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Psychometric properties of the Smartphone Application-Based Addiction Scale (SABAS) in Peruvian university students

Propiedades psicométricas del Smartphone Application-Based Addiction Scale (SABAS) en universitarios peruanos

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Abstract

The *Smartphone Application-Based Addiction Scale* (SABAS) is a brief tool that assesses the level of addiction exposure to smartphones. The purpose of the study was to examine the internal structure and reliability of this scale, applied to university students in Lima, with a sample of 463 university students, aged between 18 and 43 years (M=20.04; SD=3.29). The results show acceptable internal consistency indicators (α= 0.84; Ω= 0.84). In the fit indices of the confirmatory factor model revealed that the scale is unifactorial, showing adequate indicators (χ2/df=3.64, RMSEA = 0.07 [CI90%: 0.04 - 0.10], SRMR = 0.03, CFI = 0.99 and TLI = 0.99). It also showed positive and weak correlations with anxiety and depression symptoms of the PHQ-4 scale. The findings support the usefulness of the SABAS as a screening tool to assess smartphone addiction in the university context in Lima.

Keywords: Addiction, Smartphone, University, Psychometric, Validity, Reliability.

Resumen

La *Smartphone Application-Based Addiction Scale* (SABAS) es una herramienta breve que evalúa el nivel de exposición de adicción a teléfonos inteligentes. El propósito del estudio es examinar la estructura interna y confiabilidad de esta escala, aplicada en estudiantes universitarios de Lima, teniendo una muestra de 463 estudiantes universitarios, con edades entre 18 y 43 años (M=20,04; DE=3,29). Los resultados muestran indicadores de consistencia interna aceptable (α= 0,84; Ω= 0,84). En los índices de ajuste del modelo factorial confirmatorio reveló que la escala es unifactorial, mostrando indicadores adecuados (χ2/df=3,64, RMSEA = 0,07 [IC90%: 0,04 - 0,10], SRMR = 0,03, CFI = 0,99 y TLI = 0,99). También mostró correlaciones positivas y débil con los síntomas de ansiedad y depresión de la escala PHQ-4. Los hallazgos respaldan la utilidad del SABAS como herramienta de tamizaje para evaluar la adicción a los teléfonos inteligentes en el contexto universitario limeño.

Palabras clave: Adicción, Teléfono inteligente, Universitario, Psicométrico, Validez, Confiabilidad.

INTRODUCTION

In today's digital era, the increased use of smartphones has greatly transformed the way we relate to the environment (De Gracia *et al.*, 2002). The young population is no exception to this global trend, as they have significantly related to the use of applications and social networks in various areas of their lives (Valkenburg and Peters, 2011; Cheng *et al.*, 2024). A report by the International Telecommunication Union (ITU) has reported that in the world four out of five people over the age of ten own a cell phone (International Telecommunication Union, 2024). In Peru, the use of electronic devices has increased in recent years, where 66.3% of Peruvian households had a smartphone by 2016, while by 2021, 88.4% had these devices (Supervisory Body for Private Investment in Telecommunications, 2021).

The increased use of smartphones in Peru has transformed the way of searching and obtaining relevant information, as they constitute an important part of the tools that are commonly used for social interaction (Figueroa, 2016), because they have applications that allow improving different aspects of daily and academic life (Barquero, 2016), offering immediate access to a wide range of services such as: information and long distance communication, internet, shopping, mobility, video games, among others (Miranda & Cruz, 2019). An example of this trend in the country is that in January 2023 it hosted 25.05 million internet users in social networks, equivalent to 73.3% of the total population (Kemp, 2023).

This number leads to determine differences and similarities between the problematic use of a cell phone and the problematic use of the Internet, since the latter generates emotional and psychosocial alterations as a result of excessive gaming or the use of social networks (Andrade *et al.*, 2022; Rozgonjuk *et al.*, 2023). For Rozgonjuk et al. (2023) in both cases there is an inability to control the use that the person makes of a telephone device or medium, causing harmful consequences and interference in daily functioning. For this author, the use of mobile applications makes a difference since smart devices use some social media (e.g., Instagram, WhatsApp or Tik Tok) that are often enhanced on these devices. Moreover, addiction to these devices or social media differs from other addictions (e.g., smoking or drug addiction), due to the fact that the individual, in this case, is not addicted to an object or substance, but to the feeling or emotion provoked by these (Alavi *et al.*, 2012; Lachmann *et al.*, 2016).

