

Association Between Spritual Intelligence, Social Support and Mental Health of University Student During Covid-19 Based on Dependency Degree and Ordinal Logistics Regression

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Article Info

Article history:

Received Dec 15th, 2021

Revised Mar 29th, 2022

Accepted Apr 30th, 2022

Keyword:

Covid-19

Dependency Degree

Mental Health

Ordinal Logistics Regression

ABSTRACT

The modeling of mental health has been widely studied using statistical approaches such as the chi-square test, regression analysis, and ordinal logistics. However, not many studies apply ordinal logistic regression and dependency degree into this domain, where both of these approaches are good statistical and non-statistical approaches for investigating categorical data. In this study, the researcher is interested in combining the dependency degree and ordinal logistic regression and identifying the mental health factors of students in the Covid-19 era. The research sample was students majoring in Al-Qur'an and Tafsir Study at UIN Suska Riau. The results indicated that a significant relationship between the informative support dimension to the disorder, the instrumental dimension to avoidance and increased self-awareness with an average dependency value between dimensions of 4.13% and 4.53%. Through this relationship, it can be seen that students are more likely to experience stress disorder (PTSD) if they are reluctant to do good than the number of awards received by students.

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DOI: <http://dx.doi.org/10.24014/ijaidm.v5i1.15276>

1. INTRODUCTION

Factors related to student mental health during the Covid-19 pandemic have been widely examined, both with statistical and non-statistical approaches. However, there are still few that discuss the value of the dependence of the variables that have these associations. The application of the dependency degree as a non-statistical approach in research [1] revealed that the value of students' mental health dependence on ESDP and KTM was 21.875% and 18.75%, respectively. The percentage is small enough for a relationship between variables. Several other studies have used dependency degrees such as [2] and [3] on the mental health of parents and elementary school teachers in Pekanbaru. Research [4] indicates that self-compassion is dependent and contributes to mental health effects.

Besides, a statistical approach such as a logistic regression model can be considered. A study [5] conducted before the pandemic by applying ordinal logistic regression, produced a model with the interpretation that confusion would develop a theory that increased student stress levels by 3.4 times. Whereas, research [6] with ordinal logistic regression using proportional odds model, it was found that students' perceptions of having a risk of influencing stress were 7.28 times. Research conducted during the Covid-19 pandemic used logistic regression analysis such as [7], research [8] with multiple regression analysis, and simple regression analysis by [9]. Multivariate logistic regression analysis by [10] where adolescents with low social support had a 4.2 times greater risk of developing depressive symptoms.

Based on a previous study, 85% of US college students experience high to moderate levels of emotional distress. [11] suggested the problem occurred because students had to grapple with the new environment. This is in line with research [12] using regression analysis which asserts that social support and religiosity contribute to the level of student welfare. Thus, the more social support they receive, the better their mental status because of the empathy they get from other people, in addition [13] adds that mental health is a result of the application of religious attitudes. Religious people live healthier than non-religious people. Mental health during the Covid-19 pandemic is very important because the changes that occur drastically make students have to be able to adapt so they don't interfere with student learning activities.

Dealing with these descriptions, it is known that the implementation of dependency degree and ordinal logistic regression has not been widely used for modeling student mental health. Further, the dependency degree can be derived using rough sets approximation. Besides, ordinal logistic regression can also estimate the probability of occurrence of a variable in a population. Thus, the researcher is interested in identifying the mental health factors of students measured based on the dimensions of spiritual intelligence and social support using dependency degree and ordinal logistic regression for students majoring in Al-Qur'an and Tafsir Study at UIN Suska Riau during Covid-19. By combining the two approaches and identifying based on dimensions, it is expected that research investigations will be more accurate and the relationship between students' mental health factors during the pandemic will be more visible.

2. RESEARCH METHOD

2.1. Data

In this study, the gathering data and information were collected from 124 students of Al-Qur'an and Tafsir Study Department at UIN Suska Riau through an online survey. Additionally, The proposed variables and its dimensions are spiritual intelligence, namely self-awareness (x_1), the ability to do good (x_2), and the ability to use spiritual resources to solve problems (x_3). Emotional support (x_4), ability to do good (x_5), instrumental support (x_6), and informative support (x_7) which are dimensions of social support. Meanwhile, mental health consists of the dimensions of intrusion (y_1), avoidance (y_2), and hyperarousal (y_3).

