methods. The result shows that the motivational variable and academic stress significantly affects the students' academic performance, and that mental workload did not affect the academic performance significantly.

Keywords:

Online Course, DRAWS, SLSI, MSLQ

I. Introduction

Technological advancements have transformed many aspects of human lives, and one of those aspects is regarding education. This development is utilized in many segments of the educational institutions such as at the university level. Recently many universities have implemented a blended learning method. Blended learning is a learning method that combines the traditional approach of face-to-face in-class learning and online learning to achieve the learning objectives (Akkoyunlu and Soylyu, 2006). During the 2019/2020 school year many universities, including university under study, implements a new learning system. This system carries out a full online teaching and learning experience throughout the semester. This condition happens due to the escalation of the COVID-19 virus spread in Indonesia, which caused all of the learning processes conducted online to avoid face-to-face meetings in classrooms. However, during the implementation of this online learning, some hurdles were found and felt by the students. One of them is the effectiveness of the learning materials delivery. According to the survey conducted on 38 students, 50% of the students stated that the delivery of the materials through an online class is less effective and the rest stated otherwise. Online learning also shows other indications of the effect on online learning that are related to students, which is the stress level. The survey result shows that about 66% of the respondents stated that online learning causes an increase in the stress level felt by students, and 34% chose to say differently. From that, it can be seen that the stress level felt from online learning was experienced by the majority of the students. Based on the indications that arise due to the changes from a blended learning system to a full online learning system, this research, therefore, seeks to measure the mental workload, stress level, and the learning motivation level from university students. An analysis regarding the effect of the three variables on the academic performance of the students during the online learning period will also be presented. The result from this research is expected to give some insight and information to institutions, as well as to become a consideration for improvement recommendation for the execution of online learning system, especially on the most effective media to deliver the study materials.

II. Research Methodology

The data used for this research was obtained through a survey using a questionnaire. The survey was conducted to assess the mental workload, stress level, and students' learning motivation during the online learning experience. Different methods are selected to measure the three variables used in this research. The methods are the Defence Research Agency Workload Scale (DRAWS) method which is used to understand the mental workload of a student. Whereas Stress level related to academic matters is measured using The Student-life Stress Inventory (SLSI). Then, the students' learning motivation is measured using the Motivated Strategies for Learning Questionnaire (MSLQ) method.

Table 1. Research Variables

Variable	Name of Variable	Scale	Description
Y	Learning Achievement	Ordinal	0 = Decrease 1 = Same 2 = Increase
X1	Mental Workload	Ordinal	0 = Underload 1 = Optimal Load 2 = Overload
X2	Academic Stress	Ordinal	0 = Low Stress 1 = Moderate Stress 2 = High Stress
X3	Learning Motivation	Ordinal	0 = Low Motivation 1 = Moderate Motivation 2 = High Motivation

Table 1 shows the dependent and independent variables used in this research. The dependent variable in this research is the academic performance of the students that are marked by the cumulative grade point average (CGPA) before conducting the online learning and after the online learning period. The independent variables are the mental workload, academic stress, and learning motivation. The data processing method is started by analyzing the mental workload, stress level, and learning motivation condition using the descriptive statistical analysis. Next, inferential statistical analysis is conducted using the ordinal logistic regression to understand which variable affects the student's academic performance. Before processing the data using the ordinal logistic regression method, a multicollinearity test is done beforehand due to more than one variable of the independent variable are present in this research. If the multicollinearity test shows that there is no intercorrelation between the variables, data processing can be continued using the ordinal logistic regression method.

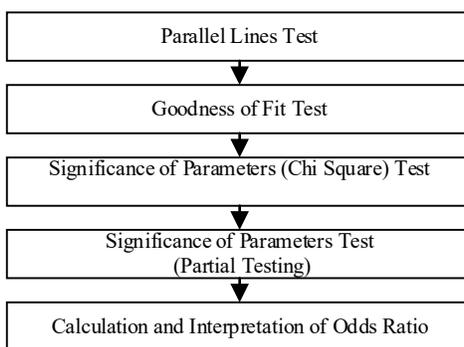


Figure 1. Ordinal logistic regression analysis steps

Figure 1 shows the steps during the data processing using ordinal logistic regression analysis. In this research, the ordinal logistic regression analysis method is used to understand the effect of mental workload, stress level, and learning motivation on the student's academic performance.

III. Data Processing and Interpretation

In this research, the survey was conducted using an online questionnaire to 357 students in the faculty of engineering of university under study (Univ I). Based on the data obtained from the questionnaire, 78.43% of the respondents experiences an increase in their academic performance, 14.01% experiences a decrease, and 7.56% has the same academic performance compared to the previous semester. From the number of credits that was taken in that 2019/2020 school year in the even semester, 1.96% of students are taking <18 credits, 61.34% took 18-20 credits, and the remaining 36.69% took more than 20 credits in that semester. Based on the online learning media that are used by the lecturers to deliver the materials, 85.15% of the respondents mentioned that they use Zoom, 5.32% use google classroom platform, 3.92% use ShareITS, 3.08% use WhatsApp, 1.40% use myITS classroom, and 1.12% use Google Meet.

