Factorial Structure, Validity and Reability of the Nomophobia Scale in Students at a State University of Lima Metropolitana

Estructura factorial, validez y confiabilidad de la escala de nomofobia en estudiantes de una universidad estatal de Lima Metropolitana

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Summary

Nomophobia understood as fear of not being able to contact or make use of a smartphone, irrational fear of losing it, running out of batteries or being without an internet signal, which generates high rates of anxiety. The consumer behaviors of this virtual society lead to the postponement of personal, academic and work objectives because more time is spent performing online activities, which turn out to be more attractive and less complex. The main objective of this research has been to determine the factorial structure, validity and reliability of the Nomophobia Scale (NMPQ). 300 students participated in a State University of Metropolitan Lima. The confirmatory factor analysis corroborated a structure of four factors, showing adequate adjustment indicators composed of CFI= .997, TLI= 0.997 and RMSEA= 0.084. confirming a second-order model, plus a first-order model. Cronbach's alpha coefficient was .964, reliability for each factor greater than .70 indicating high composite reliability (CF) and extracted mean variance (AVE) with scores greater than .50 indicating adequate convergence in all factors. It is concluded that the NMPQ is a valid and reliable instrument to measure nomophobia.

Keywords: Nomophobia; Addiction; Smartphone; Dependence; Mobile; Factorial structure.

Resumen

La nomofobia entendida como temor de no poder contactarse o hacer uso de un smartphone, miedo irracional a perderlo, quedarse sin baterías o estar sin señal de internet, lo que genera alto índices de ansiedad. Las conductas de consumo de esta sociedad virtual conllevan a la postergación de objetivos personales, académicos y laborares debido a que se dedica más tiempo a realizar actividades en línea, que resultan siendo más atractivas y menos complejas. El objetivo principal de la presente investigación ha sido determinar la estructura factorial, la validez y confiabilidad de la Escala del Nomofobia (NMPQ). Participaron 300 estudiantes en una Universidad Estatal de Lima Metropolitana. El análisis factorial confirmatorio, corroboró una estructura de cuatro factores, mostrando adecuados indicadores de ajuste compuesto por CFI= .997, TLI= 0.997 y RMSEA= 0.084. confirmando un modelo de segundo orden, más un modelo de primer orden. El coeficiente de alfa de Cronbach fue de .964, la fiabilidad por cada factor mayor a .70 indicando una alta confiabilidad compuesta (CF) y una varianza promedio extraída (AVE) con puntuaciones superior a .50 indicando una convergencia adecuada en todos los factores. Se concluye que el NMPQ, es un instrumento válido y confiable para medir la nomofobia.

Palabras clave: Nomofobia; Adicción; Smartphone; Dependencia; Móvil; Estructura factorial.

Introduction

We live in a highly competitive and constantly changing world, where information and communication technologies (ICTs) and social networks are used for almost every activity, whether academic, occupational, or social. It is in this context that some behaviors with addictive characteristics are configured. We have created a virtual society, an online world, which places us in a reality with multiple alternatives oriented to distraction, access to technology, and the propensity to immediate communication through this digital world, a world with great benefits, but that brought with it adverse consequences, such as addictive behaviors related to the excessive use of technology.

Cell phone applications are increasingly used for communication, studies, work, or distraction. However, it is worth mentioning that several applications are created with technology that generates user profiles with a prospective view of human behavior based on preferences and

characteristics, predicting and reinforcing consumption behaviors, which are guided and oriented towards the indiscriminate use of smartphones. Nomophobia arises then, understood as the state of anxiety experienced by a person, facing the absence of or disconnection from the cell phone. The term Nomophobia – whose abbreviation is "No Mobile Phobia" – was coined by the UK Post Office (2012), which reported that 53% of respondents expressed anxiety about losing their cell phone, forgetting it, running out of battery, being without coverage, not receiving calls, messages or emails (SecurEnvoy, 2012).