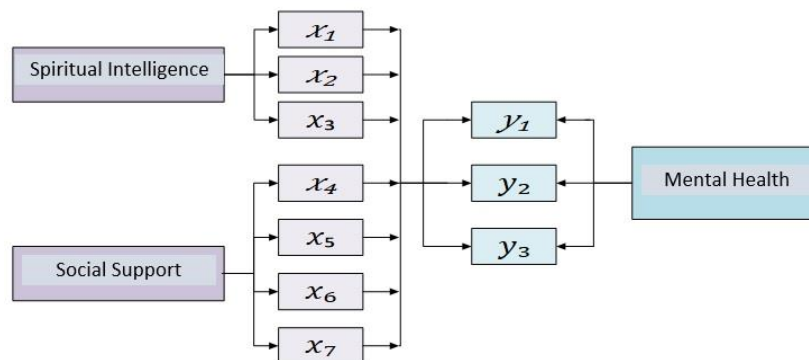


Figure 1. Variable Framework and Its Dimensions

The mental health measurement tool was based on the impact of event scale-revised (IES-R) with a total of 22 items. IES-R is effective for assessing the symptoms of Posttraumatic Stress Disorder (PTSD), which is a severe anxiety disorder that can affect both physically and psychologically. While the dimensions of spiritual intelligence amounted to 8 items and 6 items for social support. The steps for categorizing each dimension are as follows:

Step 1: Determine the maximum score, which is the highest score on the research subject based on the scale calculation.

Step 2: Determine the minimum score: which is the lowest score on the research subject based on the calculation of the scale.

Step 3: Mean value (μ): can be obtained by $\frac{\text{max score} + \text{min score}}{2}$

Step 4: Standard deviation (σ): obtained from $\frac{\text{max score} - \text{min score}}{6}$

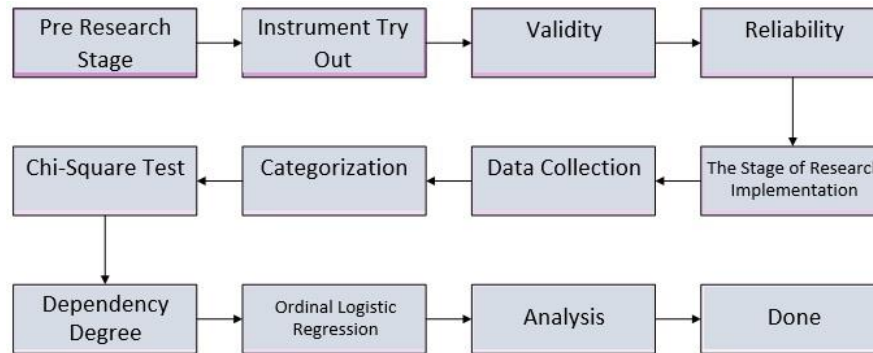
Thus, dealing with the four steps above, the categorization of each dimension can be seen in Table 1.

Table 1. Categorization of Dimension

Score Criteria	Independent Dimension Category	Dependent Dimension Category
$X \leq (\mu - \sigma)$	Low	Normal
$(\mu - \sigma) < X \leq \mu$	Medium	PTSD Light Symptom
$\mu < X \leq (\mu + \sigma)$	High	PTSD Medium Symptom
$X > (\mu + \sigma)$	Very High	Leading to PTSD Diagnose

2.2. Methods

After obtaining the categorization of each dimension, then using the chi-square test, dependency degree, and ordinal logistic regression, the relationship between the dimensions, both the magnitude of the dependency value and the probability of the occurrence of that dimension.

**Figure 2.** Research Framework

2.2.1. Chi-Square Test

The Chi-square test is a hypothesis test between the frequency of observations and expectations, where each case uses a certain hypothesis [14]. Chi-square is one of the non-parametric tests used on variables with nominal data scales. This test can be derived as follows [15]:

Step 1: Establish a Hypothesis.

H_0 : There is no significant relationship between the two dimensions.

H_1 : There is a significant relationship between the two dimensions.

Step 2: Determine the significance level of α .

Step 3: Calculation of Test Statistics.

The sampling distribution χ^2 is calculated using the following formula:

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

where O_{ij} is the observation value in the i -th row and j -th column. While E_{ij} is the expected value in the i -th row and j -th column.

Step 4: Decision Making.

Reject H_0 jika $\chi^2_{count} > \chi^2_{table}$ dan $p-value < \alpha$.

Step 5: Conclusion.

There is or is not a relationship between dimensions.

