

The Factor Structure of the Hospital Anxiety Depression Scale Adapted for Korean Preschool Teacher Candidates During the Coronavirus Disease 2019 Pandemic

Hyelin Jeong¹, Boram Lee¹

Department of Early Childhood Education, Woosong University, Daejeon, South Korea

ABSTRACT

Background: The coronavirus disease 2019 pandemic has remarkably challenged preschool teacher candidates, triggering concerns for their psychological well-being and mental health. Valid and reliable instruments to assess elements of mental health are thus required. The self-rating Hospital Anxiety Depression Scale demonstrates promise as an instrument for the identification and quantification of the states of anxiety and depression in non-psychiatric patients. The Hospital Anxiety Depression Scale is widely applied in both clinical and research contexts. However, no psychometric evaluations have been performed for this instrument with non-clinical samples such as preschool teacher candidates in South Korea. This study purposed to establish the factor structure of the Hospital Anxiety Depression Scale and to validate its Korean version and was conducted online with a sample of preschool teacher candidates during the peak of the coronavirus disease 2019 lockdown.

Methods: Data were collected from 359 undergraduates currently enrolled in a 4-year early childhood education degree program at a private university in Korea. The sample was randomly split to perform exploratory factor analysis and then confirmatory factor analysis respectively to test competing models hypothesized to reflect the factor structure of the Hospital Anxiety Depression Scale.

Results: Supplemental revisions based on confirmatory factor analysis modification indices demonstrated that a correlated 2-factor model with 1 cross-loaded item offered the best fit to the data with adequate internal reliability estimates.

Conclusion: Overall, this study confirms the validity and factor structure of the Korean version of the Hospital Anxiety Depression Scale, which is deemed an acceptable instrument that can be used to measure the symptoms of depression and anxiety in Korean preschool teacher candidates.

ARTICLE HISTORY

Received: April 20, 2022

Accepted: July 6, 2022

Publication date:
August 17, 2022

KEYWORDS: Anxiety, depression, COVID-19, factor structure, preschool teacher candidates, the Hospital Anxiety Depression Scale

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic exerted an unprecedented impact on numerous pivotal aspects of life. The COVID-19 pandemic has infected more than 15 000 000 individuals to this date and has caused more than 19 000 deaths in South Korea (hereafter Korea).¹ It remains a major focus of public health worldwide. Most countries have adopted measures such as movement restrictions, including widespread social distancing and self-quarantining, to some extent to reduce the virus spread.² Such emergency responses were urgently adopted to control the COVID-19 pandemic and limit the exposure of citizens to the deadly virus. However, the regulations evoked unfavorable mental health outcomes such as depression, anxiety, and stress in populations across the world.^{2,3} Global trends demonstrate that in general, adults experienced heightened mental health difficulties because of the COVID-19 pandemic. For example, an online survey

of the general population (aged 19-60 years) in Korea classified 31% of the participants as at risk for depression and 23% of participants as at risk for anxiety.⁴ Another study conducted with the general adult population in the United States found a 3.7-fold and a 7.5-fold higher prevalence of moderately severe and severe symptoms of depression, respectively, than pre-pandemic rates.⁵

University students were known to be particularly vulnerable to the development of mental disorders even before the current pandemic and were identified as experiencing high levels of anxiety and depressive symptoms.⁶ The advent of COVID-19 substantially raised the extent of their difficulties.

Most governments worldwide shut down educational institutions temporarily to reduce the spread of COVID-19. Thus, university students were compelled to

Corresponding author: Boram Lee, e-mail: blee@wsu.ac.kr

Cite this article as: Jeong H, Lee B. The factor structure of the hospital anxiety depression scale adapted for Korean preschool teacher candidates during the coronavirus disease 2019 pandemic. *Psychiatry Clin Psychopharmacol.* 2022;32(3):196-204.



Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

rearrange their daily lives.⁷ The ongoing pandemic and its associated mandatory physical distancing measures have forced many students to encounter unprecedented challenges. They have had to shift their in-person learning and extracurricular activities to the digital sphere, which has caused substantial changes in their customary lifestyles.⁷⁻⁹ Their academic context was hence intensely influenced by the lockdowns imposed in their countries.⁹ Students who major in early childhood education experience the same academic stressors as other university students, such as examinations, assignments, poor time management, and peer competition; however, along with these myriad stressors, preschool teacher candidates have unique stressors that go beyond college education, as they are required to undertake a teaching practicum along with a theoretical study load, which further adds to the already stressful environment. The teaching practicum is commonly rated among the most stressful study tasks for preschool teacher candidates, and this needs to be seen in terms of the relationship between teacher candidates' decisions to stay in the teaching profession and their stress levels.¹⁰ Study demands can create varying levels of stress among students and, when unmanaged, can produce undesirable health and career outcomes.

