



# Validation of the Spanish version of the Bergen Social Media Addiction Scale (BSMAS) among Spanish adolescents

Christiane Arrivillaga<sup>1</sup> · Mark D. Griffiths<sup>2</sup> · Lourdes Rey<sup>1</sup> · Natalio Extremera<sup>1</sup>

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## Abstract

Problematic social media use (PSMU) has become an increasingly researched area in the general population, specifically among adolescents. Due to its association with poor well-being and negative consequences, it is important to have assessment instruments that are valid and reliable in evaluating PSMU. The Bergen Social Media Addiction Scale (BSMAS) is the most widely used scale to assess PSMU. The present study analyzed the psychometric properties of a Spanish version of the BSMAS among Spanish adolescents. The sample comprised 688 adolescents from Spain (54% girls), aged 12 to 18 years ( $M=14.23$  years) who completed a number of self-report questions and psychometric scales. The reliability, construct validity, concurrent validity, and criterion validity of the BSMAS were evaluated. Additionally, the measurement invariance by gender and age group was also calculated. The results indicated good reliability indices (*coefficients' range* = 0.75–0.83). Moreover, PSMU was positively associated with problematic smartphone use, frequency of social networking site use, depression, anxiety, and loneliness and negatively associated with self-esteem and flourishing (*r range* = -0.16–0.65). Furthermore, configural, metric, and scalar invariance was established among boys and girls, and younger and older adolescents. The study provides preliminary evidence indicating that the Spanish BSMAS is a reliable and valid instrument to assess PSMU among Spanish-speaking adolescents.

**Keywords** Problematic social media use · Social media addiction · Bergen Social Media Addiction Scale (BSMAS) · Validation · Spain

1

## 2 1. Introduction

3 By the beginning of 2023, the social networking site (SNS) penetration rate in most  
4 European, American, and Asian countries was over 73%, and the number of active social media  
5 users is expected to grow from 5.07 billion individuals (Statista, 2024a; 2024b). Furthermore,  
6 internet users spent a daily average of 143 minutes surfing SNS (Statista, 2024c). A recent  
7 report in Spain (where the present study was carried out) found that over 90% of adolescents  
8 connect to SNS daily and experience positive emotions because of them (Andrade et al., 2021).  
9 Therefore, it seems that SNS are welcomed by and have influenced many Western countries,  
10 including Spain.

11 Despite SNS being widely beneficial for most individuals, for some, dedicating lots of  
12 time to their use may have negative consequences. Problematic social media use (PSMU) is

13 defined as an exceptional concern about social media, driven by a compulsive motivation to  
14 connect to, engage with, and excessively use SNS, resulting in day-to-day functional  
15 impairment that compromises relationships, education, and/or occupation (Andreassen et al.,  
16 2016). There is no consensus on the best term for generalized problematic use of social media  
17 and SNS, and terms used in the scientific literature (among others) include ‘social media  
18 addiction’ (Kuss & Griffiths, 2017), ‘problematic social networks use’ (Wegmann & Brand,  
19 2019), and ‘social networks use disorder’ (Wegmann & Brand, 2020). The present paper uses  
20 the term ‘problematic social media use’ because this phenomenon has not yet been recognized  
21 as a formal diagnosis. Nonetheless, most conceptual and methodological approaches are  
22 consistent with the components model of behavioral addictions, which suggests that behavior  
23 may be classified as an addiction if specific elements are present (i.e., salience, tolerance, mood  
24 modification, withdrawal, conflict, and relapse) (Griffiths, 2019).

25         One of the main reasons that PSMU causes conflict is that, at its core, there is greater  
26 psychological distress for the individual. More specifically, research has shown that PSMU has  
27 consistently been associated with decreased mental, educational, and social well-being (Boer  
28 et al., 2020; Shannon et al., 2022). Moreover, meta-analytic evidence has shown that among  
29 the most reliable indicators of the negative outcomes of PSMU are low self-esteem, poor  
30 subjective well-being, depression, anxiety, and loneliness (Huang, 2022). Therefore, these  
31 variables are among the most robust to assess concurrent validity. Moreover, PSMU increased  
32 after the COVID pandemic, and the prevalence rates across 64 countries were reported to be  
33 between 11% and 42%, depending on the classification scheme, instrument used, and  
34 population studied (Meng et al., 2022). In Spain, one in three adolescents is considered a  
35 problematic social media user (Andrade et al., 2021). Therefore, further studies are needed to  
36 better understand and prevent PSMU and its negative effects.