Nomophobia as a clinical case was described for the first time (King et al., 2010) as a disorder of the 21st century. They expressed their condition as a state that denotes discomfort and anxiety when a person is away from the cell phone or disconnected from a computer. The same authors redefine nomophobia as the modern fear of not being able to communicate via cell phone or the Internet, and describe it as a situational phobia related to agoraphobia. Therefore, nomophobia is a term referring to a set of maladaptive behaviors emitted in the absence of contact with a cell phone or connection (King et al., 2014).

In the same line, Bragazzi and del Puente (2014) point out that nomophobia is a disorder of contemporary virtual digital society referring to the discomfort, anxiety, and nervousness or anguish about feeling disconnected or not being in contact with the cell phone. Thus, nomophobia is the fear of becoming incommunicable (León-Mejía et al., 2021).

In a cross-sectional study conducted on Peruvian Medicine students (Copaja-Corzo, et al., 2022) aimed at evaluating nomophobia and its associated factors in Peruvian medical students, in a sample of 3139, it was found that 25.7% and 7.4% had moderate nomophobia and severe nomophobia, respectively, concluding that nomophobia in university students is a frequent and emerging problem, which manifests in younger students and is associated with symptoms of anxiety or depression.

Regarding the epidemiology of nomophobia, in Italy (Adawi et al., 2018), research with 403 volunteers with an average age of 27.9 reported a prevalence of 7.4 % at a severe level and 41.4 at a moderate level. In Turkey, several studies have been carried out, such as that of Adnan and Gezgin (2016) who report findings in studies conducted with the participation of 433 students from a state university, finding above-average levels of student nomophobia.

Likewise, Yildirim et al., 2016 showed 838 teacher candidates had a high prevalence of nomophobia. Similarly, an above-average prevalence of nomophobia was observed in a study with high school adolescents (Gezgin and Çakır, 2016). Moreover, in a study conducted in India (Mallya et al., 2018), a survey applied to 150 university students reported that 87% of the participants were nomophobic and 13% had a risk of nomophobia. It also indicated a preponderance of nomophobia in women.

In Brazil, a sample of 50 patients with agoraphobia and 70 without psychiatric disorders (King et al., 2014) reported a significant increase of more emotional alterations and physical symptoms such as anxiety, tachycardia, tremors, sweating, panic fear, and depression related to the absence of the telephone.

Additionally, in Lima, in a study with 461 university students, Rosales et al., 2019 identified three symptomatic factors of nomophobia: feelings of anxiety, compulsive use of the smartphone, and feelings of anxiety and panic.

In this context, it is necessary to have instruments to assess this mismatch, for which there are several tests: the Mobile Phone Problem Use Scale (MPPUS) (BOMBA) and the Questionnaire to Assess Nomophobia (QANIP) (Olivencia-Carrión et al., 2018). Of all those

mentioned the most widely used is the Nomophobia Questionnaire (NMP-Q) developed by Yildirim and Correia (2015).

The Nomophobia Questionnaire (NMP-Q) developed by Yildirim and Correia (2015) has been adapted from the first English version, with a four-factor structure, and validated in different regions and countries. It showed a Cronbach's alpha of 0.95 and also supported its convergent validity. It has been translated into Iranian (Lin et al., 2018), Italian (Adawi et al., 2018), and Tamil in India. Mallya et al., 2018 conducted a survey of 150 university students and reported a predominance of women with percentages of 87% of nomophobic behaviors. Likewise, in Portugal (Galhardo et al., 2020), in a study with five hundred participants, the NMP-Q was adapted and validated by translating it into European Portuguese, approving its factorial structure and psychometric properties.

Since the Nomophobia Questionnaire (NMP-Q) is an instrument that has been validated and translated in different regions and countries, it was considered crucial to validate the instrument in Lima since there are no psychometric studies or evidence of validation in our country.

Therefore, the purpose of this study was to determine the factorial structure of the Nomophobia Questionnaire (NMP-Q) developed by Yildirim and Correia (2015) in university students in Metropolitan Lima and identify the internal structure and consistency characteristics of the scores.