Some research has found a wide range of problem behaviors related to the use of smart devices and the internet through the use of online applications, such as dietary neglect, academic performance difficulties, sleep and personal hygiene deficits, suicidal ideation, depression, anxiety, mental wandering, and unhealthy relationships (Kuss & Griffiths, 2011; Hu *et al.*, 2022; Kao, 2023; Susmitha *et al.*, 2024; Du *et al.*, 2024, Zhang *et al.*, 2024). In addition, affected individuals present a modification of their mood, they believe that these applications are the only place where they can feel safe. However, in the long run they present symptomatologies associated with loneliness, depression and reduced psychological well-being (Arab & Diaz, 2015, Tyagi & Meena, 2022). Likewise, it entails a variety of detrimental effects on interpersonal interaction leading to a tendency to social isolation, for fear of criticism or negative social evaluation (Castro & de la Villa Moral, 2017; Naidu *et al.*, 2023).

Evidence highlights the importance of having instruments that can measure addictive behaviors linked to smartphone use (Kardefelt-Winther, 2017). In the scientific literature one can find the *"Short Version of the Smartphone Addiction Scale"* (SAS-SV) which was adapted in Spanish and Belgian adults by Lopez-Fernandez (2017), the *"Smartphone Addiction Inventory"* (SPAI) in China with a sample of 283 adult-young adults (Lin *et al.*, 2014) and the "Smartphone Addiction Propensity Scale" (SAPS) validated in South Korea with a sample of 795 elementary, middle and high school students) (Kim *et al.*, 2014).

Complementary to this, there is the *"Smartphone Application-Based Addiction Scale"* (SABAS), which is a short and easy-to-use tool to find the risk of smartphone addiction (Csibi *et al.*, 2018). It consists of 6 items, measured with a six-point Likert-type scale, where it is rated from 1 ("strongly disagree") to 6 ("strongly agree"). The internal reliability of the scale by means of Cronbach's alpha was optimal (0.81). In addition, it has congruent validity (Csibi *et al.*, 2018), where a higher score on the SABAS signals a higher likelihood of being at risk of developing an addiction to smartphone use.

The SABAS has demonstrated good psychometric properties, with a Cronbach's alpha between 0.71 and 0.86 in different countries, including Hungary with 441 schoolchildren (Csibi *et al.*, 2016), China with students from fourth to sixth grade (Chen *et al.*, 2020), Saudi Arabia with 624 participants with an average age of 25 years (El Sayed *et al.*, 2022), Italy with 205 volunteers (Soraci *et al.*, 2021), Iran with 3807 adolescents (Lin *et al.*, 2019), United Arab Emirates with 453 young adults (Vally & Alowais, 2022), and international population with a sample of 240 English-speaking international volunteers (Csibi *et al.*, 2018).

This scale has emerged as a tool to assess young people at risk for smartphone addiction. Therefore, it is essential to understand the internal structure and reliability to ensure that it is an accurate and valid measure. However, validation in the Peruvian context is not currently available, so understanding how the different items of the SABAS are grouped and related in this population will provide valuable information for both researchers and mental health professionals. Therefore, the main purpose is to analyze the psychometric properties of the *"Smartphone Application-Based Addiction Scale"* (SABAS) applied in the university population of Lima.

METHOD

Study design

The design of this research was instrumental, non-experimental and cross-sectional, aimed at evaluating the validity and reliability of the Spanish version of the *"Smartphone Application-Based Addiction Scale"* in university population in Lima (Ato et al., 2013; Hernández & Mendoza, 2018).

Participants

The sample of this study included 463 students from a private university in the city of Lima, who participated freely and voluntarily. This sample, according to Hair et al. (2019) can be considered adequate for psychometric studies, since it allows carrying out factorial analysis and reliability with sufficient statistical power, having a ratio of at least 10 participants for each item. Of this group, 75% were female and 25% male, with ages between 18 and 43 years (M=20.04; SD=3.29). The sample was collected using an intentional non-probabilistic method. In terms of academic cycle, 45% studied between the first and third cycle, 40% between the fourth and sixth cycle, 11% between the seventh and tenth cycle, and 2% between the eleventh and fourteenth academic cycle.