37 To conduct proper research concerning a specific phenomenon, it is crucial to have  
38 valid and reliable measurement tools. Consequently, several self-report psychometric scales  
39 have been developed to assess PSMU, such as the Social Media Disorder Scale (Van Den  
40 Eijnden et al., 2016), and the Social Media Addiction Questionnaire (Hawi & Samaha, 2017).  
41 However, the most widely used measures across various countries (Cheng et al., 2021) are the  
42 Bergen Facebook Addiction Scale (BFAS) (Andreassen et al., 2012) and the Bergen Social  
43 Media Addiction Scale (BSMAS) (Andreassen et al., 2016). Both scales were originally  
44 designed in English in Norway. Because numerous SNS were developed after the creation of  
45 *Facebook*, the BSMAS was proposed as an update of the BFAS by replacing the word  
46 ‘Facebook’ with ‘social media’ defined as “*Facebook, Twitter, Instagram, and the like*”  
47 (Andreassen et al., 2016, p. 254). However, a recent study found that although closely related,  
48 Facebook addiction and SNS addiction have different manifestations (Balcerowska et al.,  
49 2020). The study concluded that a measure of the wider concept of PSMU is more suitable for  
50 current research because most SNS users connect on more than one site.

51 The BSMAS has been validated among adult populations in a number of languages  
52 including Romanian (Stănculescu, 2022), Italian (Monacis et al., 2017; also includes  
53 adolescents), Korean (Shin, 2022), Bangla (Naher et al., 2022), and Greek (Dadiotis et al.,  
54 2021). Additionally, a recent study used the BSMAS among samples from nine countries,  
55 including Spain, but no detailed psychometric properties were reported (e.g., confirmatory  
56 factor analysis [CFA] and measurement invariance analyses were not conducted), and the  
57 sample only included Spanish adults (Brailovskaia & Margraf, 2022). Evidently, adolescents  
58 are developmentally distinct from adults, showing important cognitive, emotional, and social  
59 differences that may alter the way they understand and respond to psychometric instruments  
60 (Arrivillaga & Extremera, 2020; Deas et al., 2000; Valkenburg & Piotrowski, 2017). However,  
61 to the best of the present authors’ knowledge, only one Spanish (unpublished and non-peer-

62 reviewed) version by Monfil-Carratalá (2019) has used the BSMAS among an adolescent  
63 population. Again, there was little detail of its psychometric properties. The present research  
64 expanded on previous validation studies by analyzing the measurement invariance of the  
65 Spanish BSMAS across gender and age groups among adolescents, which is necessary to make  
66 comparisons between girls and boys, and early- and late-stage adolescents, and is a widespread  
67 practice in psychometric research. Therefore, the present analyses are warranted because there  
68 is no study of the psychometric properties of the BSMAS among Spanish adolescents that is  
69 available to interested researchers and practitioners.

70 Adolescence is a period in which social interactions and interpersonal relationships are  
71 crucial for development (Valkenburg & Piotrowski, 2017), and social media has become  
72 embedded in the daily lives of Spanish adolescents (Andrade et al., 2021). Because PSMU is  
73 associated with lower well-being in adolescents (Boer et al., 2020; Shannon et al., 2022) it is  
74 necessary to validate measures to fully understand adolescent PSMU. Moreover, Spanish is the  
75 main language used in over 20 countries and it is one of the most spoken languages in the  
76 world, along with English, Mandarin, and Hindi (Statista, 2023d). However, no study has  
77 examined whether the BSMAS is a developmentally appropriate measure for Spanish  
78 adolescents. To fill this gap and promote PSMU research in Spanish-speaking countries using  
79 a well-known international measure, the present study aimed at examining the psychometric  
80 properties of the BSMAS among Spanish adolescents.