Method

Participants

To obtain the sample size, G*Power 3192 was used, and multiple linear regression was taken as a test with the following criteria: a mean effect size, an alpha error of .05, a test power of 0.95, and four predictors. The minimum calculated sample size was 129 participants. Based on this, a non-probabilistic sample of 300 university students was formed, whose ages ranged from 17 to 34, with a mean age of 22.93 and a standard deviation of 3.423. Likewise, 66.7% were women (200), and 33.3% were men (100) from various schools of a public entity in Metropolitan Lima.

Instrument

Nomophobia Scale (NMP-Q).
The scale was developed by Yildirim and Correia (2015). It consists of 20 items in a Likert-type scaling. The instrument is composed of 20 items that assess four dimensions: Inability to communicate (6 items), Loss of connectivity (5 items), Not being able to access information (4 items), and Giving up comfort (5 items). The response format uses a seven-point scale, where "1" means strongly disagrees and "7" means strongly agrees. The range of scores varies between 20 and 140 points. The higher the score, the higher the level of nomophobia. The scoring presents three levels: medium, moderate and severe. The test was validated through exploratory factor analysis and principal component analysis, revealing a four-dimensional structure which accounts for 69.6% of the total variance. The internal consistency showed a Cronbach's alpha of 0.95, which supported its convergent validity.

The Spanish version was adapted by (González-Cabrera et al., 2017) conducting a study with a sample of 306 students. It employed exploratory factor analysis, which yielded a four-factor solution, accounting for 66.4% of the total variance and obtaining a total score of 0.95 for the ordinal alpha.

Procedure

For data collection, the instrument was applied by creating online Google Forms due to the social isolation mandated by the Covid 19 health emergency. Links were disseminated by social networks and email; the forms were circulated for four months from January 2022 to April 2022. The instruments were applied in a single session. The subjects decided on their participation in the research through the informed consent placed at the beginning of the form, which was anonymous and voluntary. Once the data had been evaluated and cleaned, the database was assembled and for the statistical analysis, the database was downloaded in Excel and transferred to IBM SPSS 26.0 and Amos 22.0 was used.

For data analysis, descriptive statistics were calculated: mean, standard deviation, skewness, and kurtosis for each item. A confirmatory factor analysis was carried out. The maximum likelihood estimation method, as well as the fit indices: root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker Lewis index (TLI) were used and the model was validated using the average variance extracted (AVE). For the verification of the reliability of the questionnaire, Cronbach's alpha coefficient, the Omega, and the composite reliability (CF) were estimated.

Results

A response frequency analysis was carried out, showing that all the alternatives were marked by the respondents. Table 1 shows the statistical indicators for each item in terms of mean, standard deviation, skewness, and kurtosis. The lowest mean score (2.71) was obtained by item 6 (dimension "Giving up comfort") associated with the concern caused by feeling disconnected. The highest score (4.02) was obtained by item 11 (dimension "Not being able to communicate"), which focused on the anxiety caused by the loss of digital contact with family and friends. Regarding the significant skewness indexes and the kurtosis coefficient, it is shown to be significant, finding a platykurtic distribution. Regarding the homogeneity index, it was found that all items establish correlations above .30 and communalities with scores above .50.

Confirmatory Factor Analysis of the Nomophobia Questionnaire (NMP-Q)

To analyze the construct structure of the Nomophobia NMP-Q scale, a Confirmatory Factor Analysis was carried out. An analysis was performed based on a polychoric matrix using the Unweighted Least Squares (ULS) method and an adjusted variance with the following fit indicators: CFI= .997, TLI= 0.997, and RMSEA= 0.084.

These fit indices are observed in Table 2, confirming a second-order model composed of four dimensions: Factor I, *Not Being Able to Communicate*, composed of items 10, 11, 13, 14, 15, Factor II, *Loss of Connectivity*, composed of items 16, 17, 18, 19, Factor III *Not Being Able to Access Communication* composed of items 1, 2, and 4, and finally, Factor IV *Giving up Comfort* composed of items 5, 6, and 8.