Instruments

Sociodemographic data: A brief questionnaire on sociodemographic data was used at the beginning with questions such as age, gender and current academic cycle.

Smartphone Application-Based Addiction Scale (SABAS): The Csibi *et al.* (2018) scale was used, which aims to be a user-friendly tool to find the risk of smartphone addiction. It consists of 6 items and was evaluated using the Likert Scale, where 1 is "strongly disagree" and 6 is "strongly agree". Likewise, its internal consistency through Cronbach's alpha was good (0.81). Furthermore, it presents adequate convergent validity.

Patient Health Questionnaire (PHQ-4): It is an ultra-brief 4-item tool used to detect anxious and depressive symptomatology, combining two-item scales, the PHQ-2 and GAD-2, measured through the Likert Scale where the answers are scored as 0 ("not at all") to 3 ("almost every day"). This instrument was developed by Kroenke et al. (2009) and adapted to Peru by Caycho-Rodríguez et al. (2024), the same consists of an optimal reliability ($\alpha/\Omega > 0.80$). In addition to a structure composed of two factors. Finally, depressive symptoms significantly predicted subjective well-being.

Procedures

For the determination of the sample in the present study, a structured process was used that included several key stages. First, the scale was subjected to a rigorous translation process, followed by back translation, carried out by a team of specialists fluent in English, allowing comparison of both versions and ensuring the semantic and cultural equivalence of the instrument. This method, recommended by the International Test Commission (ITC, 2010), is essential for assessing the accuracy of the translation and ensuring that differences in specific words do not compromise the clarity of the message content. While an exact match between versions is not always possible, the focus

is on ensuring that the meaning is consistent and understandable, thus ensuring the cultural and semantic validity of the instrument (ITC, 2010).

Secondly, the content validity was assessed by means of an expert judgment, formed by five specialists with experience in psychometrics, research methodology and clinical psychology. These judges evaluated the relevance, pertinence, appropriateness and clarity of the scale items, providing comments on possible improvements and adjustments needed to ensure that each item adequately measured the construct.

Third, a pilot test was carried out with a sample of 20 participants to evaluate the comprehensibility of the items, identifying possible difficulties in the interpretation of the questions and ensuring that the final version of the instrument was clear and adequate for its subsequent application in the target sample. This process allowed the necessary adjustments to be made before the final implementation of the instrument in the university population in Lima.

Fourth, the application of the instruments was carried out within the university spaces, after requesting the corresponding permissions. Participation was completely voluntary, and the participants had the opportunity to withdraw from the study without any repercussions if they so considered. To protect the privacy and confidentiality of the data, rigorous security measures were implemented, ensuring that the information provided was treated anonymously and with the utmost respect for the rights of the participants. In addition, fair and equitable treatment was guaranteed throughout the process, maintaining an ethical approach at all stages of the study and showing constant respect for each of the participants, in accordance with the ethical principles of research. This study guaranteed the informed consent of all participants. It should be noted that this study has been reviewed and approved by the "Institutional Ethics Committee of the Universidad Científica del Sur" under certificate No. 711-CIEI-CIENTÍFICA-2024.

Data analysis

The data were analyzed using SPSS v28, Jamovi 2.3.21 and JASP 0.19.3. Initially, descriptive statistical calculations were performed (frequency analysis, mean, standard deviation, skewness and kurtosis, corrected homogeneity index, communality and discrimination index). As for the frequency analyses, it is expected that the values are not at 0% or higher than 80% in the categories, demonstrating that the participants have responded without bias (De las Cuevas and Gonzales, 1992). In addition, skewness and kurtosis statistics should be between ±1.5, reflecting a normal distribution (Cheng, 2015). The corrected homogeneity index (corrected test item-total correlation) is expected to be above 0.30 demonstrating a correct correlation between each of the items and the total test score (Brzoska & Razum, 2010), while the communality index should be above 0.40. On the other hand, the Discrimination Index (DI) compares the scores between high and low scorers on the scale, expecting values with significance less than $p<0.01$ (Anastasi & Urbina, 1998). Finally, multivariate normality was assessed using Mardia's test (1970) and the matrix of polychoric correlations was used for internal structure (Domínguez, 2014).

