

Modeling Social Media Use and Anxiety Levels With Students' Sleep Quality: Ordinal Logistic Regression

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Abstract

The study tries to model sleep quality using ordinal logistic regression since the response variable is in the form of categorical data. The purpose of this study was to identify factors related to students' sleep quality based on social media usage variables and anxiety levels. One hundred and fifty students of SMAN 1 Tualang, Riau are selected with snowball technique and participated online. The result showed that there is a correlation between social media usage and anxiety over sleep quality. Social Media Usage Dependence degree on Sleep Quality was 59.3% and Anxiety level dependence degree on Sleep Quality was 65.3%. Ordinal logistical regression analysis showed that students who were inactive in social media had a good sleep quality, a rate of 0.462 times compared to students who were active in social media. Meanwhile, students with mild anxiety levels had a good sleep quality of 0.369 times compared to moderate anxiety levels.

1. INTRODUCTION

The development of increasingly sophisticated technology can make users receive various information easily. Unlimited internet access has an impact on sleep patterns. This usually occurs in adolescence [11]. A research conducted by Yahoo in collaboration with the Sandi Negara High School (STSN) conducted research on internet use in adolescents, and the results obtained were that Indonesia dominated the internet, namely teenagers aged 15-19 years as much as 64% (Dari, 2021). On the other hand, in the 2021 Hootsuite survey noted that there were 4.66 billion internet users in the world. Of these, 4.22 billion were social media users. Thus it can be said that the use of social media has become a trend in people's lives [7].

The use of social media in Indonesia is at a rate of 6-30 hours per month. This is based on the most used social media applications and video streaming applications. In general, the time people spend using social media has increased by an average of 60% over the past seven years. Currently we spend an average of 150 minutes a day on social media [6].

High use of social media can interfere with the quality of sleep for its users. Sleep quality is a condition in which the sleep an individual lives to produce fitness and freshness when he wakes up. Sleep quality includes quantitative aspects of sleep, such as sleep duration [24]. Sleep duration will vary according to body activities and body rhythms. It is important to observe these changes in order to get good quality of sleep [21].

In fact, many factors can affect the quality of sleep, one of which is anxiety. Anxiety is a negative emotion that humans feel, the appearance of tense feelings and thoughts. It is usually accompanied by symptoms of fast heartbeats, sweating and shortness of breath [2]. During COVID-19 the psychological development of adolescents was disturbed, causing uncontrollable anxiety [25].

Based on the research of Ainida, Lestari and Rizany, there was a significant relationship between the use of social media and the quality of sleep in adolescents at Madrasah Aliyah Negeri 4 Banjar [1]. Furthermore, research conducted by Punkasaningtiyas [13] also stated that social media users have a relationship with sleep quality. Also, the higher the use of social media, the worse the quality of sleep [13]. Another study, by Ratnaningtiyas and Fitriani using bivariate analysis with the chi-square test explains that there is a relationship between anxiety and sleep quality in final year students [17].

Based on the above observations, the researcher is interested in identifying factors related to the quality of students' sleep based on the variables of social media use and anxiety levels. Sampling was carried out at SMAN 1 Tualang.

2. METHOD

2.1 Research data

The population in this study were 240 class XI students of SMA Negeri 1 Tualang in Siak Regency. The sampling technique uses snowball sampling, which is a technique in which a researcher takes several samples and then asks respondents to recommend other subjects according to the description of the sample needed. The sample obtained from this population is 150 people by filling out the Google form online.

In this study, there were three variables, namely the use of social media (PMS) and anxiety levels (TK) as independent variables, then sleep quality (KT) as the dependent variable. The purpose of this study was to determine the relationship between social media use and anxiety levels on sleep quality. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI) questionnaire which consists of eighteen item statements to assess various factors related to quality sleep. The global score of the PSQI has a score range of 0-21, a minimum score of 0 (good) and a maximum score of 21 (poor). Total interpretation, if the value <5 means good sleep quality and if it is ≥ 5 then it is poor sleep quality. The higher the global score, the worse the quality of individual sleep (Daniel, 1998).

Meanwhile, to determine the categorical variable of social media usage and anxiety, the following steps are taken (Indah, 2020):

Step 1: Determination of item scores from each of the alternative answers contained on the scale.

Step 2: Add up the scores of all items that have been answered by each research subject and calculate the average score of each subject.

Step 3: Determine the categories on the variables of social media usage, anxiety and quality of sleep.