## 81 **2. Methods**

### 82 ***2.1. Participants and procedure***

83 Students from five schools in Malaga (Spain) participated in the present study. The  
84 sample was selected according to convenience criteria using cluster sampling (whole  
85 classrooms). For a population of 188,067 adolescents living in the Malaga province, a sample

86 size of 542 was necessary to conduct analyses with a 98% confidence level and a 5% margin  
87 of error. A total of 688 adolescents (54% girls, 46% boys) participated, aged 12 to 18 years ( $M$   
88 = 14.23 years,  $SD = 1.76$ ). Of these, 26.4% were in the first year of compulsory secondary  
89 education (roughly equivalent to US high school 7<sup>th</sup> grade), 23.7% in the second year, 12.4%  
90 in the third year, and 15.5% in the fourth year. Additionally, 12% were in the first year of the  
91 Baccalaureate (roughly equivalent to US high school 11<sup>th</sup> grade) and 10% in the second year.  
92 Informed consent was obtained from the school administrators and families of the adolescents.  
93 Data collection occurred during class hours (approximately 50 minutes) in the schools, in the  
94 presence of a teacher. Students were informed about the anonymity, confidentiality, and  
95 willfulness of their participation. They completed the scales in online (four schools,  $n = 597$ )  
96 and paper (one school,  $n = 91$ ) formats. There were no statistical differences between data  
97 variables collected online or offline. The study was approved by the first author's university  
98 Ethics Committee. Data collection was in accordance with the Declaration of Helsinki (World  
99 Medical Association, 2013).

## 100 **2.2. Instruments**

### 101 *2.2.1. Bergen Social Media Addiction Scale (BSMAS)*

102 The BSMAS (Andreassen et al., 2016) is a self-report scale comprising six items  
103 concerning individuals' experiences with social media over the past year. Each item is  
104 anchored on one of the six aforementioned components of the model of behavioral addictions  
105 (Griffiths, 2019). Items are rated on a five-point Likert scale from 1 ("very rarely") to 5 ("very  
106 often"), so summed scores range from 6 to 30 with higher scores indicating greater PSMU  
107 (Andreassen et al., 2016). The psychometric properties of the scale are reported in the 'Results'  
108 section.

109 The BSMAS was translated based on the guidelines of the International Test  
110 Commission (2017). The scale was first translated by a bilingual psychologist with knowledge  
111 of the research area. The scale was then back-translated and revised by two further bilingual  
112 academics with an in-depth knowledge of the target culture and population. This version of the  
113 BSMAS was then compared to the unpublished one by Monfil-Carratalá (2019). Discussions  
114 about test instructions, item meanings and rating scale were held between the translators to  
115 maximize intelligibility among the target population. The final version can be found in the  
116 Appendix.

#### 117 2.2.2. *Smartphone Addiction Scale- Short Version (SAS-SV)*

118 The Spanish version of the SAS-SV (Lopez-Fernandez, 2017; original version: Kwon  
119 et al., 2013) was used to assess problematic smartphone use. The scale contains ten items  
120 answered on a Likert scale ranging from 1 (“*strongly disagree*”) to 6 (“*strongly agree*”). An  
121 example item is “*Using my smartphone longer than I intended*”. Higher scores indicate an  
122 increased risk of problematic smartphone use. The SAS-SV has sound psychometric properties  
123 (Lopez-Fernandez, 2017). In the present study, the reliability was very good ( $\alpha = 0.87$ ;  $\omega =$   
124  $0.87$ ).

#### 125 2.2.3. *Depression, Anxiety and Stress Scale (DASS-21)*

126 The depression and anxiety subscales of the Spanish version of the DASS-21 (Bados et  
127 al., 2005; original version: Lovibond & Lovibond, 1995) were used to assess depression and  
128 anxiety. Each subscale comprises seven items assessing symptoms of depression/anxiety, using  
129 a scale ranging from 0 (“*did not apply to me at all*”) to 3 (“*applied to me very much or most of*  
130 *the time*”). An example item from the depression subscale is “*I felt that I had nothing to look*  
131 *forward to*”, and an example item from the anxiety subscale is “*I felt I was close to panic*”.  
132 Higher scores suggest increased symptomatology. The DASS-21 has good psychometric

133 characteristics (Bados et al., 2005). In the present study, the reliability was excellent for  
134 depression ( $\alpha = 0.92$ ;  $\omega = 0.92$ ) and very good for anxiety ( $\alpha = 0.86$ ;  $\omega = 0.86$ ).

#### 135 2.2.4. UCLA Loneliness Scale

136 The Spanish version of the UCLA Loneliness Scale (Velarde-Mayol et al., 2016;  
137 original version: Russell, 1996) was used to assess loneliness. The scale comprises ten items  
138 assessing feelings of loneliness with items such as “*How often do you feel you have no one to*  
139 *talk to?*” Participants respond on a Likert scale ranging from 1 (“*never*”) to 4 (“*very often*”).  
140 The scale has shown good psychometric properties (Velarde-Mayol et al., 2016). In the present  
141 study, it had very good reliability ( $\alpha = 0.89$ ;  $\omega = 0.89$ ).

