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Confirmatory Factor Analysis of the DASS-18 Scale for Assessment of Depression, Anxiety, and Stress Symptoms

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Abstract
Mental health is a crucial aspect of individual well-being, and accurate assessment of psycholocccgical distress is important for effective prevention and intervention efforts. This study aims to test the validity and reliability of the Depression, Anxiety and Stress Scale-18 (DASS-18) in the context of the Indonesian population. DASS-18 was tested on 170 students aged 13-14 years spread throughout Indonesia. Confirmatory factor analysis (CFA) was used to validate the DASS-18 factors, using a number of indices to measure model fit. The results of the analysis show that the DASS-18 is a valid and reliable tool for measuring psychological distress, with each factor showing excellent reliability. In addition, the significant positive relationships between DASS-18 factors, such as stress-anxiety, stress-depression, and anxiety-depression, underscore the close interconnection between these constructs.

Keywords *Depression, Anxiety and Stress Scale (DASS), Mental Health, Valid, Reliable, Factor.*

Introduction

The growing global impact of mental health issues has brought them into the spotlight within the last decade. The 2019 Global Burden of Disease research ranks depression and anxiety disorders as the 13th and 24th greatest causes of disability worldwide, respectively (Vos, 2020). Approximately 14% of individuals aged 10 to 19 worldwide are impacted by mental health issues (WHO, 2021). Many of these conditions are not acknowledged and consequently not treated, accounting for 13% of the worldwide disease burden as stated by the World Health Organization (WHO, 2021). Issues related to mental health in children and adolescents can have adverse effects on their physical health, academic achievements, and social interactions (Ifdil, Lela, et al., 2022). They can also result in substance misuse, self-harm, and suicidal conduct. Mental health illnesses can persist from early developmental stages into adult life, impacting individuals throughout their lifespan (Ifdil et al., 2020). Assessing the mental health of adolescents is necessary before creating and executing preventative and intervention strategies. Thus, a dependable and accurate tool designed for evaluating the mental health conditions of this group is essential and promptly required.

The Depression Anxiety Stress Scale for Youth (DASSY) is a recently created tool designed to thoroughly evaluate the adverse emotional states of depression, anxiety, and stress in children and adolescents (Cao et al., 2023). The DASS-Y is the adolescent adaptation of the Depression Anxiety Stress Scale (DASS) created by Szabó and Lovibond in April 2022. Their research team has been conducting investigations in this field since 2006. The complete DASS comprises 42 items categorized into three self-report subscales that evaluate symptoms of depression, anxiety, and stress. Aside from the complete 42-item version, there are also abbreviated variants with 21 items (DASS-21), 12 items, 9 items, and 8 items. A higher overall score on each subscale indicates a more severe reported symptom. The psychometric features

of all versions have been validated by a substantial body of published empirical research (Thapa et al., 2022; Tonsing, 2014).

The DASS-42 scale is a self-report instrument created to highlight distinctions between symptoms of depression and anxiety, while also identifying their shared characteristics known as stress (Makara-Studzińska et al., 2022). Presently, it is extensively utilized for screening in both non-clinical (Dreyer et al., 2019; Gomez et al., 2020; Habibi et al., 2017; Kyriazos et al., 2018) and clinical groups with diverse illnesses (Ali & Green, 2019; Park et al., 2020; Randall et al., 2017). The DASS-42 questionnaire has a notable drawback due to its extensive length, caused by the high number of items, leading to a longer examination duration (Lee et al., 2019). Shortened versions were made for various reasons: 21-item (Dreyer et al., 2019; Ifdil, Syahputra, et al., 2022; Kyriazos et al., 2018; Lee et al., 2019; Park et al., 2020; Randall et al., 2017), 18-item (Oei et al., 2013), 12-item (Lee et al., 2019), and 9-item (Kyriazos et al., 2018). The 21-item version is widely utilized in diverse clinical and nonclinical populations globally. It is recognized for having strong psychometric properties (Lee et al., 2019; Osman et al., 2012). The factor structure of the whole DASS-42 version is not well-defined yet, aiming to optimize the distinctions between depression and anxiety symptoms. There are 89 analyses in the literature that examined 4, 3, 2, or 1-factor models, considering and excluding correlated errors. These analyses were conducted on data collected using varying numbers of questions in the entire questionnaire (Henry & Crawford, 2005; Yeung et al., 2020). Developing abbreviated versions of the scale is motivated by the quest to identify the DASS factor model with the most favorable psychometric characteristics.