Schools of education responsible for the preparation of prospective teachers faced a special set of challenges in the context of the COVID-19 pandemic.¹¹ The closure of university and college campuses exerted a great impact on teacher preparation programs for preschool educators in training. Field-based observations have long been considered a critical general component of pre-service teacher education programs. These activities are crucial for the effective execution of the practicum of pre-service teachers^{11,12} because they offer candidates opportunities of observing specific professional skills. Teachers in training can gain practical experience through field activities and receive constructive feedback on their progress from experienced teacher mentors and university supervisors.¹¹ However, many preschool teacher candidates could not accrue such traditional field experiences because of COVID-19. Adjustments were made in Korea to the hours of field-based study required for certification: they were

reduced from 6 to 4 weeks.¹³ However, the reduced time for field observations also definitely generated distress in teacher candidates who sensed heightened anxiety because scheduled activities were postponed, their time in the field was reduced, and their field embedded lessons were altered.¹²

The growing prevalence of mental health problems in university students, including preschool teacher candidates, is a public health concern that necessitates a reliable and valid assessment tool for the identification of their mental health during the pandemic.

Counseling/medical centers on college campuses in places with limited resources must prioritize the screening of university students for anxiety and depression.^{14,15} However, numerous instruments that are currently applied in university settings were not specifically developed for a university population, for example, the Beck Depression Inventory (Beck et al.¹⁶ 1961) or the Outcome Questionnaire-45.¹⁷ Some of the used measures have been designed for university students, but they are too lengthy for widespread usage or to monitor progress, or there is limited evidence of their reliability and validity.¹⁸ Hence, the Hospital Anxiety Depression Scale (HADS)¹⁹ developed to measure symptoms of anxiety and depression could be a useful screening instrument for the appropriate assessment of mental health concerns in campus settings. The HADS is a self-rating test with only 14 items. It was initially developed for use in clinical settings and was meant for hospital out-patients aged between 16 and 65 years.¹⁹ Nevertheless, it is advantageous for university counseling centers given its brevity and its easy and convenient application make it an efficient method of assessing anxiety and depression in individuals.²⁰ Thus, the HADS could represent a theoretically sound instrument for the large-scale screening of anxiety and depression in university student populations. However, the factorial structure of the Korean version of the HADS must be established before such tasks are undertaken.

The HADS has been translated into many languages and has been applied to populations in discrete cultures, including Korea.^{21,22} The Korean version of the HADS has been validated and available for some time, but its applicability to preschool teacher candidates has never been established. The utility of the HADS in the non-hospitalized adult population is also unclear. Two studies have performed factor analysis on the Korean version of the HADS and assessed the reliability and validity of the measure. The following results have been consistently identified: (1) the HADS has demonstrated high internal consistency and (2) factor analysis produced a 2-factor solution. Although Oh et al.²¹ and Choi et al.²² previously confirmed the psychometric properties of the Korean version of the HADS, at least 2 factors currently limit its effective use in the context of Korean universities. First, Oh et al.²¹ included patients with anxiety and depression

MAIN POINTS

- University students, including the preschool teacher candidates were known to be particularly vulnerable to the development of mental disorders even before the COVID-19 pandemic.
- The Korean version of the HADS has been validated and available for some time, but its applicability to preschool teacher candidates has never been established.
- Our findings suggest that the Korean version of the HADS consists of two correlated measures of anxiety and depression.

and non-psychiatric participants in their study, whereas Choi et al.²² included patients with Parkinson's disease. Our university student sample may differ in important ways from the clinical samples of psychiatric patients. Second, the age range in the normal participant samples used by Oh et al.²¹ was 18-65 years, which—although typical of questionnaire validation studies—was a much broader range than that of the university students in our study. Due to these limitations, previous studies have not provided sufficient validation of the applicability of the HADS to Korean university students. Psychometrically, additional cross-cultural validation is warranted for the HADS. Moreover, the extant analyses of the underlying factor structure of the HADS have been quite inconsistent. For example, a few studies reported a unidimensional factor,^{22,23} while many others have suggested 2-dimensional factors aligned with Zigmond and Snaith's anxiety and depression subscales.^{20,24,25} Yet other studies have evidenced that the fundamental factor structure of the HADS comprises 3 factors instead of 2.²⁶⁻²⁸ In such situations, it is more apt to employ confirmatory factor analysis (CFA) for this validation study. This methodology could yield a more definitive determination of the factor structure of the HADS.²⁹ Thus, this study primarily aimed to evaluate the factor structure of the HADS in a sample of preschool teacher candidates in Korea. To this end, it tested competing models suggested by the literature on the HADS using a range of fit measures and CFA to determine the structural model offering the best fit to the data.

MATERIAL AND METHODS

Participants

A convenience sample of 359 female students was recruited from a 4-year private university in the central region of Korea. The total sample comprised undergraduate students enrolled in an early childhood education degree. The participants' ages ranged between 18 and 26 years, with a mean of 21.37 years (standard deviation (SD)=1.23). The majority of the respondents belonged to the age range of 18-22 years.

