Ordinal Logistic Regression Approach for Probability Analysis of Student Stress Levels

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Abstract: Stress is a condition or condition where a person feels pressured because of the many demands, both from within and from outside the individual that must be met. Stress is an uncomfortable stressful event for someone that can cause negative effects such as dizziness, emotional instability, irritability, loss of appetite, difficulty concentrating, and difficulty sleeping. One of the factors that cause stress is doing the Final Project. Someone who is experiencing stress can be seen from the level of stress, namely the level of mild, moderate and severe stress. To see a person's stress level, several variables can be used, namely physiological, emotional, cognitive, supervisory, and knowledge variables. This study aims to find out what variables affect stress levels in students. The analysis used is Ordinal Logistic Regression analysis which is one of the statistical analyzes used to determine the probability of events that are affected by the independent variable, where the response variable is a categorical scale. Variables that affect stress levels are emotional, cognitive and knowledge variables. The results showed that the higher a person's emotion, cognitive and knowledge, the smaller the chance for someone to experience severe levels of stress.

Keywords: STUDENT; STRESS LEVEL; OPPORTUNITY; ORDINAL LOGISTIC REGRESSION

1. Introduction

Stress level is a state or condition in which a person feels pressured because of the many demands, both from within and from outside the individual that must be met. Stress is an unpleasant pressing event for someone that can have negative effects such as dizziness, emotional instability, irritability, loss of appetite, difficulty concentrating, and difficulty sleeping (Sipayung, 2016). One of the factors that cause stress is doing the final project or thesis.

As in several cases, there was a tragic incident that was experienced by a final student in 2020, a student at a private university in Yogyakarta was found dead in a boarding room due to suicide due to depression and difficulty completing his thesis (S, 2020). Stress on students when working on their thesis or final project can be caused by several influencing factors including disputes with the supervisor. This is supported by research from (Gunawarti et al., 2006) which states that there is a negative relationship between student communication and thesis supervisor.

Stress when working on a thesis or final assignment is also felt by several students at various campuses who are working on a thesis or final assignment. One of them is Diploma Three Statistics Study Program Muhammadiyah Semarang Institute of Statistical Technology class of 2018. Because based on the information obtained, Diploma Three Statistics students of the Muhammadiyah Semarang Institute of Statistical Technology and Business almost all students experience delays from the allotted time.

The level of stress on students, especially the final level, can be overcome by looking at the variables that affect the level of stress itself. The variables used in this study were 5 independent variables, namely physiological, emotional, cognitive, supervisor and knowledge variables, then used 1 dependent variable, namely stress level. According to Stuart and Sundeen in (Rosiana, 2016) to overcome this stress level can be done by looking at the level of stress, namely mild stress, moderate stress and severe stress. The high cases of stress in final year students and the existence of variables that are thought to influence the stress, so it is necessary to carry out a statistical approach to determine the variables that affect a person's stress level. The stress level in this study is the dependent variable which has three categories (mild, moderate, and severe stress). Regression analysis that can be used in this study is Ordinal Logistic Regression.

Ordinal logistic regression is a statistical analysis that

is used to determine the effect of one or more independent variables on a numerical, categorical scale or a combination of both on the dependent variable on an ordinal categorical scale (Agresti, 2002).

2. Research Method

2.1 Research data and variables

The data in this study used primary data, namely data obtained directly by collecting data using an online questionnaire for Diploma Three Statistics Study Program students at the Muhammadiyah Semarang Institute of Technology and Business Statistics class of 2018, a total of 24 people.

In this study, five independent variables and one Based on previous research conducted by Fatonah et al., 2017 and Zakaria, 2017 in (S, 2020), the variables used are Supervisor variables, Knowledge variables, Physiological, Emotional and Cognitive variables. The research variables are presented in Table 1 below:

Table 1.The research variables

VARIABLES	SCALE
Stress level	Ordinal
Supervisor	Numeric
Knowledge	Numeric
Physiological	Numeric
Emotional	Numeric
Cognitive	Numeric

2.2 Ordinal logistic regression

Ordinal logistic regression is one of the statistical analyzes used for modeling, influencing variables, opportunities and classification with ordinal categorical scale response variables (Agresti, 2002).