The categorization of data into two categories is based on normally distributed and not normally distributed data (Singgih, 2001). If the data is normally distributed, then use the mean approach, while for data that is not normally distributed, use the median approach. In this study the data were categorized into two categories using the mean approach because the data obtained were normally distributed. The mean value (μ) is obtained from [sum of total score of variables / number of total scores of variables]. The total score of the variables and the number of total scores of the variables were obtained from the score of each respondent's answer (Johan, 2004). The score categorization for the variables of social media use, anxiety and sleep quality is presented in Table 1 below.

Table 1. Categorization of PMS and TK

Score Criteria	Social Media Usage		Level of Anxiety	
	Score	Category	Score	Category
$(x < \mu)$	$x < 19$	Not active	$x < 45$	Light
$(x \geq \mu)$	$x \geq 19$	Active	$x \geq 45$	Moderate

2.2 Research Method

2.2.1 Chi-Square Test

The Chi-Square test is one of the tests used to determine the relationship between categorical variables (Sidney, 1992). The Chi-Square value can be calculated using the following equation [10]:

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^k \frac{(O_{ij} - E_{ij})^2}{E_{ij}}. \quad (1)$$

In equation (1), O_{ij} is the observed value in the i -th row of the j -th column and E_{ij} is the expected value in the i -th row of the j -th column. The following are the steps used for Chi-Square testing[12]:

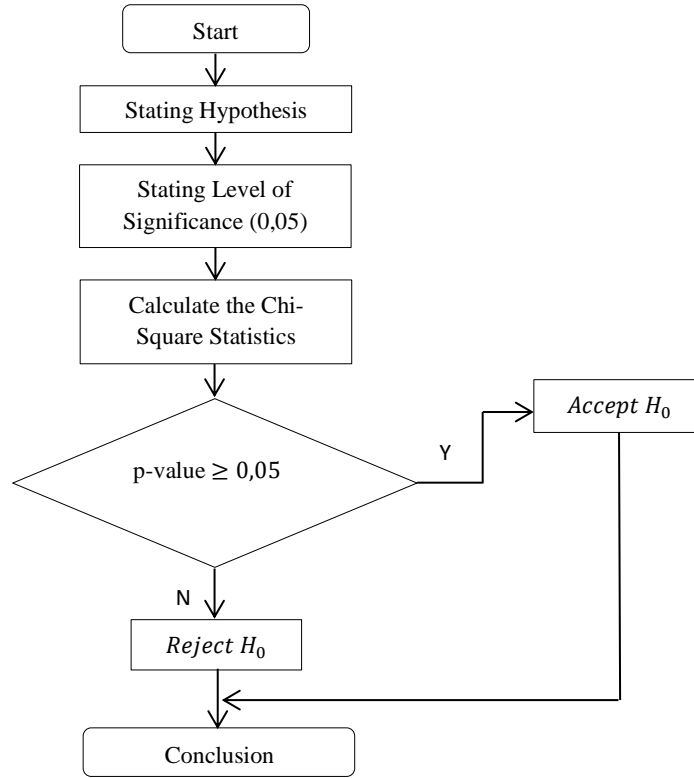


Figure 1. Chi-Square Test Flowchart

2.2.2 Ordinal Logistic Regression

Ordinal logistic regression is a statistical method used to determine the relationship between the dependent variable and the independent variable. The dependent variable has more than two categories and each category has a level. The ordinal logistic regression model is a cumulative logit model [8]. The ordinal nature of the dependent variable in a cumulative logit model is represented by cumulative probabilities. Therefore, the cumulative logit model is a model obtained by comparing the results of the probability of the independent variable p which is defined in the form of a vector X that is smaller or equal to the cumulative probability of the j -th response category. Cumulative odds are defined as follows:

$$P(Y \leq j|X) = \pi(X) = \frac{\exp(\theta_j + \sum_{k=1}^p \beta_k X_k)}{1 + \exp(\theta_j + \sum_{k=1}^p \beta_k X_k)} \quad (2)$$

Equation (3), $P(Y \leq j|X)$ is the cumulative probability at p independent variable in vector X , θ_j is the j -th category intercept parameter, X is the independent variable, Y is the dependent variable and β_k is the vector of the k th regression parameter k with $j = 1, 2, 3, \dots, j-1$ and $k = 1, 2, 3, \dots, p$. Then a logit transformation in Equation (1) to obtain the cumulative logit model formulation is as follows:

$$\text{Logit } P(Y \leq j|X) = \ln(P(Y \leq j|X) / P(Y > j|X)) = \theta_j + \sum \beta_k X_k \quad (3)$$

The research method contains a description of the method and the steps used to solve the problem in the research that is written completely, briefly, and clearly. If there is a design used in the study, it must be included in the method along with the details. The method must also be able to explain how to obtain supporting data for research results. The content in the method is made in such a way that the research can be repeated again with the same results.