Procedures

The study was approved by the Institutional Review Board of Woosong University (Protocol Code: 1041549-190709-SB-76). Data were collected via an online survey administered between January 8 and March 8, 2021. The campus was then on lockdown. Hence, an e-mail invitation to the online survey was sent to all enrolled students through the university's online system. The Google documents platform was used to create the online survey. Interested participants who clicked the link included in the e-mail invitation were directed to the online study questionnaire and were required to register their consent by clicking

the option "I agree to participate." Informed consent was obtained from all subjects involved in the study. The complete questionnaire was presented only to those who clicked this consent option. Emails explained the purpose of the study, clarified that participation in the study was voluntary and confidential, and instructed students about how to fill in the questionnaire.

Instrument

The HADS is a 14-item self-reported questionnaire classified into the HADS-Anxiety (HADS-A) and HADS-Depression (HADS-D) subscales, each assigned 7 items.¹⁹ All statements are scored on a 4-point Likert-like scale ranging from 0 (not at all) to 3 (always). Six items on the HADS (items 1, 3, 5, 6, 8, 10, 11, and 13) are reverse scored. Item scores are totaled after adjusting for the 6 reverse-scored statements, for which higher scores represent higher levels of anxiety and depression. The subscale scores on the HADS-A and the HADS-D range from 0 to 21. Zigmond and Smith recommend cut-off scores for anxiety and depression as follows: a tally of 7 or less indicates a "non-case" (no or mild incidence), 8-10 signifies a "doubtful case" (moderate), and 11 or more denotes a "definite case" (severe). This study used the Korean version of the HADS which has demonstrated good internal consistency, reliability, and construct validity in the Korean context and has thus evidenced adequate psychometric properties.²¹

Statistical Analysis

The study's statistical analyses were performed using International Business Machines Statistical Package for the Social Sciences Statistics for Windows, Version 27.0 (IBM SPSS Corp., Armonk, NY, USA). Skewness and kurtosis coefficients were computed for univariate normality analysis purposes and the computed values were within acceptable ranges demonstrating normal univariate distribution (−1.13 to 1.80). Exploratory factor analysis (EFA) was conducted to analyze the structure and dimensionality of the items in the Korean version of the HADS. The sample was randomly split into 2 subsamples of approximately equal size (nEFA=180; nCFA=179). Principal component analysis (PCA) with varimax rotation was used to extract the dimensions of the HADS construct. The Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett's test of sphericity were used to determine the sampling adequacy and the necessity for factor analysis. Criteria used to determine the factor structure were (1) minimum factor eigenvalues of 1, (2) omission of items having factor loadings less than 0.30, and (3) interpretability of the factors.

Next, the factorial validity of the HADS was tested through CFA using AMOS 23.0 software. Covariance matrices were used as input for the maximum likelihood method

of estimation procedures. Several fit indices were used to assess overall model suitability such as relative chi-square (χ^2 /degree of freedom), comparative fit index (CFI), goodness-of-fit index (GFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Acceptable model fit was indicated by the chi-square test divided by the degrees of freedom (χ^2/df) less than 5,³⁰ CFI and GFI values equal to or greater than 0.95,^{30,31} and RMSEA and SRMR values less than 0.08.^{32,33} Akaike information criterion (AIC), a CFI without a cut-off, was also used for model comparison with smaller values signifying better fitting models.³⁴

Four models were tested based on previously conducted empirical research. Model 1 represented a 1-factor model with all 14 items loaded onto a single factor. Model 2 epitomized Zigmond and Smith's original correlated 2-factor model grouped into anxiety and depression items. Model 3 signified a correlated 3-factor model in which the 3 latent variables were denoted as psychomotor agitation, anxiety, and depression according to the assessments of Dunbar et al²⁶, Friedman et al²⁷, and Barth and Martin²⁸. Model 4 tested present study's EFA results. Internal consistency was adjudged using Cronbach's alpha (α). Spearman's ρ , which tests the correlation between subscales, was performed to assess the internal reliability after the most appropriate model was selected.

RESULTS

Descriptive Statistics

Table 1 presents the mean scores and standard deviations of HADS-A and HADS-D. The mean HADS-A subscale score was calculated at 13.5 (SD=2.04), and the mean HADS-D subscale score was 9.10 (SD=1.69). These mean scores were above the values usually used to classify someone is experiencing high levels of distress that might be clinically meaningful, which is usually a score above 8.

Exploratory Factor Analysis

The EFA on the first random split-half sample ($n = 180$) using PCA with varimax rotation was carried out to investigate the underlying dimensional structure of the HADS. The assessment of factorability showed that the KMO measure was 0.86 showing that the sample size used in the study was adequate for EFA, and Bartlett's test of sphericity was significant ($\chi^2 = 1468.2$, $df = 91$, $P < .001$) indicating that the data were suitable for the factor analysis. Principal component analysis suggested a 2-factorial solution with eigenvalues greater than 1, explaining a total of 53.6% of the variance from a total of 14 items. Inspection of the scree plot also supported a 2-factor solution. No item exhibited factor loadings smaller than 0.30 on its hypothesized factor (Table 2). However, item 7 showed a certain degree of dual loadings.