The model that can be used for ordinal logistic regression is the logit model, where the properties are contained in the cumulative probability so that the cumulative logit models are models that can be compared with the cumulative probability, namely the probability that is less than or equal to the rth response category on the stated predictor variable p. in the vector xi is ($Y \le r|xi$), with a greater probability of the rth response category on p predictor variables ($Y \le r|xi$). The cumulative probability ($Y \le r|xi$) is defined as follows:

$$P(Y \le r|x_i) = \frac{\exp(\beta_{0r} + \sum_{k=1}^{\rho} \beta_k x_{ik})}{1 + \exp(\beta_{0r} + \sum_{k=1}^{\rho} \beta_k x_{ik})} \qquad (1)$$

where $x_i=(x_{i1}, x_{i2},…,x_{ip})$ is the value of the I observation ($i = 1, 2, …, n$) of each predictor variable p (Agresti, 2002). Estimation of the regression parameters is done by decomposing them using the logit transformation of $P(Y \le r|x_i)$. The above equation is obtained by substituting the Logit equation $P(Y \le r|x_i)$.

2.3 Research methodology

The analytical steps used in this study are three like searching the data, survey, data preparation, and analysis.

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a. Stages of searching for data

There are three in this section, there are three stages to be performed, including:

- *Questionnaire preparation*: At this stage, a questionnaire was prepared based on the theory and results of previous studies;

- *Validity and reliability test*: At this stage, 51 question were distributed to students who had worked on a thesis or final project randomly which were distributed in the West Java region and filled out via the Google form. Questionnaires were distributed from December 13 to January 4 to students who had already written a final project or thesis and obtained 30 students;

- *Survey*: After obtaining a valid and reliable questionnaire, then conducted a survey at the Muhammadiyah Semarang Institute of Technology Statistics and Business class of 2018 which was conducted from May 1 to May 12, 2022. The survey was carried out online, namely via Google form to all 2018 class students, totaling 24 people.

b. Data preparation stage

The results of the questionnaire data are ordinal data, but not yet in the stress category scale according to the theory. For this reason, it is necessary to re-categorize the variable Y (stress level) with an ordinal scale into 3 categories. For variable X, it is converted into numeric data by adding up the total score of each respondent.

c. Analysis phase

The analysis phase including, descriptive analysis, ordinal logistic regression, simultaneous test, partial test, and model feasibility test.

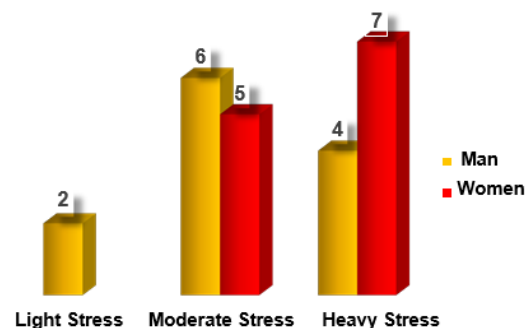## 3. Result and Discussion

3.1 Descriptive analysis

Fig 1. Student stress level based on gender.

Based on the picture above, it can be seen that the 2018 batch of 2018 students of the Diploma Three Statistics Study Program of the Institute of Statistics Technology and Business Muhammadiyah Semarang experienced severe stress mostly felt by female students. This is because the female gender is likely to be more vulnerable to stress conditions, this condition is controlled by the hormones oxytocin and estrogen as supporting factors which clearly differ in levels in men and women. Women's stress levels are also more anxious about their

incompetence and women are also more likely to experience anxiety, sleep disturbances, feelings of guilt and an increase or even decrease in appetite. This is due to the influence of the hormone estrogen which can make women experience stress more easily.
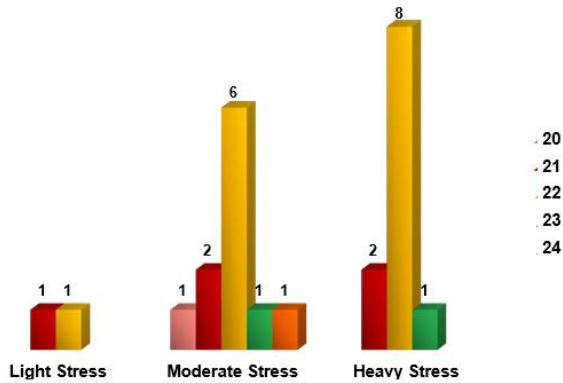

Fig 2. Student stress levels by age.