Despite the widespread use of the DASS-42 scale for assessing depression, anxiety, and stress symptoms in both clinical and non-clinical populations, its extensive length poses a practical challenge, resulting in longer examination durations. Additionally, while shortened versions have been developed, there is still ambiguity regarding the optimal factor structure of the scale for distinguishing between depression and anxiety symptoms effectively. This research aims to address the gap by systematically examining the factor structure of the DASS-18 scale abbreviated versions. By conducting a comprehensive review of the literature and analyzing existing data from various studies, the study seeks to identify the factor model with the most favorable psychometric characteristics. Ultimately, the goal is to contribute to the refinement and optimization of the DASS scale for more efficient and accurate assessment of depression and anxiety symptoms in diverse populations.

Method

Initially, normality was assessed by analyzing the distributional indices for each item in the DASS-21. Cohen et al. (2003) recommend using cut-off values below 2 for skewness and below 7 for kurtosis. We analyzed the Pearson r correlations among the DASS-21 items. Correlations ranging from 0.20 to 0.40 suggest acceptable item consistency. Correlations below 0.20 suggest items loading on several factors, whereas correlations above 0.40 imply that the items do not capture a significant amount of variance in the specific component they load on (Michalos, 2015). We performed a confirmatory factor analysis (CFA) on the DASS-21 items to assess the fit of the predictive model using JASP (Goss-Sampson, 2018). We developed a model including (Lovibond & Lovibond, 1995) framework of three adverse emotional conditions: depression, anxiety, and stress, which includes seven components. The study initially assessed Mardia's test of multivariate normality and Mahalanobis d-squared statistic (Hair et al., 2010). The sample was tested on 170 students spread throughout Indonesia with an age range of 13-14 years, respondents consisting of 30.6% (n=52) men and 69.4% (n=118) women. Sampling testing was carried out using multi-stage random sampling.

The data obtained was then analyzed using confirmatory factor analysis (CFA) to test the validity and reliability of DASS using the LISREL application. Confirmatory Factor Analysis (CFA) was conducted to validate the factors associated with the DASS, and a number of indices

were used to identify the extent of model fit. In CFA it is important to choose the appropriate index that shows the best fit (Hooper et al., 2008; Sumaryanto et al., 2019). In this study, the model was assessed using goodness of fit statistics with eight indicators: RMSEA; NFI, NNFI, CFI; IFI; RFI; SRMR, and GFI (Heiss et al., 2020; Hooper et al., 2008; Kartowagiran et al., 2019). In addition, reliability testing was carried out by determining the reliability of the DASS composite.

Result and Discussion

Descriptive statistics of the items

Eighteen items were measured by mean, standard deviation, skewness, and kurtosis (Table 1). The total mean was 1.16 (S.D = 0.77), and the range was from 0.53 to 1.48, with a standard deviation of 0.61 to 0.94. Skewness (< 2) and ranged from 0.03 to 1.44, and kurtosis (< 7) ranged from -0.66 to 1.61.