Next, a "confirmatory factor analysis" (CFA) was performed to explore the internal structure of the instrument, through the "weighted least squares method with adjusted mean and variance" (WLSMV), expecting the following fit indices: $X2/gl \leq 5$, the CFI (comparative fit index) and TLI (Tucker-Lewis index) ≥ 0.95, the RMSEA (root mean square error of approximation) and the SRMR (standardized root mean residual square) whose values should be less than 0.80 (Bentler, 1990, Chen, 2007). In addition, it examined the factorial invariance according to the sex of the participants in relation to the configural, metric, scales and residual level, expecting the CFI variance values to be less than 0.01, and the RMSEA to <0.015 (Rutkowski & Svetina, 2014). Internal consistency was verified by determining the Cronbach's Alpha and McDonald's Omega coefficients whose reference values should be higher than 0.80 (Campo-Arias & Oviedo, 2008), respectively. The criterion validity was explored with that of the SABAS scale and the PHQ-4, to understand the relationships between variables. Finally, the normative data of the scale was carried out, where normality was initially performed using the Shapiro-Wilk test, the percentiles PC10, PC25, PC50, PC75 and PC 90 were determined and reliability was calculated for each cut-off point (K2). Likewise, category levels were established in order to interpret the scale scores (Abad *et al.*, 2006).

RESULTS

Table 1 shows the descriptive analyses of the SABAS scale items. As for the response percentage (%), a minimum value of 2.4% and a maximum value of 30.9% were observed. The mean of the items ranged from 2.46 to 2.95, indicating that respondents tended to opt for alternative 2 ("disagree"). As for the standard deviation, values between 1.31 and 1.46 were recorded, suggesting low dispersion, indicating that the participants' responses were relatively homogeneous. The skewness (g^1) and kurtosis (g^2) coefficients remained within the range of +/- 1.5, which is indicative of univariate normality in the data (Cheng, 2015). According to Mardia's test, the skewness coefficient was significant ($p<0.001$) with a value of 3.89, and the kurtosis coefficient was also significant ($p<0.001$) with a value of 57.93. In addition, the Corrected Homogeneity Index (CHI) yielded values above 0.55, which is acceptable and shows that the items tend to measure the same construct consistently (Brzoska & Razum, 2010). Similarly, the communality scores (h^2) were greater than 0.34, indicating a strong relationship among the items. Finally, the Discrimination Index (DI) showed values with significance less than $p<0.01$, suggesting that the items are able to adequately differentiate between high and low levels of the measured construct (Anastasi & Urbina, 1998).

Table 1
Statistical analysis of the items

Item	Frequency						M	DE	g^1	g^2	IHC	h^2	Id
	1	2	3	4	5	6							
1	20,5	28,5	18,1	25,1	5,4	2,4	2,73	1,31	0,35	-0,71	0,55	0,34	0,000
2	28,5	28,3	16,8	14,9	8,4	3,0	2,56	1,41	0,65	-0,54	0,58	0,40	0,000
3	27,2	27,2	17,5	17,9	7,6	2,6	2,59	1,38	0,54	-0,65	0,71	0,62	0,000
4	24,6	26,1	17,9	18,1	9,5	3,7	2,73	1,44	0,47	–0,76	0,64	0,50	0,000
5	30,9	28,5	17,3	13,0	7,6	2,8	2,46	1,39	0,75	–0,34	0,66	0,53	0,000
6	19,4	24,4	19,0	21,6	10,4	5,2	2,95	1,46	0,32	-0,85	0,63	0,49	0,000

Note: 1= "strongly disagree", 2= "disagree", 3= "slightly disagree", 4= "slightly agree", 5= "agree", 6= "strongly agree", M= "Mean", SD= "standard deviation", g^1= "skewness", g^2= "kurtosis", CHI= "corrected homogeneity index", h^2= 'communality', di= "discrimination index".

Table 2 presents the analysis of the polychoric correlation among the questionnaire items, which is justified in this analysis due to the ordinal nature of the data used in this study. This type of correlation is particularly useful in instruments with ordinal scales, as is the case of many psychological questionnaires, since it allows capturing the relationship of latent variables that may not be linear, but that retain a joint response pattern (Freiberg et al., 2013; Holgado-Tello et al., 2010). The observed coefficients are positive and close to the value of 1, indicating a moderate to high correlation among the items.