Based on the picture above, it can be seen that 22-year-old students who experience the most stress are mostly students aged 22 years who are experiencing the most stress.
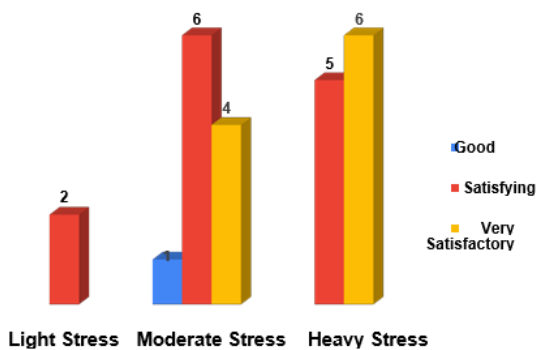

Fig 3. Student stress levels based on gpa scores.

Based on the results of the figure above, it can be seen that the 2018 class of 2018 students who experience the most stress are experienced by students with GPA scores ranging from 3.00 to 3.50.
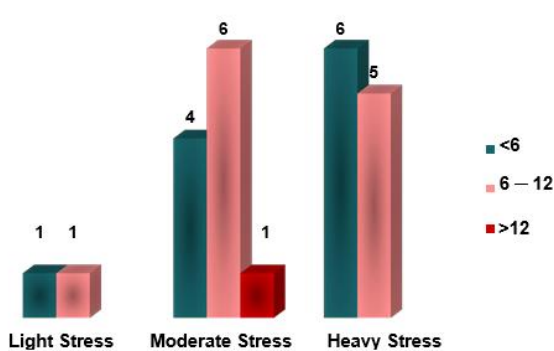

Fig 3. Student stress levels based on the time of final project work.

Based on the picture above, in general, specifically for students of the Diploma Three Statistics Study Program, Institute of Statistics Technology and Business Muhammadiyah Semarang class of 2018 who experience stress in general, namely students who have been working on their final assignment for a long time, namely 6-12

months. The longer students work on their final assignments, it is possible that various kinds of problems will arise so that these students will experience higher levels of stress or the longer students work on their final assignments, these students will have the opportunity to experience higher stress compared to students working on their final assignment. less than 6–12 months. Because when students take longer to work on their Final Assignment, the higher the stress level, this can be caused by obstacles when working on it. For example, students get emotional quickly when working on it, students have difficulty concentrating when working on it, and students find it difficult to find literature on their Final Project.

3.2 Model significant test results

Modeling in research obtained two models, namely as follows:

$$\log(Y_1) = 8.665 + 0.668X_2 - 0.706X_3 + 0.285X_5$$
$$\log(Y_2) = 14.181 + 0.668X_2 - 0.706X_3 + 0.285X_5$$

a. Simultaneous test

Simultaneous testing was carried out using the G Test approach and the results were obtained as shown in the table below:

Table 2. Simultaneous Test Results.

Model	Log Likelihood	Chi-Square	P-value
Intercept Only	44.267		
Final	24.886	19.381	0.000

Based on the table above, it can be seen that the P-value <0.05 so reject H0, then there is a significant influence between all variables, namely variable Emotional, variable Cognitive, and variable Knowledge on variable Level stress.

b. Partial test

Table 3. Partial test results

Variables	Coeffitient	Wald	P-value
Stress Level = 1	8.665	5.610	0.018
Stress Level = 2	14.181	8.387	0.004
Emotional	0.668	7.399	0.007
Cognitive	-0.706	4.388	0.036
Knowledge	0.285	5.480	0.019

Based on table above, it can be seen that there is a significant effect for variable Emotional, Cognitive and Knowledge variable on variable Stress Level partially or individually.

3.3 Model feasibility test results

The feasibility test of this model was carried out using the goodness of fit test and the results were obtained as shown in the table below:

Table 4. Goodnes of fit test results.

	Chi-Square	Df	P-value
Pearson	26.525	43	0.977
Deviance	24.886	43	0.988

Based on the table above, the Sig value > 0.05 so that a decision is obtained to accept H0 and it is concluded that the model obtained is appropriate and feasible to use.

3.4 Interpretation of explanatory variables

The interpretation of explanatory variables can be explained in the table below:

Table 5. Interpretation of explanatory variables.