Table 1. Descriptive Statistics for HADS Items

HADS Items	M	SD
HADS-A		
Item 1: Feeling of tension	2.34	0.71
Item 3: Frightened feeling	2.14	0.84
Item 5: Worrying thoughts	1.95	0.80
Item 7: Relaxed feeling	1.18	0.69
Item 9: Butterflies in stomach	0.67	0.69
Item 11: Restless feeling	2.60	0.59
Item 13: Feeling of panic	2.56	0.65
Total score		
HADS-D		
Item 2: Enjoyment	1.08	0.94
Item 4: Laughter	0.56	0.68
Item 6: Cheerful feeling	1.85	0.71
Item 8: Feeling slowed down	1.98	0.86
Item 10: Lost interest in appearance	2.38	0.84
Item 12: Look forward to things	0.76	0.84
Item 14: Enjoyment of book/ radio/ TV	0.49	0.65
Total score	13.5	2.04

HADS-A, Hospital Anxiety Depression Scale-Anxiety subscale; HADS-D, Hospital Anxiety Depression Scale-Depression subscale; HADS, Hospital Anxiety Depression Scale; SD, standard deviation.

Table 2. Factor Loadings of HADS Items in the EFA

HADS Items	Factor 1	Factor 2
HADS-A		
Item 1: Feeling of tension	0.69	
Item 3: Frightened feeling	0.72	
Item 5: Worrying thoughts	0.55	
Item 7: Relaxed feeling	0.41	0.33
Item 9: Butterflies in stomach	0.47	
Item 11: Restless feeling	0.50	
Item 13: Feeling of panic	0.63	
Total score		
HADS-D		
Item 2: Enjoyment		0.77
Item 4: Laughter		0.51
Item 6: Cheerful feeling		0.45
Item 8: Feeling slowed down		0.38
Item 10: Lost interest in appearance		0.62
Item 12: Look forward to things		0.42
Item 14: Enjoyment of book/radio/TV		0.73
Eigenvalues	3.28	1.69
Percentage of variance explained	20.2	33.4
Total percentage of variance explained	53.6	

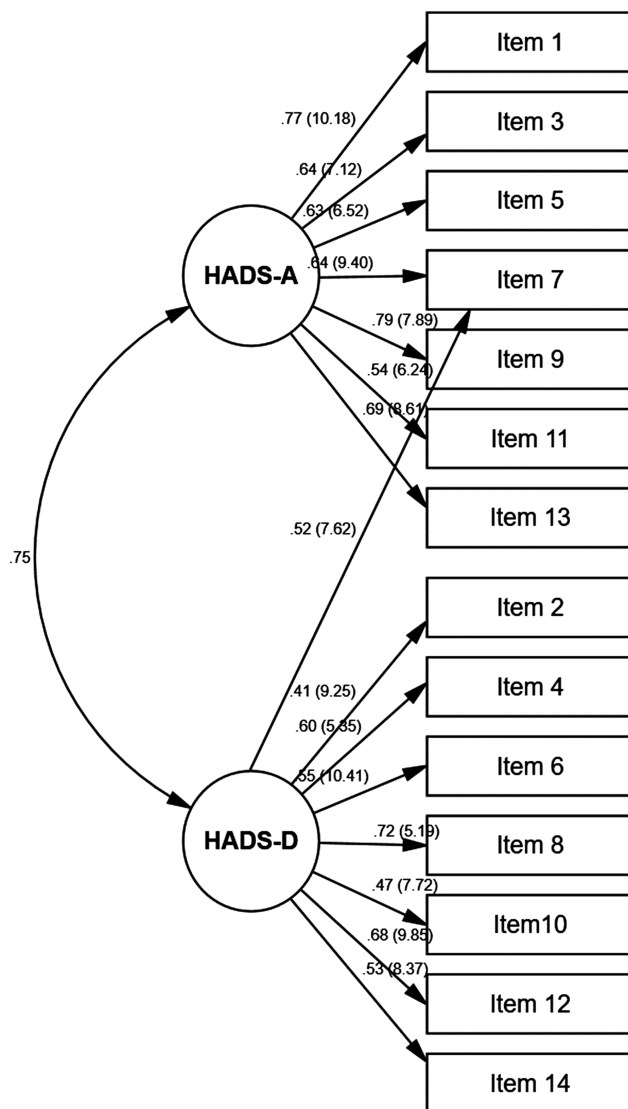
HADS-A, Hospital Anxiety Depression Scale-Anxiety subscale; HADS-D, Hospital Anxiety Depression Scale-Depression subscale; HADS, Hospital Anxiety Depression Scale; EFA, exploratory factor analysis.

Table 3. Goodness-of-Fit Indices of Models for the HADS

Model	<i>k</i>	χ^2	<i>df</i>	χ^2/df	CFI	GFI	RMSEA (90% CI)	SRMR	AIC
Model 1	14	506.8	77	6.6*	0.77	0.85	0.125 (0.115-0.135)	0.079	562.80
Model 2	14	229.0	58	3.9*	0.92	0.95	0.076 (0.074-0.096)	0.061	363.02
Model 3	14	362.7	0.62	5.9*	0.82	0.89	0.116 (0.105-0.128)	0.077	420.72
Model 4	14	229.0	58	3.9*	0.92	0.95	0.076 (0.074-0.096)	0.061	363.02

k, number of items; *df*, degrees of freedom; CFI, comparative fit index; GFI, goodness of fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean residual; AIC, Akaike information criterion.