#### 142 2.2.5. Flourishing Scale (FS)

143 The Spanish version of the FS (Ramírez-Maestre et al., 2017; original version: Diener  
144 et al., 2010) was used to assess subjective well-being. The FS comprises eight items answered  
145 on a scale spanning from 1 (“*strongly disagree*”) to 7 (“*strongly agree*”). An example item is  
146 “*I lead a purposeful and meaningful life*”, where higher scores indicate greater well-being. The  
147 scale has shown good psychometric properties (Ramírez-Maestre et al., 2017). In the present  
148 study, the reliability was excellent ( $\alpha = 0.90$ ;  $\omega = 0.90$ ).

#### 149 2.2.6. Single Item Self-Esteem Scale (SISE)

150 The Spanish version of the SISE (Dominguez-Lara, 2020; Robins et al., 2001) was used  
151 to assess self-esteem (i.e., “*I have high self-esteem*”). Students were asked to respond using a  
152 scale from 1 (“*does not describe me at all*”) to 5 (“*describes me very well*”). The SISE has  
153 shown good psychometric properties among Spanish-speaking youth (Dominguez-Lara, 2020).

#### 154 2.2.7. Frequency of SNS use

155 Participants were asked about the daily number of hours spent using SNS on weekdays  
156 and weekends, using the following scale: 1 = I do not use them, 2 = Less than two hours, 3 =  
157 Between two and three hours, 4 = Between three and five hours, and 5 = More than six hours.  
158 These response ranges were created to facilitate participants' estimation of SNS use because  
159 this information was not objectively measured.

### 160 **2.3. Statistical analyses**

161 *SPSS 23, JASP 0.16.2.0, and Excel Office 16* software were used to analyze the data.  
162 Expectation maximization was used to impute missing data (1.66% of values were missing at  
163 random). First, reliability was estimated using Cronbach's alpha ( $\alpha$ ), McDonald's omega ( $\omega$ ),  
164 composite reliability (CR), average variance extracted (AVE), and standard error of  
165 measurement (SEM). For the first three, values of over 0.7 are acceptable in newer areas of  
166 research such as PSMU, for AVE values over 0.5 indicate suitability, and SEM is expected to  
167 be  $\leq SD/2$  (Hair et al., 2018; Shrestha, 2021; Wuang, Su & Huang, 2012). Second, descriptive  
168 statistics, inter-item correlations, and item-total correlations were calculated.

169 Third, a confirmatory factor analysis (CFA) was conducted to assess construct validity.  
170 Items were treated as ordinal and the diagonally weighted least squares (DWLS) estimation  
171 method was used, which is based on a polychoric correlation matrix and asymptotic covariance  
172 matrix. This method is appropriate for Likert-type scales, such as the BSMAS (Mîndrilă, 2010).  
173 Model fit was assessed based on widely used fit indices: the root mean square error of  
174 approximation (RMSEA  $< 0.06$ ), the standardized root mean square residual (SRMR  $< 0.08$ ),  
175 the comparative fit index (CFI  $\geq 0.95$ ), and the Tucker-Lewis index (TLI  $\geq 0.95$ ) (Hu & Bentler,  
176 1999). The specified cut-off criteria for fit indices are used as a rule to minimize Type I and  
177 Type II error rates (Hu & Bentler, 1999).

178 Fourth, measurement invariance (configural, metric, and scalar) was calculated by  
179 gender and age group (younger adolescents: 12 to 14 years, older adolescents: 15 to 18 years;  
180 based on the United Nations Children’s Fund [UNICEF], 2011 classification of early and late  
181 adolescence). As illustrated by Putnick and Bornstein (2016), establishing measurement  
182 invariance is necessary to verify that an instrument evaluates the same construct across  
183 different groups, and so that robust conclusions about potential differences or similarities can  
184 be drawn. Configural invariance is established if the model complies with the aforementioned  
185 standards; metric invariance is indicated by  $\Delta CFI > -0.005$ ,  $\Delta SRMR < 0.025$ ,  $\Delta RMSEA <$   
186  $0.01$ , and  $\Delta \chi^2 p\text{-value} > 0.05$ , while scalar invariance is implied if  $\Delta CFI > -0.005$ ,  $\Delta SRMR <$   
187  $0.005$ ,  $\Delta RMSEA < 0.01$ , and  $\Delta \chi^2 p\text{-value} > 0.05$  (Putnick & Bornstein, 2016).