Based on the above fit indicators, the first-order model demonstrating General Nomophobia was considered. Figure 1 shows that not all the items have contributed and saturated in the same factors. Therefore, those that did not saturate adequately due to their low factorial weight should be eliminated (items 3, 7, 9, 20). This model was considered the most adequate to represent the theoretical model found.

Table 1.

Nomophobia Questionnaire (NMP-Q) Item Analysis

ITEMS	FR							M	SD	g1	g2	CHI	h2
	1	**2**	**3**	**4**	**5**	**6**	**7**						
Item 1	12.3	11.3	22.3	26.0	17.0	7.3	3.7	3.61	1.560	0.056	-0.542	0.652	0.753
Item 2	10.3	11.0	18.0	28.0	20.3	9.7	2.7	3.77	1.528	-0.145	-0.590	0.659	0.822
Item 3	23.0	11.3	23.7	29.0	9.3	3.0	0.7	3.02	1.442	0.066	-0.737	0.735	0.691
Item 4	13.0	10.7	17.7	28.3	19.3	9.0	2.0	3.65	1.547	-0.153	-0.682	0.659	0.767
Item 5	19.7	14.7	24.0	23.7	13.0	4.7	0.3	3.11	1.469	0.102	-0.845	0.766	0.653
Item 6	30.3	12.7	26.7	20.7	6.0	3.3	0.3	2.71	1.436	0.369	-0.644	0.746	0.636
Item 7	15.3	10.0	18.3	18.3	23.0	11.7	3.3	3.72	1.700	-0.127	-0.955	0.694	0.525
Item 8	26.3	10.3	22.0	15.7	15.3	8.3	2.0	3.16	1.726	0.244	-1.012	0.732	0.602
Item 9	18.0	13.3	22.0	24.0	13.3	8.0	1.3	3.31	1.573	0.117	-0.801	0.641	0.510
Item 10	11.3	10.3	14.7	21.7	30.0	10.0	2.0	3.87	1.565	-0.372	-0.731	0.712	0.780
Item 11	11.0	9.0	10.7	24.7	28.0	14.3	2.3	4.02	1.590	-0.475	-0.617	0.679	0.840
Item 12	21.0	12.3	23.3	24.7	12.3	5.7	0.7	3.15	1.519	0.107	-0.820	0.822	0.766
Item 13	15.0	12.0	14.3	28.3	20.7	7.7	2.0	3.59	1.582	-0.160	-0.804	0.780	0.842
Item 14	19.7	12.0	19.7	25.0	15.3	7.3	1.0	3.30	1.583	0.026	-0.919	0.805	0.823
Item 15	16.3	14.0	16.3	29.3	14.7	7.3	2.0	3.42	1.576	0.022	-0.767	0.777	0.823
Item 16	29.3	14.3	23.7	23.3	5.3	3.7	0.3	2.73	1.443	0.354	-0.675	0.812	0.782
Item 17	26.3	16.7	18.7	25.0	8.7	3.7	1.0	2.88	1.517	0.326	-0.729	0.774	0.764
Item 18	26.0	14.7	25.3	20.3	9.7	3.0	1.0	2.86	1.481	0.348	-0.603	0.830	0.817
Item 19	25.7	13.7	21.3	27.3	7.7	4.0	0.3	2.91	1.468	0.182	-0.841	0.773	0.775
Item 20	26.0	14.0	19.7	24.0	10.7	4.7	1.0	2.97	1.560	0.257	-0.840	0.769	0.737

Note: FR: frequency of response; M: mean; SD: standard deviation; g1: skewness coefficient; g2: kurtosis coefficient; CHI: homogeneity index; h2: communalities. The 20 items correspond to four dimensions: Not being able to access information (4 items, 1- 4); Giving up comfort (5 items, 5-9); Not being able to communicate (6 items, 10-15) and Loss of connectivity (5 items, 16-20).