**P* < .01.



Results of CFA with *t*-values (in brackets)

Two-factor model of the HADS. Factors: HADS-A (Anxiety), HADS-D (Depression).

(*N* = 359; χ^2 = 229.0; *df* = 58; χ^2/df = 3.9; CFI = .92; GFI = .95; RMSEA = .076 (90% CI = .074-.096); SRMR = .061)

Figure 1. Two-factor model of the HADS. Factors: HADS-A (anxiety), HADS-D (depression) (*n* = 359; χ^2 = 229.0; *df* = 58; χ^2/df = 3.9; CFI = 0.92; GFI = 0.95; RMSEA = 0.076 (90% CI = 0.074-0.096); SRMR = 0.061). HADS-A, Hospital Anxiety Depression Scale-Anxiety subscale; HADS-D, Hospital Anxiety Depression Scale-Depression subscale; HADS, Hospital Anxiety Depression Scale; CFA, confirmatory factor analysis; CFI, comparative fit index; GFI, goodness-of-fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual.

Confirmatory Factor Analyses

Table 3 outlines the results of the CFA performed to examine the factor structure of the HADS. Four models were tested: 3 informed by theoretical models and 1 model derived from the results of the EFA using the other split-half sample ($n = 179$).

The fit statistics for the 1-factor model of the HADS demonstrated unacceptable fit on all indices except for SRMR: $\chi^2 = 506.8$, $df = 77$; $\chi^2/df = 6.6$; CFI = 0.77; GFI = 0.85; RMSEA = 0.125 (90% CI = 0.115–0.135); SRMR = 0.079. Conversely, the original correlated 2-factor model and the model informed by our EFA results, which consists of the correlated anxiety and depression factors (model 4), provided a good fit to the data, as evidenced by a decrease in the value of chi-square and the improved GFI, RMSEA, and SRMR statistics. However, the CFI value (0.88) was slightly below the recommended criterion of 0.90 to indicate a good fit. The inspection of the modification indices suggested that the model fit could be improved by allowing cross-loadings for item 7 (an anxiety item: “I can sit at ease and feel relaxed”) on the depression factor. This model was found to suit the data because all fit indices yielded scores in the good to excellent fit range: $\chi^2 = 229.0$; $df = 58$; $\chi^2/df = 3.9$; CFI = 0.92; GFI = 0.95; RMSEA = 0.076 (90% CI = 0.074–0.096); SRMR = 0.061. (Figure 1). The estimated between-factors correlation for this model was computed at 0.75. Finally, the correlated 3-factor model offered a less conducive fit to the data than the 2-factor model: $\chi^2 = 362.7$, $df = 62$; $\chi^2/df = 5.9$; CFI = 0.82; GFI = 0.89; RMSEA = 0.116 (90% CI = 0.105–0.128); SRMR = 0.077. The AIC statistics of 363.02, a value lower than the 1-factor

Table 4. Standardized Factor Loadings for CFA Models

HADS Items	Factor 1	Factor 2
HADS-A		
Item 1: Feeling of tension	0.77	
Item 3: Frightened feeling	0.64	
Item 5: Worrying thoughts	0.63	
Item 7: Relaxed feeling	0.64	
Item 9: Butterflies in stomach	0.79	
Item 11: Restless feeling	0.54	
Item 13: Feeling of panic	0.69	
HADS-D		
Item 2: Enjoyment		0.41
Item 4: Laughter		0.60
Item 6: Cheerful feeling		0.55
Item 8: Feeling slowed down		0.72
Item 10: Lost interest in appearance		0.47
Item 12: Look forward to things		0.68
Item 14: Enjoyment of book/radio/TV		0.53

HADS-A, Hospital Anxiety Depression Scale-Anxiety subscale; HADS-D, Hospital Anxiety Depression Scale-Depression subscale; HADS, Hospital Anxiety Depression Scale; CFA, confirmatory factor analysis.

Table 5. Item-Scale Analysis of the HADS

HADS Items	Correlation of Item with Overall Scale	Cronbach's Alpha if the Item is Deleted
HADS-A		
Item 1: Feeling of tension	0.57	0.87
Item 3: Frightened feeling	0.64	0.86
Item 5: Worrying thoughts	0.54	0.86
Item 7: Relaxed feeling	0.50	0.87
Item 9: Butterflies in stomach	0.59	0.87
Item 11: Restless feeling	0.58	0.87
Item 13: Feeling of panic	0.69	0.86
HADS-D		
Item 2: Enjoyment	0.72	0.88
Item 4: Laughter	0.48	0.87
Item 6: Cheerful feeling	0.44	0.87
Item 8: Feeling slowed down	0.61	0.87
Item 10: Lost interest in appearance	0.50	0.86
Item 12: Look forward to things	0.66	0.87
Item 14: Enjoyment of book/radio/TV	0.52	0.86

HADS-A, Hospital Anxiety Depression Scale-Anxiety subscale; HADS-D, Hospital Anxiety Depression Scale-Depression subscale; HADS, Hospital Anxiety Depression Scale.