188 Fifth, independent *t*-tests were conducted to assess the differences in gender and age  
189 groups. Sixth, Pearson coefficient correlations were used to assess concurrent validity (DASS-  
190 21, UCLA-Loneliness, SAS-SV, Self-esteem, and FS) and criterion validity (daily hours of  
191 SNS use) (Prieto & Delgado, 2010).

## 192 **3. Results**

### 193 ***3.1. Reliability and descriptive statistics***

194 Regarding the reliability of the BSMAS, it was found that Cronbach’s  $\alpha = 0.75$ ,  
195 McDonald’s  $\omega = 0.75$ , CR = 0.83, AVE = 0.45, and SEM = 2.5. Moreover, Table 1 presents  
196 the descriptive statistics, inter-item correlations, and item-total correlations of the BSMAS. All  
197 inter-item correlations were significant ( $p < 0.01$ ) and between  $r = 0.22$  and  $r = 0.51$ , and all  
198 item-total correlations were above 0.61.

#### 199 **Table 1**

200 *Descriptive statistics, inter-item correlations, and item-total correlations of the BSMAS*

Items	Mean	Standard deviation	Skewness	Kurtosis	2	3	4	5	6	7
1. Salience	2.44	1.20	0.50	-0.78	0.51	0.32	0.25	0.34	0.30	0.67
2. Tolerance	1.99	1.17	1.00	-0.09		0.41	0.36	0.41	0.29	0.74
3. Mood modification	2.60	1.40	0.42	-1.13			0.27	0.30	0.22	0.65
4. Relapse	1.99	1.17	1.06	0.13				0.27	0.31	0.61
5. Withdrawal	2.21	1.37	0.81	-0.70					0.34	0.68
6. Conflict	1.96	1.19	1.12	0.19						0.61
7. BSMAS	13.16	5.00	0.59	-0.24						-

201 All correlations are significant  $p < 0.01$  (two-tailed).

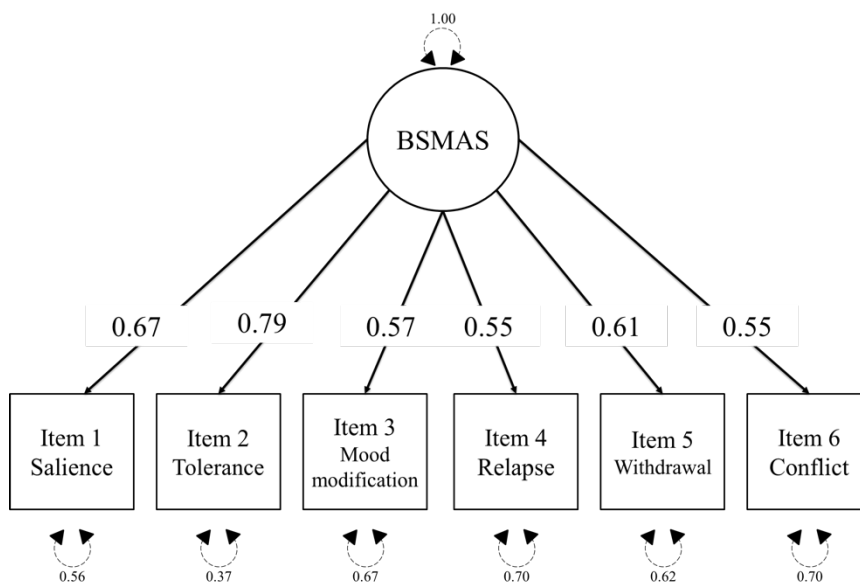
202

### 203 3.2. Construct validity

204 Regarding construct validity, the CFA results indicated that a one-factor model yielded  
 205 a good fit:  $\chi^2_{(9)} = 16.50$ ,  $p = 0.06$ , CFI = 0.99, TLI = 0.99, RMSEA = 0.03 [90% CI 0.00; 0.06],  
 206 SRMR = 0.03. Figure 1 shows the factor loadings of the BSMAS items, indicating that all of  
 207 them were  $\geq 0.55$ .

#### 208 Fig. 1

209 *Factor loadings of the BSMAS items*



210

211 Table 2 presents the results of the measurement invariance analyses by gender and age  
 212 group. As shown, all the indices were adequate, except for the  $\chi^2$  *p*-value for scalar invariance  
 213 by gender, which should have been non-significant.