Table 2.

Factor Loading of the Nomophobia Questionnaire (NMP-Q) Items.

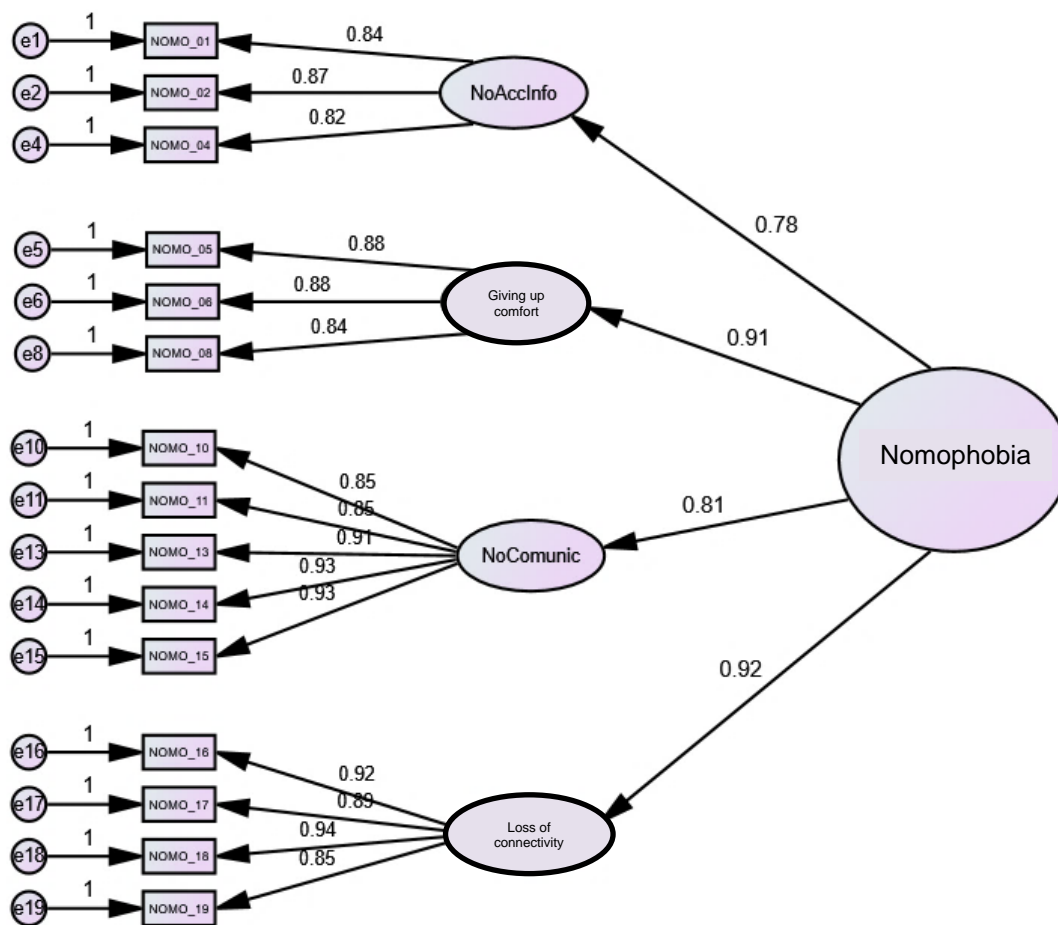|	Factors			
	1	**2**	**3**	**4**
NOMO_01			0.066	
NOMO_02			0.902	
NOMO_04			0.694	
NOMO_05				0.708
NOMO_06				0.837
NOMO_08				0.679
NOMO_10	0.748			
NOMO_11	0.852			
NOMO_13	0.805			
NOMO_14	0.680			
NOMO_15	0.743	0.355		
NOMO_16		0.726		
NOMO_17		0.756		
NOMO_18		0.725		
NOMO_19		0.679		

Figure 1.
Structural Equation Model for the Nomophobia Questionnaire (NMP-Q)

First- and Second-Order Model for the Nomophobia Questionnaire (NMP-Q).