This research uses the DRAWS method to measure the mental workload of the students. According to the score grouping, this method is divided into three categories of mental workload conditions, which are underload (<40%), optimal load (40 – <60%) and overload (>60%). The calculation using the DRAWS method are obtained as follows and shown in Figure 2.

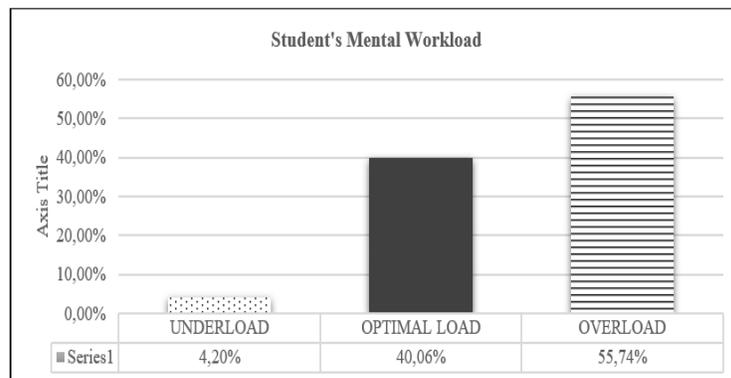


Figure 2. The overall mental workload of faculty students

Figure 2 shows that the mental workload of the students are mostly on the overload condition, showing a value of 55.74%, followed by optimal load with 40.06% and the remaining 4.20% that falls into the underload category.

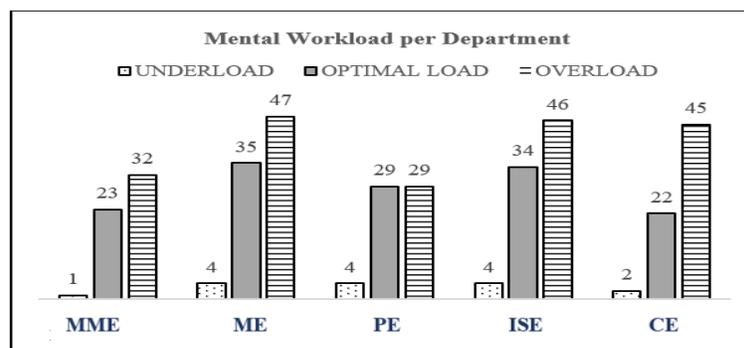


Figure 3. The mental workload condition of each department

After the mental workload status of the students has been reviewed, the review is also done based on each department in that faculty. According to Figure 3, there are four out of five departments that shows a majority of their students that falls into the overload mental workload, which are M&ME department, ME department, ISE department, and CE department. However, the number of students who are having the overload and optimal mental workload are equal.

Table 2. Average score based on each DRAWS dimension

Department	ID	CD	OD	TP
MME	11,91	17,67	15,92	17,88
ME	12,18	15,18	15,85	17,84
PE	10,78	14,07	15,60	18,35
ISE	11,71	15,40	16,14	17,88
CE	12,39	16,80	16,43	19,41
Overall Average	11,82	15,74	16,00	18,25

The DRAWS method consists of four dimensions: input demand, central demand, output demand, and time pressure. This also happens when it was analyzed based on each department, where it shows that time pressure dimension has the highest average score.

The calculation on the academic stress using the SLSI instrument shows the following result.

Table 3. General description of respondent's academic stress

Number of Participants	Average Total Score	Lowest Score	Highest Score	Standard Deviation
357	53,14	28,08	76,91	8,04

Based on Table 3, it can be seen that the average total score from the respondent is 53.14, with the lowest score of 28.08 and the highest score of 76.91. The standard deviation is equals to 8.04. Next, the academic stress scores are grouped into categories, which are shown in the Table 4.

Table 4. Distribution of academic stress scores

Stress Categories	Score Range	Frequency	Percentage
<i>Mild Stress</i>	$X < 45,10$	66	18,49%
<i>Moderate Stress</i>	$45,10 \leq X \leq 61,18$	240	67,23%
<i>Severe Stress</i>	$X > 61,18$	51	14,29%

Based on Table 4, the academic stress category is divided into three, namely low stress (score < 45.10), moderate stress ($45.10 \leq \text{score} \leq 61.18$), and high stress (score > 61.18). From each of these categories, the results showed that the majority of students experienced academic stress in the medium category, namely 67.23% of student respondents, while the remaining 18.49% experienced low stress and 14.29% experienced high stress. Moreover, Figure 4 shows that most of the students in each department faculty experiences stress on the moderate level during the online learning period.