(AIC = 562.80) and the 3-factor (AIC = 420.72) models, further confirmed the superior fit of the 2-factor model. All factor loadings were positive and statistically significant for both HADS-A and HADS-D and most exceeded 0.40. The standardized factor loadings are presented in Table 4.

Reliability and Item Analysis

Item properties were analyzed based on corrected item-total correlations and coefficients and variations in Cronbach's alpha coefficients if items were deleted (Table 5). The reliability coefficients measured for scale analysis by Cronbach's alpha were 0.88 for the entire HADS, 0.84 for anxiety, and 0.78 for depression subscales, indicating suitable reliability. The scale's item-total correlations were -0.44 to 0.72 , with low corrected item-total correlations determined for item 4 on the anxiety scale and item 6 on the depression scale. However, Cronbach's alpha did not change substantially for both scales when their corresponding items were eliminated. This outcome indicates the unified reliability of items included in the anxiety and depression scales. Spearman's ρ was moderate between the subscales for the modified 2-factor model.

DISCUSSION

The current study aimed to identify the best-fitting factor structure for the application of HADS for preschool teacher candidates in Korea. To the best of the knowledge of the

authors, this study is one of the first on this sample to perform such an analysis using EFA and CFA. The use of cross-validated EFA and CFA clarified and confirmed the latent structure of the HADS, providing evidence for a 2-factor structure with both methods. This structure is in accordance with the original 2-factor structure found by Oh et al²¹ in the Korean sample. The instrument was thus conceptualized as a 2-factor score representing anxiety and depression. However, the extant investigations have suggested several other factor structures, compromising its dimensionality consensus.^{22,23,26-28} The different factor structures or discrepancies in results reported in the existing literature are partially attributed to the use of (1) individuals with different cultural backgrounds and translated languages; (2) age range distinctions represented by study samples and sample heterogeneity involving children and elderly populations (e.g., 8-101 years old);^{35,36} (3) discrete participant characteristics (e.g., a psychiatric sample vis-à-vis community-based participants);^{20,22,24,27} (4) the use of varying statistical techniques (e.g., EFA vs. CFA); or (5) uneven sample sizes. The present study's findings of a 2-factor model with moderate correlations corroborate the results registered by investigations examining similar samples (i.e., psychologically distressed but not hospitalized members of a community).^{20,24} Moreover, the cross-loading of the current study's EFA and CFA of item 7 aligns with the findings of previous studies.^{20,24,25} This study allowed a cross-loading for item 7 to improve the CFI and attain the commonly accepted minimum model fit value of 0.90. However, this item must be carefully examined. First, item 7 was originally intended to measure anxiety but was found to display significant loading onto the depression factor. This evidence is congruent with past research indicating the problematic nature of item 7, which has been deemed a poor item because it has evinced strong factor loadings for either anxiety or depression in several previous studies that have reported 2-factor solutions with both clinical and non-clinical samples.^{20,24,25} This anomalous and dual-factor loading could emanate from the ambiguous phrasing of item 7.²⁵ That it simultaneously refers to psychomotor agitation ("cannot sit at ease") and inner tension or anhedonia ("cannot feel relaxed") of depression could explain the anomalous dual loading of item 7 on both anxiety and depression subscales.²⁴ Matsudaira et al²⁴ have suggested that the ambiguous phrasing of item 7 should be amended, and the item should be divided into 2 statements in the future to clarify its target construct.

The current study's results for internal consistency demonstrated the satisfactory reliability of the HADS, in correspondence with previous studies reporting findings of 2-factor models.^{20,24,25} Discriminant validity was supported through moderate correlations between the HADS-A and HADS-D subscales. The mean scores for the present study's sample demonstrated the possible presence of

clinically relevant levels of anxiety and depression, usually designated by a score above 8. Snaith and Zigmond's cut-off criterion of HADS-A and HADS-D scores of 8 or more was applied in this study and the results revealed that 87% of the sample accrued scores of 9 or above on the anxiety subscale and 70% accumulated scores of 9 or above on the depression subscale. This finding is consistent with the self-screening of participants, especially in non-hospitalized settings.²⁰ The study was conducted during the peak of the COVID-19 pandemic. Hence, it is understandable that many preschool teacher candidates could have been sensing clinically meaningful levels of distress.

