

Longitudinal Measurement Invariance of the Depression Anxiety Stress Scale (DASS-21) in Filipino Adolescents

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Citation

Simon PD & Bernardo ABI. 2022.
Longitudinal measurement
invariance of the Depression
Anxiety Stress Scale (DASS-21) in
Filipino adolescents Transactions
NAST PHL 44. [doi.org/10.57043/
transnastphl.2022.2557](https://doi.org/10.57043/transnastphl.2022.2557)

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ABSTRACT

The Depression Anxiety and Stress Scale-21 (DASS-21) is a commonly used screener of mental health symptoms, and researchers continue to study the scale's psychometric properties in different cultures and age groups. We tested the longitudinal measurement invariance of the DASS-21 across two time points on a sample of 312 Filipino adolescents. The confirmatory factor analysis indicated adequate fit between the hypothesized three-factor solution and the data from the adolescent sample. The DASS-21 also exhibited strict longitudinal invariance, and the subscales also displayed adequate reliability in the two time points. The results are the first demonstration of longitudinal invariance with a Filipino sample and provide evidence that DASS-21 can be useful in both screening and in monitoring severity of different categories of symptoms over time, particularly among school-based Filipino youth.

Keywords: Depression, anxiety, stress, confirmatory factor analysis, reliability, longitudinal measurement invariance

Abbreviations: DASS, Depression Anxiety Stress Scale; EM, Expectation-Maximization; MCAR, Missing completely at random;

INTRODUCTION

The early identification and screening of depression and anxiety symptoms in vulnerable individuals is an important component of global efforts to prevent the onset of depression and anxiety (World Health Organization 2017). Among the vulnerable populations are adolescents, including school-based youth (January et al. 2018). One way to enable early detection of mental health issues is to use validated self-report measures that are cost-efficient but that are also appropriate for measuring changes in severity categories over time.

The Depression Anxiety Stress Scale (DASS; Lovibond and Lovibond 1995) is a widely used tool to measure core symptoms of depression and anxiety. Originally a 42-item measure, a short form (DASS-21) was developed to allow for more efficient use in various settings. DASS-21 displayed adequate psychometric properties in adolescent (Le et al. 2017; Lee 2019; Szabó 2010), clinical and non-clinical samples (Lee et al. 2019). While evidence for a modified one-factor model exists (Lee 2019), the best model comprised of three factors consistent with the developers' proposed scales (Vignola and Tucci 2014; Yeung et al. 2018). Even the adapted and translated version of the DASS-21 to Brazilian Portuguese (Vignola and Tucci 2014), Turkish (Yildirim et al. 2018), Chinese (Chan and Bernardo, 2017), Bahasa Malay (Musa et al. 2007), Persian (Ashgari et al. 2008) were found to fit the three-factor structure of DASS-21. Factorial invariance of the three-factor structure of DASS-21 across four countries was also demonstrated among adolescents from Australia, Chile, China, and Malaysia (Mellor et al. 2015). While a cross-cultural study demonstrated strong measurement equivalence for the depression and anxiety subscales across Pakistan and Germany, the stress subscale displayed weak measurement invariance (Bibi et al. 2020) and low reliability in another study (Anghel 2020). One study tested the longitudinal measurement invariance of DASS-21 in a clinical population using Classical Test Theory (Page et al. 2007), while two studies found only the Depression scale of DASS-21 to be invariant across time (Brown 2007; Brown and Rosellini 2011).

The DASS-21 is used in the Philippine context (e.g., Montano and Acebes, 2020; Tee et al., 2020), but to date, there is no validity data for the original version of the DASS-21 in a non-clinical sample of university students in the Philippines other than a recently published

validation of the DASS-21 in Ilokano (Bengwasan et al, 2022). This is a point of concern since adolescents in resource-constrained contexts are considered to be some of the most vulnerable (January et al. 2018). There has also been no study on the longitudinal invariance of the DASS-21 in a Filipino sample. Examining the longitudinal measurement invariance of the DASS-21 is needed to prove its adequacy to screen for mental health symptoms and monitor changes in severity of symptoms over time. A longitudinally invariant scale can be used to measure constructs equally in different time points within a same group. In this regard, the present study aimed to test the structural validity of the DASS-21 across two time points.