Table 2

Polychoric correlation of items

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6
Item 1	1.000					
Item 2	0.453	1.000				
Item.3	0.551	0.623	1.000			
Item 4	0.421	0.498	0.609	1.000		
Item 5	0.439	0.502	0.643	0.554	1.000	
Item 6	0.459	0.455	0.528	0.614	0.648	1.000

A CFA was then carried out using the "weighted least squares with mean and variance adjusted variance" (WLSMV) estimator to evaluate the structure of the proposed model. This method is relevant due to its ability to handle variables of ordinal nature, in addition to providing more powerful and robust estimates (Han, 2022). Table 3 shows adequate fit indices of the model to the data. The CFI, TLI values were higher than 0.95, while the RMSEA value was less than 0.08 and SRMR was 0.06, being these acceptable according to what is reported in the scientific literature (Hu & Bentler, 1999). These results suggest that the proposed model is consistent and adequate, highlighting a unifactorial structure of the scale.

Table 3

Fit indices for the factorial model

	χ2/df	p-valor	RMSEA (90% CI)	CFI	TLI	SRMR
Values	3,64	<0,001	0,07 (0,04 – 0,10)	0,99	0,99	0,03

Figure 1

One-factor model

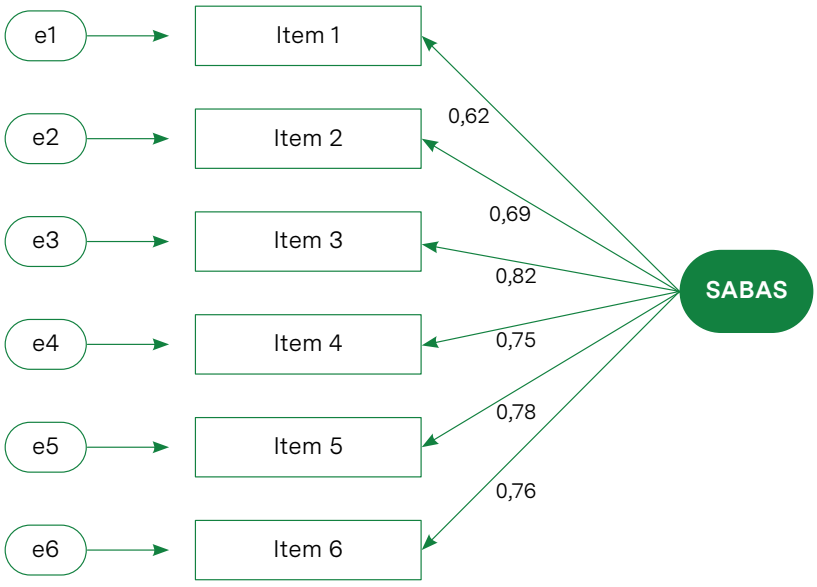

Table 4 presents the Multigroup Confirmatory Factor Analysis (MCFA) performed to evaluate the measurement invariance of the SABAS scale. Initially, the configurational invariance model (M1) was examined, whose fit was satisfactory, with CFI = 0.96, RMSEA = 0.13 and χ^2/gl = 5.48, indicating that the factor structure is consistent in both groups (men and women), which cautiously supports the equivalence of the model configuration. Next, the metric invariance model (M2) was evaluated, which tested the equality of factor loadings between both groups. The results showed an inadequate fit and, when comparing this model with M1, the changes observed in the fit indices yielded a value of ΔCFI =0.01, and a ΔRMSEA = 0.03, which is higher than the limit stipulated in the scientific literature (ΔCFI < 0.01; ΔRMSEA < 0.015) (Cheung & Rensvold, 2002) (Cheung & Rensvold, 2002). The scalar invariance model (M3), which evaluates the equality of the intercepts, also revealed an adequate fit when compared to the metric model, with no significant changes in the fit indices ΔCFI =0.00 but not in the RMSEA = 0, 04. Finally, the strict invariance model (M4), which examines the equality of the variances and covariances of the measurement errors, was analyzed. The results showed that the model fit was adequate, when compared to the scalar model, a ΔCFI < 0.01 and a ΔRMSEA < 0.01 were observed.