Table 5 shows the average score of the stress based on dimension. In the type of stressor category, the dimension that has both the highest average dimension score and highest average per-item score is the Change dimension, with the score of 6.42 and 3.21, respectively. Meanwhile, in the reaction to the stressor category, the dimension that has both the highest average dimension score and highest average per-item score is the Physiological dimension, with the score of 5.15 and 2.57, respectively.

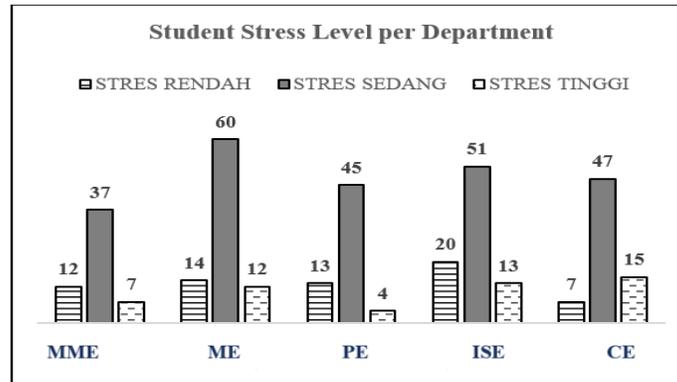


Figure 4. Stress level conditions per department

Table 5 Average score of academic stress level by dimension

Categories	Dimension	Average of Dimension	Average each Statement Item
Type of Stressor	Frustrations	7,43	2,48
	Conflicts	4,75	2,37
	Pressures	7,88	2,63
	Changes	6,42	3,21
	Self-imposed	8,22	2,74
Reactions to Stressor	Physiological	5,15	2,57
	Emotional	4,63	2,31
	Behavioral	4,02	2,01
	Cognitive Appraisal	4,66	2,33

The calculation using the MSLQ instrument to measure the learning motivation level of the students are shown Table 6.

Table 6. Overview of respondents' motivation to learn

Number of Participants	Average Total Score	Lowest Score	Highest Score	Standard Deviation
357	45,31	26,44	63,72	5,86

Based on Table 6, the average total score from the respondents is 45.31, with the lowest score of 26.44 and the highest score of 63.72. The standard deviation is equals to 5.86. Furthermore, the categories of learning motivation are divided into three, low motivation, moderate motivation, and high motivation. From each of these categories, the results showed that the majority of students had learning motivation in the medium category, namely 69.75% of student respondents, while the remaining 12.89% had low motivation and 17.37% had high motivation.

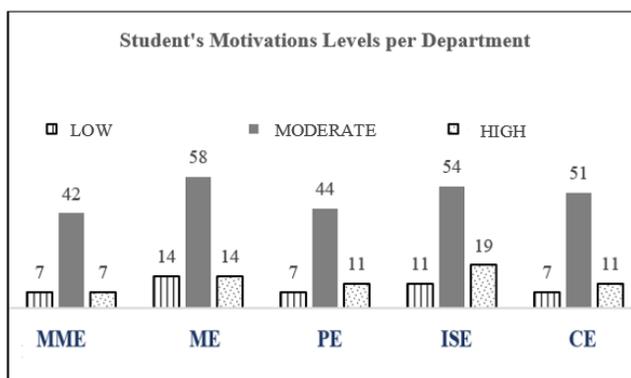


Figure 5. The student' motivation level of each department

Figure 5 reveals the student's motivation level for each department. As can be seen from the figure, most of the students from each of department have the moderate motivation level during the online learning period.

Table 7. Score - average level of learning motivation based on dimensions

Aspects	Dimension	Average of Each Dimension	Average of each Statement Item
<i>Value Components</i>	<i>Intrinsic goal orientation</i>	8,89	2,96
	<i>Extrinsic goal orientation</i>	6,23	3,12
	<i>Task value</i>	9,21	3,07
<i>Expectancy Components</i>	<i>Control of learning beliefs</i>	9,46	3,15
	<i>Self-efficacy for learning and performance</i>	5,78	2,89
<i>Affective Components</i>	<i>Test anxiety</i>	5,73	2,87

Next, the instrument in this section measures the learning motivation that consists of three aspects: value components, expectancy components, and affective components. Table 7 shows that in the value components aspect, the dimension that has the highest average dimension score and the highest score per item is the extrinsic goal orientation dimension, with the values of 6.23 and 3.12, respectively. The table also shows the scores for the expectancy components aspect. It shows that the control of learning beliefs dimension has the highest average dimension score and the highest score per item, with the values of 9.46 and 3.15, respectively. The last aspect, affective components, only has one dimension, which is the test anxiety. The average dimension score and the score per item for this dimension are 5.73 and 2.87, respectively.