	P(Y=1)	P(Y=2)	P(Y=3)
Emotional	0.999664	0.000335	0.0000014
Cognitive	0.9999148	0.0000848	0.0000003
Knowledge	0.9997706	0.0002284	0.0000009

a. Emotional

The emotional variable coefficient value is 0.688. This means that the higher the emotional level of Diploma Three Statistics Study Program students of the 2018 Muhammadiyah Institute of Statistics Technology and Business Semarang who are doing their Final Project, the chance for a mild stress level to occur is 0.999664, which means the higher the student's emotional level, the chance for stress levels to occur. light is getting lower.

The emotional variable coefficient value is 0.688. This means that the higher the emotional level of Diploma Three Statistics Study Program students of the 2018 Muhammadiyah Institute of Statistics Technology and Business Semarang who are doing their Final Project, the chance of a moderate stress level occurring is 0.000335, which means that the higher the emotional level of students, the chance of a high level of stress occurring. stress is running high.

The emotional variable coefficient value is 0.688. This means that the higher the emotional level of Diploma III Statistics Study Program students of the 2018 Muhammadiyah Institute of Technology Statistics and Business Semarang who are doing their Final Assignment, the chance for severe stress levels to occur is 0.0000014, which means the higher the student's emotional level, the chance for stress levels to occur. the weight is getting higher.

b. Cognitive Variables

The coefficient value of the cognitive variable is -0.706. This means that the higher the cognitive level of the 2018 Diploma III Statistics Study Program students, Muhammadiyah Semarang Institute of Statistics and Business Technology who are doing their final assignment, the chance of a mild stress level is 0.9999148, which means that the higher the student's cognitive level, the chance of a stress level occurring. the lighter the higher.c. Knowledge.

The results obtained by the coefficient value of the cognitive variable is -0.706. This means that the higher the cognitive level of Diploma Three Statistics Study Program students of the 2018 Muhammadiyah Institute of Statistics Technology and Business Semarang who are doing their Final Project, the chance of a moderate stress level is 0.0000848, which means the higher the cognitive level of students, the chance of stress levels occurring is getting lower.

The results obtained by the cognitive variable

coefficient value of -0706. This means that the higher the cognitive level of Diploma Three Statistics Study Program students of the 2018 Muhammadiyah Institute of Statistics and Business Technology Semarang who are doing their Final Project, the chance for a high stress level to occur is 0.0000003, which means that the higher the student's cognitive level, the higher the chance for a high stress level to occur. the weight is getting lower.

c. Knowledge variable

The results obtained by the coefficient value of the knowledge variable is 0.285. This means that the higher the level of knowledge of Diploma Three Statistics Study Program students of the 2018 Muhammadiyah Institute of Statistics Technology and Business Semarang who are doing their Final Project, the chance of a mild stress level is 0.9997706, which means that the higher the level of student knowledge, the chance of a stress level occurring. light is getting lower.

The results obtained by the coefficient value of the knowledge variable is 0.285. This means that the higher the level of knowledge of Diploma III Statistics Study Program students of the 2018 Muhammadiyah Institute of Technology Statistics and Business Semarang who are doing their Final Project, the chance of a moderate stress level is 0.0002284, which means that the higher the level of student knowledge, the chance of a stress level occurring. is getting higher.

The results obtained by the coefficient value of the knowledge variable is 0.285. This means that the higher the level of knowledge of Diploma III Statistics Study Program students of the 2018 Muhammadiyah Institute of Technology Statistics and Business Semarang who are doing their Final Project, the chance for a high stress level to occur is 0.0000009, which means that the higher the student's level of knowledge, the higher the chance for a stress level to occur. the weight is getting higher.

5. Conclusion

The 2018 class of 2018 students of Diploma III Statistics Study Program Muhammadiyah Semarang Institute of Statistics and Business who experience the most severe stress are female students and the duration of completing the Final Project is 6-12 months. Variables that influence the stress level of the final student of the Diploma Three Statistics Study Program, Muhammadiyah Institute of Statistics and Business Technology, Semarang are influenced by the Emotional, Cognitive and Knowledge variables.

Conflict of interest

The authors certify that they have no competing financial interests or personal relationships that could influence the work reported in this paper.

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