2.2.3 Dependency Degree

The dependency degree is used to determine the dependency of an attribute in the rough sets approach to give a system decision $A=(U,C,D)$, where U is a set of objects, C is a set of conditional attributes and D is a set of decision attributes. Intuitively, the attribute set of D depends entirely on the attribute set C , denoted by $C \Rightarrow D$, if the attribute value of C uniquely determines the attribute value of D . It is said that D depends on C to degree k ($0 \leq k < 1$), denoted by $C \Rightarrow_k D$ [8], where

$$k = \gamma(C, D) = \frac{Card(U_{x \in U/D} C.(D))}{Card(U)} \quad (4)$$

Equation (2) is part of the rough sets approach which is often used for categorical data analysis. The steps in calculating the dependency degree are as follows:

Step 1: Prepare attribute data and decision conditions in the form of categorical data based on the criteria.

Step 2: Arranging each condition attribute and decision following the criteria into a set form

Step 3: Determine the intersection between the sets of conditional and decision attributes

Step 4: Calculating the degree of dependency between condition attributes and decision attributes using Equation (2).

3. RESULTS AND DISCUSSION

3.1 Characteristics of Respondents

Demographic data of respondents by gender group were 95 women (63.3%) and 55 men (36.7%). In this study, the majority of students used social media to find information, study needs, school assignments and as entertainment as many as 75 people (50%). Based on the duration of accessing social media, it was found that as many as 58 people (38.7%) accessed social media for 6-12 hours. From the results of research [15], it shows that teenagers who access the internet at home tend to use the internet with the most frequency intensity, namely every day. Based on the length of sleep in a day, as many as 74 people (49.3%) sleep 8-9 hours a day, and as many as 9 people (6%) sleep more than 9 hours a day. From the results of the study, it was found that the majority of respondents slept for 8-9 hours a day. Sleep is needed by every individual in order to be able to maintain health status at an optimal level. Sleep can restore the body's condition, improve one's memory, reduce stress, depression, anxiety and maintain a balance of ability and concentration when carrying out various activities [14].

The discussion in this section was made with the aim of knowing the relationship between the use of social media (x_1) and anxiety levels (x_2) on the quality of sleep (y) of students using Ordinal Logistic Regression and Dependency Degree.

Table 2. Respondent data

Respondent Number	x_1	x_2	y
R1	2	2	1
R2	2	1	1
R3	1	1	1
\vdots	\vdots	\vdots	\vdots
R150	1	1	2

Table 2, is the respondent's data which is classified into 2 categories based on the categorization in Tables 1 and 2. For the variable category x_1 , namely "1 = not active" and "2 = active". For the x_2 variable category, namely "1 = mild" and "2 = moderate", and for the variable category y namely "1 = good" and "2 = bad".

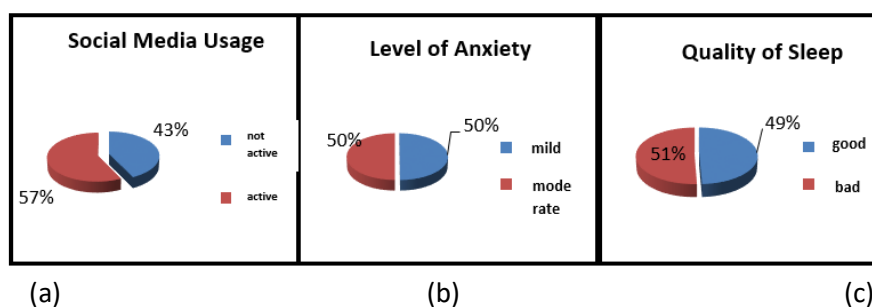


Figure 3. Pie chart (a) Social Media Usage (b) Level of Anxiety and (c) Quality of Sleep

In Figure 3 (a), it can be seen that the group of respondents who actively use social media is 57.3% and the group of respondents who are not active using social media is 42.7%. From Figure 3 (b), it can be seen that respondents experienced mild and moderate levels of anxiety. Adolescents are prone to experiencing moderate or mild anxiety, then adolescents often experience anxiety due to several factors such as past experiences, physical conditions, and interpersonal conflicts, in general they have psychosomatic symptoms such as cold sweats, tremors, nausea and nervousness. From Figure 3 (c), it can be seen that out of 150 students, 51% of them experienced poor or bad sleep quality and 49% experienced good sleep quality.