214

215 **Table 2**216 *Measurement invariance of the BSMAS by gender and age group*

Model and comparisons	Fit statistics				
	$\chi^2$ (df) or $\Delta\chi^2$ ( $\Delta$ df)	<i>p</i> -value	CFI or $\Delta$ CFI	SRMR or $\Delta$ SRMR	RMSEA or $\Delta$ RMSEA
<b>Gender</b>					
<i>Models</i>					
M1: Configural	21.852 (17)	0.190	0.997	0.038	0.029
M2: Metric	27.003 (22)	0.211	0.997	0.043	0.026
M3: Scalar	59.922 (40)	0.022	0.988	0.043	0.039
<i>Model comparisons</i>					
M2-M1	5.151 (5)	0.397	0.000	0.005	- 0.003
M3-M2	32.919 (18)	0.017	- 0.009	0.000	0.013
<b>Age group</b>					
<i>Models</i>					
M1: Configural	22.834 (17)	0.155	0.997	0.039	0.032
M2: Metric	27.449 (22)	0.195	0.997	0.043	0.027
M3: Scalar	44.480 (40)	0.289	0.997	0.047	0.018
<i>Model comparisons</i>					
M2-M1	4.615 (5)	0.464	0.000	0.004	- 0.005
M3-M2	17.031 (18)	0.520	0.000	0.004	- 0.009

217

218 Table 3 shows the results of the *t*-tests comparing total BSMAS scores by gender and  
 219 age group. As can be seen, females and older adolescents had significantly higher scores,  
 220 although with small effect sizes.

221 **Table 3**

222 *Comparison of BSMAS scores by gender and age group*

	<i>N</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>
Gender						
Girls	364	13.85	5.00	4.04	0.000	0.31
Boys	304	12.30	4.88			
Age group*						
Younger	369	12.77	5.09	- 2.62	0.008	0.21
Older	292	13.79	4.82			

223 \*Younger adolescents were aged 12 to 14 years; Older adolescents were aged 15 to 18 years.

224

225 **3.3. Concurrent and criterion validity**

226 Finally, to assess concurrent validity, correlations between the BSMAS and indicators  
 227 of well-being (i.e., self-esteem and flourishing) and psychological maladjustment (i.e., anxiety,  
 228 depression, loneliness, and problematic smartphone use) are shown in Table 4. Furthermore,  
 229 correlations between the BSMAS and daily hours spent on SNS are provided. As shown,  
 230 significant negative associations were found with well-being indicators and significant positive  
 231 associations with maladjustment and problematic smartphone use, supporting concurrent  
 232 validity. Moreover, significant and positive associations were found with daily hours spent on  
 233 SNS, presenting evidence of criterion validity.

234 **Table 4**

235 *Descriptive statistics and correlations to establish BSMAS validity*

Variables	1	2	3	4	5	6	7	8	9
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1. BSMAS	13.16 (5.00)	0.35**	0.36**	0.17**	0.65**	-0.18**	-0.16**	0.32**	0.37**
2. Anxiety		0.69 (0.70)	0.72**	0.36**	0.29**	-0.30**	-0.26**	0.05	0.12**
3. Depression			0.88 (0.86)	0.39**	0.32**	-0.43**	-0.42**	0.06	0.13**
4. Loneliness				21.42 (7.04)	0.13**	-0.34**	-0.32**	0.02	0.07*
5. Problematic smartphone use					27.37 (10.98)	-0.21**	-0.15**	0.33**	0.37**
6. Flourishing						41.32 (10.43)	0.42**	-0.03	-0.13**
7. Self-esteem							2.89 (1.36)	-0.10**	-0.21**
8. Daily hours SNS (weekdays)								3.38 (1.13)	0.60**
9. Daily hours SNS (weekends)									3.60 (1.11)

236 Means and (standard deviations) on the diagonal. \*\*  $p < 0.01$  \*  $p < 0.05$

237

#### 238 4. Discussion

239 The present study evaluated the psychometric properties of a Spanish version of the  
 240 BSMAS among Spanish adolescents. Regarding internal consistency, previous studies have  
 241 found satisfactory Cronbach's  $\alpha$ , McDonald's  $\omega$ , CR, AVE, and SEM for BSMAS adaptations  
 242 (Andreassen et al., 2016; Brailovskaia & Margraf, 2022; Dadiotis et al., 2021; Monacis et al.,  
 243 2017; Naher et al., 2022; Shin, 2022; Stănculescu, 2022). Similarly, the present study  
 244 corroborated adequate reliability indices, except for AVE which was lower than expected.  
 245 Moreover, significant inter-item correlations were found to be lower than in previous studies  
 246 (e.g., Dadiotis et al., 2021; Monacis et al., 2017), but the item-total correlations were higher  
 247 than previous studies (e.g., Lin et al., 2017; Stănculescu, 2022). Overall, the results of the  
 248 present study indicated that the Spanish BSMAS has adequate internal consistency.