Some limitations must be acknowledged apropos the results obtained by the present study. First, the sample size was somewhat small for CFA, and the findings were limited to students from the Early Childhood Education (ECE) Department in Korea, this could have influenced the study's generalizability. Therefore, the findings reported in the current study do not apply to the broader Korean youth population, which includes males and females or to other populations who are not experiencing psychological distress or who are suffering from a general medical condition. Convenience sampling also highly restricts the representativeness of the samples. Thus, future research initiatives should further test the factor structure of the HADS with diverse non-college-aged populations randomly recruited from the community. Next, the study sample comprised only female participants, which is unsurprising because the gender imbalance in the early childhood education workforce is a reported longstanding global phenomenon.³⁷ Replicating this study with a larger, randomized sample that includes male participants would expand the knowledge of distress in preschool teacher candidates. Finally, the 2-factor model of the HADS should be cautiously interpreted in the present setting given the possible cross-loading of item 7. This item represents a double-barrel question and must be further evaluated and modified to apprehend the originally intended constructs. Finally, future studies should confirm the convergent and discriminant validity of the Korean version of the HADS by examining its association with other anxiety and depression scales. For example, HADS-A focuses on symptoms relating to autonomic anxiety and HADS-D focuses on symptoms relating to anhedonia, while other scales, such as the Beck Depression Inventory and the State-Trait Anxiety Inventory, measure other aspects of depression and anxiety, including guilt, hopelessness, and somatic symptoms. The HADS excludes somatic symptoms.

To conclude, the current study contributes significantly to the existing literature because it is the first to analyze the factor structures of the HADS with a sample of preschool teacher candidates in Korea. Exploratory factor analysis and CFA performed for this study found that the Korean version of the HADS exhibits an underlying 2-dimensional factor structure, an observation consistent with non-hospitalized

samples.^{20,24} It can thus be deduced that the HADS may be deployed as a robust and efficient first-line screening and detection tool in campus settings, especially for students who satisfy the diagnostic criteria for a disorder.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Woosong University (Approval Number: 10415 49-19 0709- SB-76).

Informed Consent: Informed consent was obtained from all subjects involved in the study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - B.L.; Design - B.L., H.J.; Supervision - B.L.; Funding - B.L.; Materials - H.J.; Data Collection and/or Processing - B.L.; Analysis and/or Interpretation - H.J.; Literature Review - B.L.; Writing - B.L., H.J.; Critical Review - B.L., H.J.

Declaration of Interests: The authors have no conflicts of interest to declare.

Funding: This work was supported by Woosong University: [Gran Number: 120933-0988-76].

REFERENCES

1. Cases in Korea, central disaster management headquarters. Available at: <http://ncov.mohw.go.kr/en/>. Accessed March 12, 2022.
2. Liu C, McCabe M, Kellett-Renzella S, Shankar S, Gerges N, Cornish K. Addressing depression symptoms among university students under COVID-19 restrictions-The mediating role of stress and the moderating role of resilience. *Int J Environ Res Public Health*. 2021;18(23):12752. [CrossRef]
3. Chen W, Liang Y, Yin X, Zhou X, Gao R. The factor structure and Rasch analysis of the Fear of COVID-19 Scale (FCV-19S) among Chinese students. *Front Psychol*. 2021;12:678979. [CrossRef]
4. Kim DM, Bang YR, Kim JH, Park JH. The prevalence of depression, anxiety and associated factors among the general public during COVID-19 pandemic: a cross-sectional study in Korea. *J Korean Med Sci*. 2021;36(29):e214. [CrossRef]
5. Ettman CK, Abdalla SM, Cohen GH, Sampson L, Vivier PM, Galea S. Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic. *JAMA Netw Open*. 2020;3(9):e2019686. [CrossRef]
6. Le Vigouroux S, Goncalves A, Charbonnier E. The psychological vulnerability of French university students to the COVID-19 confinement. *Health Educ Behav*. 2021;48(2):123-131. [CrossRef]
7. Villani L, Pastorino R, Molinari E, et al. Impact of the COVID-19 pandemic on psychological well-being of students in an Italian university: a web-based crosssectional survey. *Global Health*. 2021;17(1):39. [CrossRef]
8. Sofianidis A, Meletiou-Mavrotheris M, Konstantinou P, Stylianidou N, Katzis K. Let students talk about emergency remote teaching experience: secondary students' perceptions on their experience during the COVID-19 pandemic. *Educ Sci*. 2021;11(6):268. [CrossRef]
9. Zurlo MC, Cattaneo Della Volta MF, Vallone F. COVID-19 Student Stress Questionnaire: development and validation of a questionnaire to evaluate students' stressors related to the coronavirus pandemic lockdown. *Front Psychol*. 2020;11:576758. [CrossRef]
10. Geng G, Midford R, Buckworth J. Investigating the stress levels of early childhood, primary and secondary pre-service teachers during teaching practicum. *JTEFS*. 2015;17(1):35-47. [CrossRef]
11. VanLone J, Pansé-Barone C, Long K. Teacher preparation and the COVID-19 disruption: understanding the impact and implications for novice teachers. *Int J Educ Res Open*. 2022;3:100120. [CrossRef]
12. Atkins C, Danley A. Supporting teacher candidates during COVID-19: lessons learned. *Educational Renaissance*. 2020;9:31-40.
13. *Certification for Childcare Teacher*. Available at: <http://chrd.childcare.go.kr>. Accessed March 12, 2022.
14. Erdur-Baker O, Aberson CL, Barrow JC, Draper MR. Nature and severity of college students' psychological concerns: a comparison of clinical and nonclinical national samples. *Prof Psychol Res Pract*. 2006;37(3):317-323. [CrossRef]
15. Keum BT, Miller MJ, Inkelas KK. Testing the factor structure and measurement invariance of the PHQ-9 across racially diverse U.S. college students. *Psychol Assess*. 2018;30(8):1096-1106. [CrossRef]
16. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch Gen Psychiatry*. 1961;4:561-571. [CrossRef]
17. Lambert MJ, Burlingame GM, Umphress V, et al. The reliability and validity of the outcome questionnaire. *Clin Psychol Psychother*. 1996;3(4):249-258. [CrossRef]
18. Kia-Keating M, Moore S, Furlong MJ, Liu S, You S. Structural validity of the depression, anxiety, and stress scales-21 adapted for U.S. undergraduates. *Emerg Adulthood*. 2018;6(6):434-440. [CrossRef]
19. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. 1983;67(6):361-370. [CrossRef]
20. Nezelek JB, Rusanowska M, Holas P, Krejtz I. The factor structure of a Polish language version of the hospital anxiety depression scale (HADS). *Curr Psychol*. 2021;40(5):2318-2326. [CrossRef]
21. Oh SM, Min KJ, Park DB. A Study on the standardization of the Hospital Anxiety and Depression Scale for Koreans: a comparison of normal, depressed and anxious groups. *J Korean Neuropsychiatr Assoc*. 1999;38:289-296.
22. Choi JH, Jeon S, Hong S, Kim A, Park JY, Yang HJ. The reliability and validity of the Korean version of Hospital Anxiety and Depression Scale using Rasch measurement theory in patients with Parkinson's disease. *J Korean Neurol Assoc*. 2021;39:312-321.
23. Razavi D, Delvaux N, Farvacques C, Robaye E. Screening for adjustment disorders and major depressive disorders in cancer in-patients. *Br J Psychiatry*. 1990;156:79-83. [CrossRef]
24. Matsudaira T, Igarashi H, Kikuchi H, et al. Factor structure of the Hospital Anxiety and Depression Scale in Japanese psychiatric outpatient and student populations. *Health Qual Life Outcomes*. 2009;7:42. [CrossRef]