METHOD

Participants and Procedure

Participants were recruited from a state university in the Philippines, and all students who agreed to participate indicated their signed informed consent before providing data. Scales were administered to undergraduate students from a state university in the Philippines located in the CALABARZON region (Region IV-A) in Southern Luzon. The survey was given twice with a two-month gap between time points. Sample at baseline included 400 students. After Little MCAR's tests turned out non-significant results, missing data were handled using Expectation-Maximization (EM). Students who were not able to accomplish the survey in both time points were dropped from the analysis. Data from 312 students (Men = 30.9%, Women = 69.1%) with a mean age of 18.99 ($SD = 1.17$) were analyzed for the study.

Instrument

Depression, Anxiety, and Stress Scale-21 (DASS-21)

DASS-21 is composed of three seven-item self-report subscales that measure depression, anxiety, and stress (Lovibond and Lovibond 1995). Items are rated from 0 = *did not apply to me at all* to 3 = *applied to me very much*, or *most of the time*, depending on the degree to which the respondents concur with the statements. Scores for each subscale are added and multiplied by two to obtain the final score.

Table 1. Bivalent correlations among DASS subscales across time points.

	DASS-D time 1	DASS-A time 1	DASS-S time 1	DASS-D time 2	DASS-A time 2	DASS-S time 2
DASS-D time 1	--	.61**	.64**	.62**	.48**	.53**
DASS-A time 1			.71**	.41**	.58**	.51**
DASS-S time 1				.45**	.53**	.52**
DASS-D time 2					.66**	.74**
DASS-A time 2						.77**
DASS-S time 2						--

Note: **p < .001; D = Depression; A = Anxiety; S = Stress

RESULTS

Reliability coefficients of the three subscales in the two time points are adequate, with Cronbach's α 's = .76, .67, and .72 for time 1 and .77, .73, and .80 for time 2 depression, anxiety and stress, respectively. Table 1 presents the correlations between the subscales within the two time points and between the two time points. For both time 1 and time 2, all variables displayed strong correlations with each other. The variables also exhibited moderately strong correlations between time points, with time 1 depression and time 2 depression showing the strongest correlation with each other.

Longitudinal Measurement Invariance

Confirmatory Factor Analysis using maximum likelihood estimation was conducted to test longitudinal measurement invariance. DASS-21 consisted of three latent variables (Depression, Anxiety, and Stress), each with seven indicators. Modification indices check revealed that eight pairs of indicators were highly correlated, thus, error terms of items within the same factor were permitted to covary. The three-factor model of DASS-21 indicated adequate fit with the data: $\chi^2 = 345.57$, $df = 178$, $p < .001$, RMSEA = .06, CFI = .90, SRMR = .04, TLI = .88. Although TLI was below criterion, all the other fit indices provide enough indication of a good fit. Factor loadings ranged from .35 to .65 for DASS-Depression, .26 to .63 for DASS-Anxiety, and .27 to .62 for DASS-Stress.

Longitudinal measurement invariance of the DASS-21 across two waves of data collection was then analyzed. Based on recommendations of Barbosa-Leiker et al.

(2011), configural invariance, metric invariance (equal factor loading), scalar invariance (equal factor variance and covariance), and residual variance invariance (equal error variance and covariance) were assessed. Configural equivalence was considered met if the scale's hypothesized model fits well across the two waves of data collection (e.g., model had identical number of factors, and each item loaded onto the same factor for each time point). Metric invariance was considered achieved when there is equivalence at the level of measurement weights. Scalar equivalence was considered attained if there is equivalence across measurement intercepts.

Table 2 displays the results of the longitudinal measurement equivalence test. The variations in CFI and RMSEA indexes between the models are presented. After establishing configural invariance over time, the full slate of factor loadings was examined for similarity over time. Then the scalar invariance was assessed by incorporating equality constraints for the factor loadings as well as equality constraints for the variances and covariances among the latent variables. The final model adds the measurement residuals portion, constraining the residual variance to equality as well as the covariances. DASS-21 featuring three latent constructs and eight pairs of correlated items adequately fit the longitudinal data, demonstrating strict invariance. Differences in CFI between comparison and nested models were less than .02 (Cheung & Rensvold 2002), and the change in RMSEA is lower than .015 (Chen 2007).

Table 2. Longitudinal measurement invariance test of DASS-21.