249 Construct validity was assessed using CFA. Previous findings showed a generally good  
 250 fit with a one-factor model (e.g., Lin et al., 2017; Monacis et al., 2017; Shin, 2022; Stănculescu,  
 251 2022). In the present study, all fit indices were as expected, showing good model fit. Consistent

252 with all the previous validation studies that conducted CFA, factor loadings for BSMAS items  
253 were high.

254 With regards to measurement invariance, configural invariance means that the basic  
255 organization of the construct remained equivalent across groups; metric invariance reflects that  
256 each item contributed to the latent construct to a similar degree; and scalar invariance indicates  
257 that mean differences in the latent construct captured all mean differences in the shared  
258 variance of items (Putnick & Bornstein, 2016). Based on this approach, most indices standards  
259 should be reached to establish invariance at each level. The results supported configural and  
260 metric invariance among both girls and boys, and configural, metric, and scalar invariance  
261 among younger and older adolescents. Regarding scalar invariance across gender, four out of  
262 five indicators suggested invariance, with the chi-square difference test being the only  
263 exception. However, researchers have previously noted a change of focus toward alternative  
264 fit indices (e.g., CFI, RMSEA, and SRMR) because  $\chi^2$  tends to be sensitive to even small  
265 deviations from a perfect-fitting model (Putnick & Bornstein, 2016). Therefore, scalar  
266 invariance across genders may be cautiously inferred.

267 The results are also consistent with prior studies indicating measurement invariance  
268 across gender and age groups (e.g., Lin et al., 2017; Monacis et al., 2017; Naher et al., 2022;  
269 Stănculescu, 2022). Furthermore, similar to results of the present study, in the studies that have  
270 compared gender groups, girls had had higher scores than boys (e.g., Monacis et al., 2017;  
271 Stănculescu, 2022). Finally, age group comparisons were analyzed in the study by Monacis et  
272 al. (2017). Although they compared older adolescents with adults, and the present study  
273 compared younger and older adolescents, in both studies, higher scores were found in older  
274 adolescents. Therefore, evidence seems to suggest an increased vulnerability among this age  
275 group.

276           Regarding concurrent validity, previous validation studies analyzed the associations  
277 between BSMAS and several positive and negative adjustment outcomes. For instance,  
278 Monacis et al. (2017) found that PSMU showed a positive association with gaming disorder  
279 and insecure attachment and a negative association with secure attachment. Similarly, prior  
280 studies found that higher PSMU was related to higher stress, anxiety, depression, loneliness,  
281 and hyperactivity, and associated with lower self-esteem, happiness, and mental health  
282 (Brailovskaia & Margraf, 2022; Dadiotis et al., 2021; Lin et al., 2017; Naher et al., 2022;  
283 Stănculescu, 2022). Consequently, the present study's results are consistent with these research  
284 findings having found positive associations between BSMAS scores and anxiety, depression,  
285 loneliness, and problematic smartphone use and negative associations with self-esteem and  
286 flourishing.

287           After the COVID-19 pandemic, psychological problems, such as depression, anxiety,  
288 general mental distress, feelings of loneliness, and reduced self-esteem arose among the  
289 adolescent population (National Observatory for Technology and Society in Spain, 2023).  
290 Research shows that these types of psychological problems are closely related to PSMU  
291 (Huang, 2022). Coincidentally, after the pandemic, cases of PSMU and problematic smartphone  
292 use also increased worldwide (Meng et al., 2022). There is some evidence indicating that  
293 psychological distress and PSMU increased during stricter pandemic restrictions in adolescents  
294 due to greater isolation in this period (e.g., Magson et al., 2021). It has also been suggested that  
295 the constraints during this time may have lasting effects on the emotional and social  
296 development of adolescents (Montag & Elhai, 2020).