2.2.2. Dependency Degree

Dependency degree is a way to measure the dependence of a variable x and y by using a rough set approach. Rough set theory (RS) is a new approach to reasoning about data. Suppose $DT = (U, C \cup D)$ is a decision table, where U is a set of objects, C is a set of condition attributes, and D is a set of decision attributes. Given x as a U object, the values of x in c and x in d are given as $c(x)$ and $d(x)$, respectively, where $c \in C$ and $D = \{d\}$. The subset of C is denoted by B , where $B \subseteq C$. The indiscernibility relation for two objects x and y is defined by $x|(B)y$, if and only if $c(x) = c(y)$ for any $c \in B$ where $x \in U$ and $y \in U$. In other words, $I(B)$ is called an equivalence relation. The quotient set of U with the indiscernibility relation,

or B , is called the equivalent class family or partition block, denoted by $U/I(B)$ or U/B . The U/B partition contains x denoted by $B(x)$. For example $\gamma(B, D)$ be the degree of dependence of the attribute indicating the degree to which D depends on B [16]:

$$\gamma(B, D) = \frac{|Pos_B(D)|}{|U|} \quad (2)$$

$$Pos_B(D) = \cup_{x \in U/D} B(x) \quad (3)$$

The steps for working on the dependency degree are as follows [3]:

Step 1: Transform numeric data into categorization based on the criteria.

Step 2: Arrange in the form of a set according to the criteria for each variable.

Step 3: An intersection is formed between the set of dependent and independent variables.

Step 4: Calculate the value of dependency degree.

2.2.3. Ordinal Logistic Regression

The regression analysis used to analyze the relationship between the dependent variable and the independent variable, one of which is ordinal logistic regression, where the dependent variable is on an ordinal scale and is polychotomous. The model used in ordinal logistic regression is a cumulative model. If there is a response category of j then the ordinal logistics model is defined as follows:

$$\text{logit}(Y_{(j-1)}) = \ln\left(\frac{Y_{j-1}}{1-Y_{j-1}}\right) = \theta_{j-1} + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k \quad (4)$$

The steps for working on ordinal logistic regression are as follows [5]:

Step 1: Test Parallel Lines.

Parallel lines test is used to test all categories with the following hypotheses:

H_0 : The model produces the same regression coefficient.

H_1 : The model does not produce the same regression coefficient.

Test statistics:

$$PL = -2 \ln\left(\frac{l_0}{l_1}\right) \sim \chi^2_{\alpha, p(j-2)} \quad (5)$$

Decision H_0 is rejected when $p\text{-value} < \alpha$ or when $PL > \chi^2_{\alpha, p(j-2)}$.

Step 2: Goodness of fit

This test is used to see whether the ordinal regression of the logit model is feasible or not feasible to use.

H_0 : The model fits the data.

H_1 : The model does not match the data.

$$D = -2 \sum_{i=1}^n y_{ij} \ln\left(\frac{\hat{\pi}_{ij}}{y_{ij}}\right) + (1 - y_{ij}) \ln\left(\frac{1 - \hat{\pi}_{ij}}{1 - y_{ij}}\right) \quad (6)$$

Decision H_0 is rejected when $p\text{-value} < \alpha$ atau $D > \chi^2_{\alpha, p(j-2)}$.

Step 3: Coefficient of Model Determination.

The value of the coefficient of determination is shown by the *Pseudo R-Square* value.

Step 4: Estimation Result of Ordinal Regression Logit Model.

Used to prove whether the hypothesis is rejected or accepted.

Step 5: Model Interpretation.

To simplify the interpretation of the model, the odds value is used.

3. RESULT AND ANALYSIS

This section will discuss the implementation of ordinal logistic regression and dependency degree for mental health students of Al-Qur'an and Tafsir Sciences class 2018 in the Covid-19 era. Based on the categorization in Table 1, the following research results are obtained:

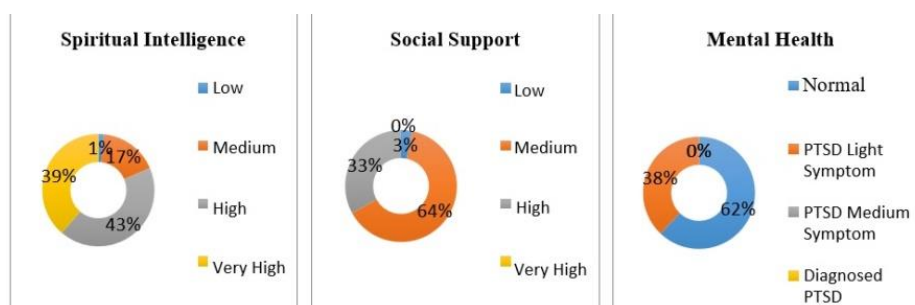


Figure 3. The percentage among variables and their criteria

From Figure 3, the majority of students of Al-Qur'an and Tafsir have mental health in the normal category with an average of 82.52%. This indicates that during the Covid-19 pandemic, the students of Al-Qur'an and Tafsir were in good condition and all activities were running smoothly. The Covid-19 pandemic has happened for more than a year, so then it enables students to be able to adapt to circumstances and have accepted the changes. Each dimension of spiritual intelligence and social support is in the high category, only the dimensions of emotional support and appreciation support are dominated by the low category. Good mental health will have a psychological effect, or it can be said that the given mental health will improve mental health. The more social support students receive from the Qur'an and Tafsir, the better their mental condition [12]. Besides, family members or friends who are always there to share empathy with them can reduce anxiety and depression [10].

3.1. Relationship of Mental Health Dimensions Based on the Chi-Square Test

The relationship between the dimensions of spiritual intelligence and social support on the mental health of students of Al-Qur'an and Tafsir Sciences can be investigated using the chi-square test. With the help of IBM SPSS Statistics 22 software, these associations can be shown in Table 2.

Table 2. Relationship of the Dimensions of the Independent and Dependent Variables

Dimension	y ₁			y ₂			y ₃		
	x ² _{hitung}	x _{tabel}	sig	x ² _{hitung}	x ² _{tabel}	.sig	x ² _{hitung}	x ² _{tabel}	sig
x ₆	13,596	16,919	0,137	14,774	12,592	0,02	9,270	6,919	0,41
x ₇	31,153	12,592	0,000	2,514	9,488	0,64	17,371	2,592	0,01

Dealing with the output in Table 2, it is known that x²_{count} on the dimensions of instrument support and informative support is greater than x²_{tabel}. In addition, the p-value in both dimensions is smaller than the specified significance value, so H₀ is rejected. Thus, there is a significant relationship for the dimensions of instrumental support to the dimensions of the disorder, the dimensions of informative support to avoidance, and the dimensions of increasing awareness. During the Covid-19 Pandemic, students of the Qur'an and Tafsir Sciences spent more time in their hometowns and gathered with their families. In addition, the interaction between fellow students has increased, just talking about daily activities or lecture assignments so that advice, suggestions, and feedback occur in that environment. The provision of facilities and materials in the form of more funds to buy internet quotas also contributes to maintaining the mental stability of students. Providing this instrumental support helps student activities to reduce the feeling that they are unable to carry out work [17].

3.2. Relationship Dimensions of Mental Health Based on Dependency Degree

Based on the chi-square test, the informative support dimension is significant to the distraction dimension (intrusion) and the hyperarousal dimension and the instrumental support dimension is significant to the avoidance dimension.

Step 1: Transform numeric data into categorical data in Table 3.

Table 3. Transformation of Numerical Data into Categorical Data

Resp	x ₆	x ₇	y ₁	y ₂	y ₃
R1	3	3	0	0	0
R2	3	3	0	0	2

Resp	x_6	x_7	y_1	y_2	y_3
R3	2	2	0	0	0
⋮	⋮	⋮	⋮	⋮	⋮
R124	2	2	0	0	0

Step 2: Arrange each variable according to the criteria into the form of a set.

Table 4. Transformation of Variables into Set Notation

Variabel	Elemen Himpunan
x_6	={{Rendah}, {Sedang}, {Tinggi}, {Sangat Tinggi}} ={{R19, ..., R99}, {R17, R37, ..., R106}, {R3, R5, ..., R124}, {R1, R2, ..., R120}}
x_7	={{Rendah}, {Sedang}, {Tinggi}, {Sangat Tinggi}} ={{R4, R39, ..., R69}, {}, {R3, R5, ..., R123}, {R1, R2, ..., R124}}
⋮	⋮
y_3	={{Normal}, {Gejala PTSD Ringan}, {Gejala PTSD Sedang}, {Mengarah Pada Diagnosa PTSD}} ={{R1, R3, ..., R124}, {R25, R33, ..., R118}, {R2, R4, R5, ..., R113}, {R37, R47}}

Step 3: Determine the intersection between the sets.

In Table 5, the element slices between the conditional attribute and the decision attribute.

Table 5. Intersection between Conditional Attributes and Decision Attributes

Conditional Attribute	Decision Attribute		Conditional Attribute \cap Decision Attribute		
		(y_1, y_2, y_3)	y_1	y_2	y_3
x_6	Low	Normal	{R19, R99}	{R19, ..., R99}	{R19, ..., R99}
	Medium	Light PTSD Symptom	{}	{R17, ..., R106}	{R106}
⋮	⋮	⋮	⋮	⋮	⋮
x_7	Very High	Diagnosed PTSD	{}	{}	{R37}

Step 4: Calculating dependency degree.