Table 1. Descriptive statistics (n = 170; items = 18)

Code	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
S1	1.31	0.63	0.53	0.19	0.42	0.37
S3	1.32	0.73	0.38	0.19	0.06	0.37
S4	1.12	0.75	0.23	0.19	-0.29	0.37
S5	0.84	0.66	0.31	0.19	-0.25	0.37
S7	1.41	0.78	0.03	0.19	-0.39	0.37
A2	0.82	0.84	0.71	0.19	-0.28	0.37
A3	1.45	0.78	0.31	0.19	-0.30	0.37
A4	1.39	0.85	-0.04	0.19	-0.66	0.37
A5	1.48	0.75	0.41	0.19	-0.26	0.37
A6	1.06	0.85	0.35	0.19	-0.65	0.37
A7	1.26	0.87	0.25	0.19	-0.58	0.37
D1	0.89	0.61	0.21	0.19	0.36	0.37
D2	1.41	0.73	0.26	0.19	-0.16	0.37
D3	0.82	0.81	0.75	0.19	-0.01	0.37
D4	1.44	0.73	0.32	0.19	-0.15	0.37
D5	1.31	0.71	0.20	0.19	-0.07	0.37
D6	1.05	0.94	0.54	0.19	-0.64	0.37
D7	0.53	0.76	1.44	0.19	1.61	0.37

Confirmatory Factor Analysis (CFA)

Validity and reliability studies must be conducted to validate the scale and confirm its ability to produce appropriate information (Ercan & Kan, 2004). Cross-validation of the three factors identified through CFA, as recommended (Harerimana & Mtshali, 2020) multicollinearity was identified among the factors as independent variables. In table 2 there is a positive correlation between the factors in the DASS, for example: stress-anxiety (r = 0.93), stress-depression (r = 0.98) and anxiety-depression (r = 0.82), meaning that there is a significant positive relationship between factor ($p < 0.05$). Furthermore, Polit and Beck stated that it is

recommended that items be removed from the scale if they do not meet the requirements for a coefficient value lower than 0.30 (Polit & Beck, 2004). Based on Polit and Beck's theory, the researchers determined that items with loading factors below 0.30 were not used, and 18 items met the loading factor requirements in this study of 0.34 to 0.66 (Table 3).

Table 2. Correlation matrix of the factors in the CFA model

	Stress	Anxiety	Depression
Stress	1.00		
Anxiety	0.93	1.00	
Depression	0.98	0.82	1.00

Table 3. Results of estimates in the CFA model (n = 170; items = 18)

Factor	Code Item	Loading Factor	Z-Value	R^2	CV	AVE
Stress	S1	0.37	8.13	0.35	0.86	0.50
	S3	0.52	9.73	0.46		
	S4	0.54	10.56	0.53		
	S5	0.38	7.98	0.33		
	S7	0.45	7.90	0.33		
Anxiety	A2	0.56	9.98	0.49	0.94	0.55
	A3	0.52	9.28	0.44		
	A4	0.58	9.46	0.46		
	A5	0.52	9.76	0.47		
	A6	0.53	8.53	0.39		
	A7	0.58	9.49	0.46		
Depression	D1	0.34	7.53	0.31	0.94	0.50
	D2	0.48	9.03	0.42		
	D3	0.55	9.69	0.46		
	D4	0.54	10.90	0.55		
	D5	0.48	9.44	0.45		
	D6	0.66	9.81	0.48		
	D7	0.44	7.78	0.34		

Apart from that, table 3 also shows the composite reliability (CV) for each DASS factor (Stress = 0.86; Anxiety = 0.94; and Depression = 0.94), meaning that the reliability for each factor is very good and the Average Variance Extracted (AVE) value is very good. on each DASS factor (Stress = 0.50; Anxiety = 0.55; and Depression = 0.50) meaning that the overall amount of variance in the indicator explained by the latent construct is acceptable.

The model with standard estimates is presented in Fig. 1. Chi-square goodness of fit statistics is not statistically significant ($\chi 2$ = 156.51, d.f = 125, p = 0.02953, RMSEA = 0.039). Although the Chi-square statistic tends to be a statistically significant test, it is very sensitive to model fit, and tends to reject the model when the sample or model is large (Khine, 2013; Yuan & Chan, 2016). Due to the limitations of Chi-square, several other indices were used to assess model fit using Goodness of Fit Statistics with eight indicators: RMSEA; NFI, NNFI, CFI; IFI; RFI; SRMR, and GFI.