Table 4

Fit indices of measurement invariance models according to sex

Groups Sex	χ^2	$\chi^{2/gl}$	CFI	RMSEA (90% CI)	Comparison Criteria	Δχ2	ΔCFI ≤0.010	ΔRMSEA ≤0.015
Configurational (M1)	98,58	5,48	0,96	0,13 (0,11 – 0,16)				
Metrics (M2)	75,66	3,29	0,97	0,10 (0,07 – 0,12)	M2 VS M1	2,25	0,01	0,03
Scalar (M3)	82,11	1,79	0,98	0,05 (0,03 – 0,07)	M3 VS M2	1,90	0,01	0,04
Strict (M4)	82,11	1,79	0,98	0,05 (0,03 – 0,07)	M4 VS M3	5,35	0	0

The internal consistency of the instrument was evaluated using Cronbach's alpha and McDonald's omega, obtaining a value of 0.84 for both statistics, which evidences a good internal consistency of the scale. Furthermore, no significant variations were observed when eliminating some items (0.80 - 0.84), which reinforces the stability of the instrument and its robustness in terms of internal consistency.

Regarding the criterion validity, the results presented in Table 4 reflect a positive and weak correlation of the SABAS with anxious and depressive symptomatology, indicating a statistically significant relationship between smartphone app-based addiction and anxiety and depressive symptoms, although of low magnitude. These results support the convergent validity of the instrument, providing evidence that the relationships between the constructs measured, although modest, are consistent with what is theoretically expected.

Table 5

Validity evidences related to other variables

		Ansiedad	Depresión
SABAS	Rho de Spearman	0,218	0,249
	valor p	<0,001	< 0,001

Finally, the normative data of the scale was conducted. First, the Shapiro-Wilk test was performed to verify the normality of the smartphone app-addiction scale data. The results indicated that the data do not follow a normal distribution ($p < 0.05$), which is consistent with previous studies suggesting that variables related to addictive behaviors tend to present asymmetric distributions (Pedrosa *et al.*, 2015). Due to the absence of normality, we chose to calculate percentiles instead of measures based on parametric assumptions. Subsequently, 10th,

25th, 50th, 75th, and 90th percentiles were calculated (Moriwaki & Kamio, 2014). They allowed us to identify key reference points in the distribution of the data. These percentiles provide a detailed description of how addiction levels are distributed in the sample studied, allowing for a more accurate interpretation of participants' addiction-related behavior based on smartphone apps. The use of percentiles facilitates the classification of participants into different levels (low, medium-low, medium, medium-high and high), which is a common practice in psychometrics to identify groups at risk (Medrano & Pérez, 2019). To assess the reliability of the scores at each of these cut-off points, the Livingston's (1972) K2 coefficient was used. This allows estimating the stability of the scores obtained at the different levels of the scale (Fernández-Arata & Merino-Soto, 2014). This coefficient is particularly useful in psychometric studies, since it measures the precision of the scores in specific ranges, offering information on the consistency of the scores in each percentile group. In this case, K2 values indicate that as scores increase, the stability of responses also increases, suggesting that participants with higher levels of addiction exhibit more consistent behaviors over time.

Table 6

Normative data

Percentile	Direct Score	Range	Level	Criterial Coefficient (K2)
10	8	6-8	Low usage	0,943
25	12	9-12	Moderate-low usage	0,894
50	16	13-16	Average usage	0,849
75	20	17-20	Moderate-high usage	0,888
90	24	21-24	Problematic-addictive usage	0,939

DISCUSSION

This study aimed to analyze the psychometric properties of the Spanish version of the *"Smartphone Application-Based Addiction Scale"*, applied to the population of a private university in Lima. The results of the SABAS show the existence of a unifactorial scale, indicating that all items are interrelated. This result is in agreement with the research conducted by Csibi *et al.* (2018), who observed that each of the six items of the SABAS correlates significantly with all the other items of the scale, supporting the idea of its unidimensionality. Chen *et al.* (2020) through a CFA evaluated the factor structure of this scale, finding that the factor loadings of the items were considered acceptable and statistically significant. Other studies again support the construct validity of the scale by reaffirming its unidimensional structure (Leung *et al.*, 2020; Lin *et al.*, 2017; Yam *et al.*, 2019, Ruckwongpatr *et al.*, 2024).