25. Ogawa M, Watanabe Y, Motegi T, et al. Factor structure and measurement invariance of the Hospital Anxiety and Depression Scale across the peripartum period among pregnant Japanese women. *Neuropsychiatr Dis Treat*. 2021;17:221-227. [\[CrossRef\]](#)
26. Dunbar M, Ford G, Hunt K, Der G. A confirmatory factor analysis of the Hospital Anxiety and Depression scale: comparing empirically and theoretically derived structures. *Br J Clin Psychol*. 2000;39(1):79-94. [\[CrossRef\]](#)
27. Friedman S, Samuelian JC, Lancrenon S, Even C, Chiarelli P. Three-dimensional structure of the Hospital Anxiety and Depression Scale in a large French primary care population suffering from major depression. *Psychiatr Res*. 2001;104(3):247-257. [\[CrossRef\]](#)
28. Barth J, Martin CR. Factor structure of the Hospital Anxiety and Depression Scale (HADS) in German coronary heart disease patients. *Health Qual Life Outcomes*. 2005;3:15. [\[CrossRef\]](#)
29. Chen H, Mui AC. Factorial validity of the Center for Epidemiologic Studies Depression Scale short form in older population in China. *Int Psychogeriatr*. 2014;26(1):49-57. [\[CrossRef\]](#)
30. Marsh HW, Hau KT, Wen Z. In search of golden rules: comment on hypothesis testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu & Bentler's (1999) findings. *Struct Equ Model*. 2004;11(3):320-341. [\[CrossRef\]](#)
31. Byrne BM. Testing for multigroup equivalence of a measuring instrument: a walk through the process. *Psicothema*. 2008;20(4):872-882.
32. Browne MW, Cudeck R. Alternative ways of assessing model fit. *Sociol Methods Res*. 1992;21(2):230-258. [\[CrossRef\]](#)
33. Fan X, Sivo SA. Sensitivity of fit indices to model misspecification and model types. *Multivariate Behav Res*. 2007;42(3):509-529. [\[CrossRef\]](#)
34. Akaike H. A new look at the statistical model identification. *IEEE Trans Autom Contr*. 1974;19:716-723.
35. González-Loyola M, Oyanadel C, Peñate W. Adaptation and factor structure of the Hospital Anxiety and Depression Scale on Chilean children and adolescents. *Rev Latinoam Psicol*. 2020;52:63-70. [\[CrossRef\]](#)
36. Helvik AS, Engedal K, Skancke RH, Selbæk G. A psychometric evaluation of the Hospital Anxiety and Depression Scale for the medically hospitalized elderly. *Nord J Psychiatry*. 2011;65(5):338-344. [\[CrossRef\]](#)
37. Xu Y, Waniganayake M. An exploratory study of gender and male teachers in early childhood education and care centres in China. *Compare*. 2018;48(4):518-534. [\[CrossRef\]](#)