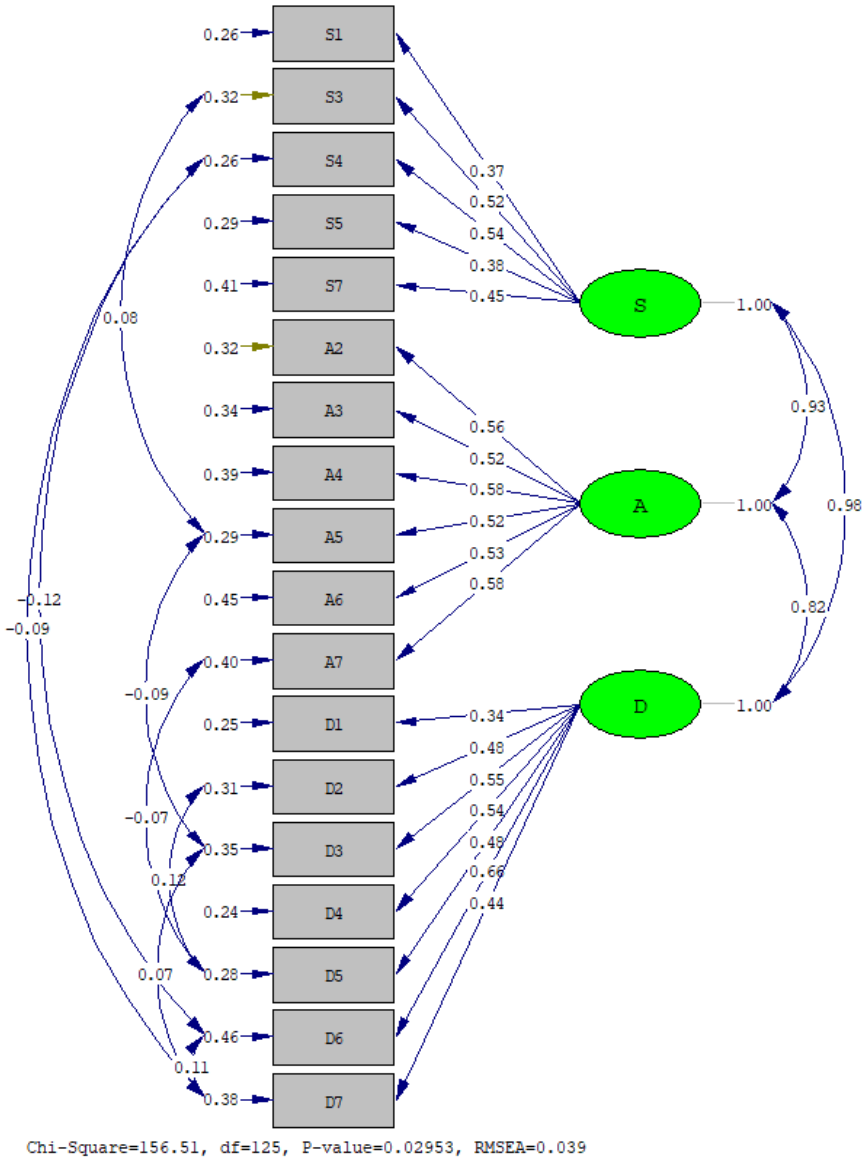

Figure 1. CFA Model Fit DASS (with standardized estimates).

Names of Factors: S (Stress); A (Anxiety); D (Depression).