297           In addition, some theories suggest that problematic digital technology use may arise  
298 from overusing online applications, such as social media, as a means of compensatory use to  
299 alleviate psychological distress (e.g., Brand et al., 2019; Kardefelt-Winther, 2014). Therefore,  
300 prior research and theoretical frameworks support the relevance of having valid measurement

301 instruments of PSMU that account for the relationship between PSMU and psychological  
302 distress among the Spanish adolescent population. The aforementioned findings of the present  
303 study provide evidence in this regard, therefore, supporting the concurrent validity of the  
304 Spanish BSMAS for adolescents.

305 Criterion validity in the present study was established by analyzing associations  
306 between the BSMAS and daily hours spent on SNS. These findings are also consistent with  
307 prior studies analyzing associations with social media intensity (Stănculescu, 2022), SNS  
308 addiction proneness (Shin, 2022) and daily hours spent on SNS (Brailovskaia & Margraf, 2022;  
309 Dadiotis et al., 2021; Lin et al., 2017; Naher et al., 2022). Therefore, the results support the  
310 criterion validity of the BSMAS among Spanish adolescents.

311 The present study has some limitations. First, a community sample of healthy  
312 adolescents was used, and the data were self-reported, which reduces the probability of finding  
313 adolescents with PSMU, and is susceptible to social desirability and recall biases. Future  
314 studies should include clinical samples or use clinical interviews to reduce these biases and  
315 further assess BSMAS validity. Second, all the data were cross-sectional, so predictive validity  
316 and test-retest reliability could not be assessed. Therefore, future research should include  
317 repeated measures designs. Third, the study relied on a monocultural sample, therefore, the  
318 generalization to other Spanish-speaking cultures needs to be analyzed in future studies.  
319 Fourth, AVE was lower than expected. In this regard, it is worth mentioning that the specified  
320 cut-off criterium for AVE is considered a more conservative measure than CR (Fornell &  
321 Larcker, 1981), leading some authors to suggest that if CR is good, the internal consistency of  
322 the scale is acceptable (Shrestha, 2021). In addition, it has been noted that the cut-off of  
323 acceptable AVE is a measure that relies on conventional rule-of-thumb rather than on statistical  
324 testing procedures (Cheung et al., 2023). Nonetheless, the lower-than-expected value of AVE  
325 indicates more error in the items than the variance explained by the construct, suggesting a

326 need for future refinement of the instrument. Finally, the psychometric properties of the  
327 BSMAS in most languages have been analyzed using Classical Test Theory (therefore, the  
328 present study followed these psychometric testing guidelines) (e.g., Dadiotis et al., 2021;  
329 Monacis et al., 2017; Shin, 2022). Because such guidelines have specific limitations,  
330 researchers might want to carry out other types of psychometric testing (e.g., Item Response  
331 Theory, Rasch analysis) as has been conducted in previous studies (i.e., Lin et al., 2017;  
332 Stanculescu, 2022), to further support the findings from this study.

333         Despite these limitations, the present study had important strengths. It is the first study  
334 to examine measurement invariance across adolescent age groups. Because adolescents have  
335 different experiences at specific developmental stages, it is concluded that the Spanish BSMAS  
336 might be used with early and middle-stage adolescents to consider these differences in research  
337 (World Health Organization, 2010). Moreover, because Spanish is one of the most widely  
338 spoken languages worldwide, and this is the first study to present a psychometric validation of  
339 the Spanish BSMAS, this version should be of utility among Spanish-speaking populations and  
340 in cross-cultural studies, after replication. The study provides preliminary evidence to suggest  
341 that the Spanish BSMAS has adequate psychometric properties, and that the scale is a reliable  
342 and valid tool to assess PSMU among Spanish adolescents.

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## 552 **Appendix**

553 Spanish version of the Bergen Social Media Addiction Scale (BSMAS) for adolescents

554 Instrucciones: A continuación, encontrarás algunas afirmaciones sobre tu uso de las **redes**  
555 **sociales**. Utiliza la siguiente escala para contestarlas.

1	2	3	4	5
Casi nunca	Algunas veces	La mitad de las veces	La mayoría de las veces	Casi siempre

Durante el último año, con qué frecuencia has...

1. ...pasado mucho tiempo pensando en redes sociales o planeando su uso?
2. ...tenido un deseo cada vez mayor de usar más y más las redes sociales?
3. ...usado las redes sociales para olvidar tus problemas personales?
4. ....intentado reducir el uso de redes sociales, pero no has podido?
5. ...te has sentido nervioso o molesto cuando te han prohibido usar las redes sociales?
6. ...usado tanto las redes sociales que ello ha tenido un impacto negativo en tus estudios?