IV. Result and Analysis

The result from mental workload calculation shows an indication that the changes in learning model to a full online learning model requires a higher degree of attention. The mental workload is affected by the attention that is required while performing cognitive tasks. According to the calculation result and the available/existing theory, the habitual change from the blended learning model to the full online learning model requires students to adapt with new habits and procedures, therefore, making the learning activity that is classified as an automated activity becomes an activity that needs adjustment and requires a higher attention span/degree.

The mental workload condition was also analyzed based on the dimensions, and it was found that the time pressure dimension has a higher score compared to the other dimensions. This dimension measures the time limit of finishing a task and the intensity of the task that was given by the lecturers, therefore this indicates that time limit and task intensity gives a high mental workload to the students. This happens because, during the online learning system,

lecturers give additional tasks to the students with the hope to enhance the student's understanding of the materials delivered. According to the number of credits that are taken by the students for this semester, the majority of students are taking 18-20 credits. Seeing that condition, if the task intensity given to the students is high in all subjects, it can cause multi-assignment in the same time which sometimes also has a time pressure, affecting the mental workload. Mental workload caused by multi-assignments is not only triggered by the amount of work that needs to be completed, but also the attention span that needs to be given because time-sharing and divided attention exist for each task.

The result also reveals that most of the student's academic stress falls in the moderate level category. It implies that the majority of the students can control their academic stress during the online learning period. The cause of academic stress on students can be divided into two factors: internal and external factors. Online learning means that students can learn from their own home, which makes external factors, such as family, may affect the stress level. Based on previous research, there is a relationship between the role of parents and student's stress levels (Heiman and Karim, 2005; Sutjiato, et.al., 2015).

The calculation of students' learning motivation level shows that the students have a moderate learning motivation level. This result indicates that there is evident the presence of ability and desire to learn during the online learning process. However, this self-regulated learning cannot be maximally facilitated through an online learning system. This is because this method of learning is highly dependent on the availability of an internet connection. Internet connection requires adequate infrastructure and is quite costly. Communications through the internet has some obstacles, such as slow internet connection, which hinders the process of optimally facilitating the students' needs (Wicaksono, 2012; Pratiwi, 2020).

From the data processing, it can be seen that academic stress and learning motivation are independent variables that significantly affect academic performance, which in this research is the dependent variable. The calculation result from the learning motivation variable, which shows the same result as previous research (Wijaya, 2018; Ramdhan and Harsono, 2015) shows that students' learning motivation positively affects the academic performance of the students. Additionally, the analysis of mental workload level felt by students is then used to determine which online media is most effective in delivering study materials for the students. Selection of the most effective media is needed because it could affect student ability in understanding the course material, learning motivation, mental workload, and study performance.

This research also investigates the online learning media that suitable for the students during online learning courses in regard to mental workload. Initial result reveals that the audio-visual media is the most preferable option for online learning. The audio-visual media learning model has an advantage, where the video can be replayed by students, therefore making it more flexible for the lecturers (Didin, et.al., 2005). This is in line with by previous research conducted by Luhulima, et al. (2016). Therefore, to achieve the learning objectives, one of the innovations that can be developed is the use of good design videos in the delivery of learning materials.

V. Conclusions and Suggestions

The calculation of mental workload using the DRAWS method shows that the majority of the students experiences the overload mental workload. However, when it is observed based on the dimensions, the time pressure dimension has the highest average score compared to the other three dimensions. The calculation of academic stress using the SLSI instrument shows that the majority of the students experiences moderate stress level. When it is observed according to the type of stressors, the 'Change' dimension has the highest average score. In the reaction to stressors category, the 'Physiological' dimension has the highest average score. The calculation of students' learning motivation using the MSLG instrument shows that the majority of the students have a moderate motivation level. When the motivation level was observed from the value components aspect, the extrinsic goal orientation has the highest average score, the expectancy components aspect has the highest average score for control of learning beliefs dimension, and the affective components aspects has the lowest average score compared to the previous two dimensions. By using ordinal logistic regression analysis, it was obtained that academic stress and learning motivation significantly affects the academic performance, yet, mental workload does not affect the academic performance significantly. Moreover, with the mental workload approach, the result shows the most effective media for delivering materials is the audio-visual media. In future research, the respondents' sample can be expanded, to different faculties in the university or

even different universities. Future research can take into consideration the other factors that might affect the academic performance dependent variable that are not encompassed in this research.

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Biography / Biographies

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Faricha Khairunnafi was an undergraduate student at the Department of Industrial and Systems Engineering, Sepuluh Nopember Institute of Technology, Surabaya. During her study period in the Department of Industrial and System Engineering ITS, she has experienced to do fieldwork at PT Semen Indonesia (Persero) Tbk in the Tuban Operations Unit in the Human Capital section ,as well as, at PT Industri Kereta Api (Persero) in the Department of Maintenance.