The dependency degree value is obtained by adding up the slice values for each variable. By using Press. 2, obtained the value of dependency degree on the dimensions of social support and informative support for mental health in Table 6.

Table 6. Dependency Degree

Variable	y_1	y_2	y_3
x_6	0,024	0,056	0,064
x_7	0,040	0,032	0,064

Responding to the results of Table 6, it is known that students majoring in Al-Qur'an and Tafsir Science feel that the facilities and materials obtained do not reduce the feeling of inability to carry out online learning. The interactions that occur during the pandemic with peers and family are also not enough to prevent loneliness which can lead to higher depression and anxiety.

3.3. Mental Health Model Based on Ordinal Logistic Regression

At this stage, with the help of the IBM SPSS Statistics 22 software, the results of the model's feasibility test (goodness of fit) were obtained. The chi-square Deviance value was 58.790 for the distraction dimension, the avoidance dimension was 69,536, and 107.726 for the awareness-raising dimension. With a p-value of 1.00, the logistic regression model obtained is feasible to use. For the general model of ordinal logistic regression, it can be seen in Table 7.

Table 7. Parameter Estimation Results for Mental Health Dimensions

y_1	β	sig.	y_2	β	sig.	y_3	β	Sig.	OR
$[y_1 = 0]$	3,36	0,01	$[y_2 = 0]$	3,25	0,01	$[y_3 = 0]$	1,19	0,04	$1,34 \times 10^{-8}$
$[y_1 = 1]$	5,03	0,00	$[y_2 = 1]$	3,59	0,00	$[y_3 = 1]$	2,08	0,00	0,338
$[y_1 = 2]$	6,25	0,00	$[x_2 = 0]$	-1,08	0,00	$[y_3 = 2]$	4,38	0,00	$9,44 \times 10^{-10}$

y_1	β	sig.	y_2	β	sig.	y_3	β	Sig.	OR
$[x_1 = 1]$	-18,12	0,00				$[x_5 = 0]$	-20,78	0,00	

Based on Table 7, obtained 8 logit models for the mental health of students majoring in Al-Qur'an and Tafsir Science class 2018, UIN Suska Riau. The general model of ordinal logistic regression is as follows:

$$\text{Logit}(\text{Disorder}_{[Normal]}) = 3,365 - 18,12KD \quad (7)$$

$$\text{Logit}(\text{Disorder}_{[PTSD \text{ mild symptoms}]}) = 5,030 - 18,12KD \quad (8)$$

$$\vdots \quad \vdots$$

$$\text{Logit}(P. \text{Awareness}_{[PTSD \text{ mild symptoms}]}) = 2,078 - 20,78DP \quad (13)$$

$$\text{Logit}(P. \text{Awareness}_{[PTSD \text{ moderate symptoms}]}) = 4,386 - 20,78DP \quad (14)$$

Based on the calculation of the odds ratio, it can be seen that low self-awareness for students has the potential to experience PTSD symptoms of $1,341 \times 10^{-8}$ times. Students who are reluctant to do good are at risk of experiencing PTSD symptoms by 0.338 times and $9,439 \times 10^{-10}$ times for students who do not get the encouragement to move forward. Each dimension that has a relationship with mental health has a very small risk of PTSD symptoms. These results are in line with research [17] where the stress level of students is only 0.616 times greater at risk of increasing when the awards received by students are few. Based on Nagelkerke's coefficient of determination, it is 0.218 or 21.8% for mental health with the dimensions of distraction and avoidance. Dimensions of increased awareness of 0.180 or 18%. This means that 79% and 82% are related to factors not found in this study.

4. CONCLUSION

Statistical and non-statistical approaches used in this study were suitable for categorical data. Dealing with the result of the statistical approach, namely the chi square test and ordinal logistic regression, the dimensions of the two independent variables, it indicated it had a relationship with the mental health of students of Al-Qur'an and Tafsir Sciences. These results were reinforced by a non-statistical approach using a dependency degree, however the percentage of the dependency level of the response variable on the variable was very small, it implies the mental health of students during Covid-19 is more related to other factors not included in this study such as economic factors, the environment around the place, and support from lecturers. Furthermore, it is expected that further research will know more about the respondent's character and expand the connection so that data collection runs smoothly and well.

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