Table 4. Goodness of Fit Statistics

Goodness of Fit Statistics Indicator	Standard Value	Result	Conclusion
RMSEA	≤ 0.08	0.039	Good fit
NFI	≥ 0.90	0.96	Good fit
NNFI	≥ 0.90	0.99	Good fit
CFI	≥ 0.90	0.99	Good fit
IFI	≥ 0.90	0.99	Good fit
RFI	≥ 0.90	0.96	Good fit
Std. RMR	≤ 0.05	0.048	Good fit
GFI	≥ 0.90	0.91	Good fit
CV	≥ 0.70	0.99	Very good
AVE	≥ 0.50	0.502	Acceptable

Table 4 shows the results of DASS Goodness of Fit Statistics: RMSEA = 0.039 (< 0.08); NFI = 0.96 (> 0.90); NNFI = 0.99 (> 0.90); CFI = 0.99 (> 0.90); IFI = 0.99 (> 0.90); RFI = 0.96 (> 0.90); Std RMR = 0.048 (< 0.05); and GFI = 0.91 (> 0.90). Goodness of Fit Statistics DASS provides excellent results with good fit conclusions for the DASS model. Apart from that, the reliability value of DASS is very good with a CV value = 0.99 and the overall amount of variance in the indicators explained by the latent construct is acceptable (0.502). The results show that the model in Figure 1 is suitable and valid and reliable for measuring depression, anxiety and stress (DASS-18).

Discussion

The findings of this research show that the composite reliability (CV) for each DASS factor is (Stress = 0.86; Anxiety = 0.94; and Depression = 0.94), meaning that the reliability for each factor is very good and the Average Variance Extracted (AVE) value for each -each DASS factor (Stress = 0.50; Anxiety = 0.55; and Depression = 0.50) means that the overall amount of variance in the indicator explained by the latent construct is acceptable, and the DASS Goodness of Fit Statistics provides very good results with the conclusion of good fit in the DASS model. The psychometric qualities of the DASS-21 have been investigated in a variety of adult populations, and the findings have been positive. Broadly speaking, research has documented favorable internal consistency for both the three scales and the overall score. Alpha coefficient estimates for the Depression, Anxiety, and Stress scales in clinical (Antony et al., 1998; Bottesi et al., 2015) and nonclinical samples (Sinclair et al., 2012; Wang et al., 2016) span a specific range of alpha coefficient estimates in relation to each scale. Although less frequently documented, internal consistency for the entire scale is typically assessed and reported as a value ranging from 0.92 to 0.96 (Vasconcelos-Raposo et al., 2013; Wang et al., 2016). The convergent and discriminant validity of the DASS-21 Depression and Anxiety scales have been deemed satisfactory when compared to other anxiety and depression measures, respectively. The Beck Depression Inventory (BDI) and the State-Trait Anxiety Inventory (STAI) are constructs with which the anxiety scale correlates strongly. The BADI (Strunk et al., 2015) and the State-Trait Anxiety Inventory (Gloster et al., 2008) are also constructs with which the depression scale is highly correlated.

The implication of this research is that in clinical practice, the DASS-18 may serve as a valuable screening tool to identify individuals experiencing elevated levels of stress, anxiety, and depression. Early detection of these symptoms can facilitate timely intervention and support, which can ultimately improve patient outcomes. Overall, the findings from this study confirm the utility of the DASS-18 as a reliable and valid measurement tool for assessing psychological distress. Its strong psychometric properties make it a valuable tool for both researchers and health practitioners, contributing to advances in mental health assessment and intervention efforts.

Conclusion

The results of this research show that DASS-18 is valid and reliable for taking measurements, each factor has a very good reliability value. Furthermore, the goodness of fit statistics of DASS-18 provide very good results with the conclusion of good fit for the DASS-18 model. Another finding is that there is a significant positive relationship between the DASS-18 factors, for example: stress-anxiety (r = 0.93), stress-depression (r = 0.98) and anxiety-depression (r = 0.82). The results of this research can guide counselors and therapists to intervene in depression, anxiety and stress problems, as well as design guidance and counseling service programs implemented by guidance and counseling teachers in schools and guidance and counseling service units on campus. The three-factor model in the DASS-18 will be a useful

tool for assessing individual behavioral tendencies towards psychological problems such as: depression, anxiety and stress.

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