Table 3. Quality of Sleep on Social Media Usage

		Quality of Sleep		Total
		Good	Bad	
Social Media Usage	Not Active	41	23	64
	Active	33	53	86
Total		74	76	150

Based on Table 3, it was found that there were 86 respondents who actively used social media and experienced poor sleep quality as many as 76 students. This study also obtained an illustration that the majority of respondents actively use social media, this is related to several government policies to suppress the spread of COVID-19, one of which is social restrictions. This result is in line with previous research which stated that 80% of respondents agreed that social media could be an escape from all activities and problems. The use of social media can satisfy individuals, entertain their psychological state when they feel bored, alone during the COVID-19 pandemic [21]. Addition to the use of social media can have a negative impact on students' sleep patterns. Excessive use of social media has a bad risk of 3,836 times on the quality of sleep so that the use of social media greatly affects the quality of student sleep [22].

Table 4. Quality of Sleep on Level of Anxiety

		Quality of Sleep		Total
		Good	Bad	
Level of Anxiety	Mild	48	27	75
	Moderate	26	49	75
Total		74	76	150

Based on Table 4, it was found that a group of 75 respondents experienced mild and moderate levels of anxiety and 76 students experienced poor sleep quality. From this study it was found that class XI students of SMAN 1 Tualang experienced mild or moderate anxiety so that they experienced poor sleep quality. This is in line with research Aryadi, [3], which shows that the worse the quality of student sleep, the higher the level of depression, anxiety, or stress experienced.

3.2 Ordinal Logistic Regression

3.2.1 Parameter Estimation

In this section it is used to determine the general model of ordinal logistic regression using the maximum likelihood method with the help of IBM SPSS Statistics 23.0 software, the following results are obtained.

Table 5. Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	Odds Ratio
Threshold Location	[Quality of Sleep =1]	-0,855	0,269	10,077	1	0,002	
	[Social Media Usage =1]	-0,773	0,362	4,563	1	0,033	0,462
	[Social Media Usage =2]	0 ^a	-	-	0	-	-
	[Level of Anxiety =1]	-0,996	0,357	7,767	1	0,005	0,369
	[Level of Anxiety =2]	0 ^a	-	-	0	-	-

Based on Table 5, there are 2 categories of independent variables that are significantly related to the dependent variable because the p-value or Sig.<0.05. So that the general model of ordinal logistic regression is obtained as follows:

$$\text{Logit}(y_{[Good]}) = 0,855 - 0,773x_1[\text{not active}] - 0,996x_2[\text{mild}]$$

Based on Table 5, the odds ratio for the variable x_1 is 0.462, meaning that students who are not active in social media usage have a good sleep quality level of 0.462 times (below 1 and negative regression coefficient) compared to students who are active in social media use. Meanwhile, the odds ratio for the variable x_2 is 0.369, meaning that students with a mild level of anxiety have good sleep quality of 0.369 times (below 1 and a negative regression coefficient) compared to students with moderate anxiety.

3.2.2 Partial Parameter Test

Partial testing aims to determine the relationship of the independent variables to the dependent variable. Based on Table 5, the variables of social media use and anxiety levels are related to sleep quality because the significant value is less than 0.05.

3.2.3 Simultaneous Parameter Test

The measurement results are used to determine whether all independent variables have a simultaneous relationship to the dependent variable, in full, and are presented in Table 6.

Tabel 6. Simultaneous Parameter Test

Model	-2 Log Likelihood	Chi-Square	Df	Sig.
<i>Intercept Only</i>	33,560			
<i>Final</i>	15,880	17,680	2	0,000

Based on Table 6, it can be seen that there was a decrease in the value of -2 Log Likelihood from Intercept Only to Final with a significance level of $p < 0.001$. This means that models with independent variables are better than models with only intercepts.

3.2.4 Goodness of fit Test

The Followings are the results of the model suitability test using the Deviance method test.