On the other hand, in this study a "factorial invariance" or "multigroup confirmatory factor analysis" was performed in order to evaluate the consistency of the factorial structure of the SABAS scale in two demographic groups: male and female. First, its basic structure was tested, which is consistent in both groups, meaning that in both groups the underlying factor explains the responses in both groups. Now, when analyzing the specific link between the items and the factors (factor loadings), it was found that these are not completely equal between the two groups, which allows us to infer men and women could interpret some items of the scale differently. In addition, when comparing the starting points of the responses given by the participants (intercepts), some differences were

observed indicating that both groups could have different tendencies when answering certain items, even with the same level in the underlying factor. However, despite the existence of these differences, when we proceeded to evaluate the more stringent measures (variances and covariances of the errors) we found consistency between both groups. These analyses indicate that the SABAS scale has a general structure that is valid for men and women, although there are differences in how the groups respond to certain specific aspects, which should be taken into consideration when interpreting the comparative findings. In this case, partial invariance would be considered in accordance with the guidelines of Dimitrov (2010).

To assess the criterion validity of the measure, an analysis of correlations between SABAS scores and the "Patient Health Questionnaire for Depression and Anxiety PHQ-4" (Kroenke *et al.*, 2009) was conducted. The analyses revealed significant associations, albeit of a weak and positive nature between the SABAS and the PHQ-4 anxiety and depression, thus providing a deeper understanding of how this measure relates to other similar tools and its ability to distinguish among related constructs. These associations support the notion that this measure is capturing constructs similar to those established in the literature. Furthermore, they are congruent with previous research, specifically with the studies by Csibi *et al.* (2018), Solon *et al.* (2021), Bueno-Brito *et al*. (2024) and Meneses and Andrade (2024), so these findings strengthen the validity of the scale.

The results of the internal consistency analysis, evaluated through Cronbach's alpha and McDonald's omega, highlight notably high values for the scale. These results are higher than those obtained in the studies by Nurmala *et al.* (2022), Leung *et al.* (2020) and Vally and Alowais (2022). This value suggests that the scale items are closely interrelated and consistently measure the construct. Finally, barcoding was carried out, in which the percentiles were measured by considering the cut-off points in a systematic way. This process resulted in an app-based smartphone addiction risk level ranging from very low to very high scores, thus providing a detailed understanding of the distribution of the construct in the studied population.

On the other hand, it is essential to consider the limitations inherent to the present study. First, the social desirability bias could have influenced the results. Given this, it is recognized that individuals tend to seek social approval and, therefore, their responses could have conformed to accepted social norms (Festinger, 1954), i.e., it is possible that some students tend to avoid responses that denote negative or problematic behavior, systematically choosing more favorable or neutral alternatives. Second, the research was carried out with a relatively small sample of students from Lima, which could have widened the margin of error in the results obtained (Pineda *et al.*, 1994). In addition, the findings may not generalize to other population groups. Third, the SABAS, being a self-report response scale, could introduce the risk of inaccurate responses due to personal conditions such as forgetfulness, lack of introspection or intentional bias. Fourth, being a brief screening test, it might not deepen in determinant aspects of addiction associated with the use of smartphones (emotional, social and functional).

For future research, it is suggested to carefully analyze the specific applications that contribute most to the generation of addictions among young university students. In addition, it is necessary to increase the sample size in order to obtain more complete psychometric information, as well as to extend it to other populations and contexts within the Peruvian reality. There is no doubt about the potential and benefits that could derive from the scale, which, being a screening tool, allows the rapid identification of possible cases of addiction to smartphones, which could be useful to intervene prior to the appearance of the problem or its intensification. In addition, its application could mean a reduction in cost, time and resources and be easy to apply in various contexts.

CONCLUSIONS

The findings of this study highlight that the Smartphone Application-Based Addiction Scale counts with a unidimensional factorial structure in the Peruvian university population. In addition, the scale scores are weakly positively related to anxiety and depression on the

PHQ-4 scale. Finally, it has adequate internal consistency indicators. These analyses support the usefulness of the SABAS as a reliable tool to assess smartphone addiction in the Lima university context, highlighting areas for future research and methodological improvements.

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