Model	$\chi^2(df)$	RMSEA	CFI	Δ RMSEA	Δ CFI	SRMR	Δ SRMR
Configural	602.221(356)	.033	.947	--	--	.032	--
Metric	602.221(374)	.031	.950	.002	.003	.037	.005
Scalar	602.221(380)	.031	.952	.000	.002	.045	.008
Residual variance	602.221(409)	.028	.958	.003	.006	.045	.000

Notes. $N=312$; df = degrees of freedom; RMSEA = root mean square error of approximation; CI = confidence interval; CFI = comparative fit index; SRMR = standardized root mean squared residual; Δ RMSEA = differences in RMSEA values between models; Δ CFI = differences in CFI values between models; Δ SRMR = differences in SRMR values between models.

DISCUSSION

The DASS-21 (Lovibond and Lovibond 1995) is a widely used measure that distinguishes among depression, anxiety, and stress, that has been used in the Philippines with very few published studies to support its validity. In this study, the longitudinal measurement invariance across two time points of the three-factor structure of the DASS-21 was confirmed. The subscales also displayed adequate reliability. This demonstrates the instrument's utility not only for screening severity of symptoms of depression, anxiety and stress among Filipino adolescents but also for monitoring actual changes in severity of different categories of symptoms across time. Longitudinal measurement invariance is an indicator of a high- functioning instrument that can be used for both screening and research purposes. The measure can be useful for psychiatrists, mental health clinicians, and counsellors in the early screening of students with potential mental health concerns. Researchers can also utilize it to measure depression, anxiety, and stress in longitudinal study designs due to its apparent stability between administrations. As an abbreviated version of DASS-42, DASS-21 can also be administered more easily to people whose attention and concentration tend to be limited.

Validation of tools that are available in the public domain is an important step towards early prevention and intervention for mental health conditions. Early screening could aid in recognition of warning signs before mental health symptoms develop into full-blown disorders. DASS-21 showing adequate reliability across severity categories means that the instrument can aid in an accurate assignment of individuals to groups based

on the severity of their symptoms. Availability of such a tool is important for university students in resource-constrained settings whose mental health are largely ignored relative to the general population (January et al. 2018). The current study expanded evidence for DASS-21's reliability and longitudinal invariance to non-native-English-speakers within a resource-constrained context, as respondents were undergraduate students in a public university in a developing country where not much attention is being paid to mental health.

Limitations and Recommendations

Though the study has clear contributions, it is not without limitations. Future research on the DASS-21 can aim to gather data from a larger sample of respondents to increase the power of the study. It can be noted that DASS-21 in this sample of Filipino adolescents had less than ideal model fit prior to modification indices check. Thus, further studies on the scale to see how the items can be improved are recommended. Future studies can also consider comparing the results of an investigation of DASS-21's three factor structure with a test of a unified or one-factor model, since this is beyond the scope of the present study. Furthermore, research that validates DASS-21 on different populations with varied socio-demographic characteristics is recommended to increase representativeness. Finally, as the English version of the DASS-21 was used, one way that future studies can further extend this research is through the translation and validation of the DASS-21 in different Philippine languages (see e.g., Bengwasan et al. 2022).

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Appendix**DASS-21 Instructions and Items**

Instructions: Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement. The rating scale is as follows:

0 = Did not apply to me at all

1 = Applied to me to some degree, or some of the time

2 = Applied to me to a considerable degree or a good part of time

3 = Applied to me very much or most of the time

1. I found it hard to wind down (s)
2. I was aware of dryness of my mouth (a)
3. I couldn't seem to experience any positive feeling at all (d)
4. I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion) (a)
5. I found it difficult to work up the initiative to do things (d)
6. I tended to over-react to situations (s)
7. I experienced trembling (e.g. in the hands) (a)
8. I felt that I was using a lot of nervous energy (s)
9. I was worried about situations in which I might panic and make a fool of myself (a)
10. I felt that I had nothing to look forward to (d)
11. I found myself getting agitated (s)
12. I found it difficult to relax (s)
13. I felt down-hearted and blue (d)
14. I was intolerant of anything that kept me from getting on with what I was doing (s)
15. I felt I was close to panic (a)
16. I was unable to become enthusiastic about anything (d)
17. I felt I wasn't worth much as a person (d)
18. I felt that I was rather touchy (s)
19. I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat) (a)
20. I felt scared without any good reason (a)
21. I felt that life was meaningless (d)