Tabel 7. Goodness of fit test

	Chi-Square	df	Sig.
<i>Pearson</i>	0,184	1	0,668
<i>Deviance</i>	0,184	1	0,668

Based on Table 7, a Chi-Square value of 0.184 is obtained with a significant value of 0.668. With a significant value > 0.05 it can be concluded that the model obtained is in accordance with the data used.

3.2.5 Coefficient of Determination

Based on the SPSS output presented in Table 8, the pseudo coefficient of determination for Cox and Snell is 0.111, Nagelkerke is 0.148, and McFadden is 0.085. The Nagelkerke coefficient of determination is 0.148 meaning that the variability of dependent variables that can be explained by the variability of all the independent variable is 14.8% and 85.2% is influenced by other factors that are not included in assessment aspects that can affect the quality of students' sleep during the COVID-19 period.

Table 8. Pseudo R-Square

Cox and Snell	0,111
Nagelkerke	0,148
McFadden	0,085

3.2.6 Relationship Analysis Based on Dependency Degree

Step 1 : Transformation of numeric data into categorical data as shown in Table 10

Table 9. Categorizing Numerical Data

Respondents Number	Independent Variable		Dependent Variable
	x_1	x_2	y
R1	Active	Mild	Bad
R2	Active	Moderate	Bad
R3	Not Active	Moderate	Bad
\vdots	\vdots	\vdots	\vdots
R150	Active	Mild	Bad

Step 2: Arranging each variable according to the criteria into a set form

Table 10. Transforming Variable into Sets Notation

Variable	Set Membership
Social Media Usage	$= \{\{\text{Not Active}\}, \{\text{Active}\}\}$ $= \{\{R3, R5, R6, \dots, R146, R147, R148\}, \{R1, R2, R4, \dots, R145, R149, R150\}\}$
Anxiety	$= \{\{\text{Mild}\}, \{\text{Moderate}\}\}$ $= \{\{R2, R3, R4, \dots, R149, R150\}, \{R1, R10, R13, \dots, R142, R143, R144\}\}$
Quality of Sleep	$= \{\{\text{Good}\}, \{\text{Bad}\}\},$ $= \{\{R4, R5, R6, \dots, R146, R147, R148\}, \{R1, R2, R3, \dots, R144, R149, R150\}\}$

Step 3: Determine the intersection between the independent variable sets and the dependent variable.

Table 11. The Intersection between Independent Variables and Dependent Variable

Conditional Attribute		Decision Attribute Quality of Sleep	Conditional Attribute \cap Decision Attribute
Social Media	Not Active	Good	$\{R5, R6, R7, \dots, R146, R147, R148\}$
	Active	Bad	$\{R1, R2, R9, \dots, R144, R149, R150\}$
Anxiety	Mild	Good	$\{R4, R5, R6, \dots, R146, R147, R148\}$
	Moderate	Bad	$\{R1, R10, R14, \dots, R140, R141, R144\}$

Step 4: Calculate the dependency degree between the Independent Variable and the Dependent Variable.

The dependency degree between Social Media Use and Anxiety Level on Sleep Quality is:

$$k_A = \left(\frac{36}{150} + \frac{53}{150} \right) = \frac{89}{150} = 0.593 = 59.3\%.$$

$$k_B = \left(\frac{49}{150} + \frac{49}{150} \right) = \frac{98}{150} = 0.653 = 65.3\%.$$

Based on the k_A and k_B calculations, it was obtained that the level of association between Social Media Use and Sleep Quality was partially related to 59.3% and Anxiety to Sleep Quality was 65.3%. This shows that, the quality of sleep of students is influenced by dependence on the use of social media and anxiety levels.

4. CONCLUSION

Based on the data analysis, it was concluded that the social media usage and anxiety levels were related to the quality of students' sleep during the COVID-19 pandemic. This can be seen from the odds ratio values of 0.462 and 0.369. Students who are not actively using social media have a better level of sleep quality, with a value of 0.462 times compared to students who are active. While students with mild anxiety levels have good sleep quality by 0.369 times compared to students with moderate anxiety levels. This decision is supported by the Dependency Degree value which indicates that the level of dependence of the Social Media Usage on Sleep Quality is 59.3% and Anxiety on Sleep Quality is 65.3%. The results of this study can give an idea of the importance of regulating sleep patterns. Thus the results of this study can also be used as a basis for determining the ideal time limit for using social media.

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