Regarding the reliability of the instrument, Table 3 shows a Cronbach's Alpha coefficient with a total score of .964 (CI AL .95% = .960 - .963), which indicates that the scores of the Nomophobia Questionnaire (NMP-Q) in students from a state university in Metropolitan Lima guarantee the consistency of the scores. Likewise, the reliability for each factor was greater than .70, which indicates high composite reliability (CR). Likewise, the average variance extracted (AVE) showed a score above .50, showing adequate convergence in all factors.

Table 3.
Analysis of Reliability Coefficients of the Nomophobia Questionnaire (NMP-Q).

Factors	Cronbach's Alpha α	CR	AVE	Omega McDonald ω
F1	0.942	0.941	0.802	0.94
F2	0.933	0.934	0.812	0.928
F3	0.862	0.869	0.711	0.862
F4	0.872	0.879	0.750	0.873

Note: Sig..000; gl^2: 281; CR: Composite Reliability; AVE: Average Variance Extracted.

Discussion

The purpose of this study was to evaluate the factorial structure, validity, and reliability of the Nomophobia Questionnaire (NMP-Q) developed by Yildirim and Correia (2015) in university students in Lima, and identify the internal structure and consistency characteristics of the scores. It is appropriate to mention that no studies were found to validate the instrument in our setting.

The results found confirmed a second-order model composed of four dimensions according to the original structure and a first-order model showing general nomophobia. The reliability of the instrument showed a Cronbach's Alpha coefficient with a total score of .964, indicating that the scores guarantee the internal consistency of the instrument. Likewise, the reliability of each factor was greater than .70, indicating high composite reliability (CR) and the average variance extracted (AVE) with scores above .50, showing adequate convergence in all factors. The results show similarity with the study of León-Mejía et al. (2021) who reported a factorial structure of four correlated factors, evidencing a second-order factor that would explain the association among the four dimensions of nomophobia. The results also agree with the Iranian study conducted by Lin et al. (2018) who conclude that the questionnaire had four factors and was appropriate to evaluate nomophobia in Iranian adolescents. They also indicated that the factorial structure was invariant in the measurement of gender, reporting a slight mismatch in its factors and a low AVE value in factor 2, which coincided with our study that had to eliminate items 3, 7, 9, 20 because they did not saturate adequately due to their low factorial weight. This could be explained by cultural discrepancies in terms of the Nomophobia phenomenon. However, it was possible to corroborate the existence of four factors in the instrument, coinciding with the original authors of the questionnaire.

In the Italian version of the instrument, Adawi et al., (2018) suggested a three-factor solution in which the dimensions giving up comfort and loss of connection were merged, not coinciding with the results of this study and being pertinent to mention that a AFE was performed in the Italian study, while the Iranian (Lin et al., 2018), Brazilian (Galhardo, 2020) and the Chinese versions (Ma & Liu, 2018), with AFC, showed similar fit indices to that of our study.

Regarding the limitations of the study, the Nomophobia Questionnaire NMP-Q was applied through online forms due to the social isolation mandated by the Covid 19 health emergency. This may have affected the incidence in response frequencies due to the presence of anxiety or due to the mandatory confinement. No method was employed to detect false responses beyond informed consent.

Conclusions

In conclusion, this study has described and analyzed the factorial structure, validity, and reliability of the Spanish version of the NMP-Q proposed by González-Cabrera et al. (2017), confirming the four-factor model of León-Mejía et al. (2021) and the original four-factor model of Yildirim and Correa (2015). Through the fit indices, a second-order model is confirmed, composed of four dimensions, and a first-order model demonstrates General Nomophobia. The study shows psychometric evidence that justifies the use of the Scale to assess nomophobia, and suggests future research that associates the construct with other variables to confirm its internal and external validity. The validation of the instrument with larger simples considering demographic factors, such as age, gender, education level, and time spent using the smartphone, is also suggested.

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