

ORIGINAL

## A multidimensional measure of social networking addiction: Psychometric properties of AdiTec-I scores in Spanish-speaking adolescents and young adults

### *Una medida multidimensional de la adicción a las redes sociales: Propiedades psicométricas de las puntuaciones del AdiTec-I en adolescentes y adultos jóvenes hispanohablantes*

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#### Abstract

Social networking addiction (SNA) is not formally recognized as a disorder in current diagnostic systems, although research has mainly approached it from an addiction-based perspective. Most available instruments provide predominantly unidimensional scores, which may limit the characterization of symptom heterogeneity. The AdiTec-I was developed as a multidimensional instrument adapted from DSM-IV-TR substance abuse and dependence criteria to assess SNA. This study examined evidence of validity based on the internal structure of AdiTec-I scores, reliability estimates, convergent and discriminant evidence, and measurement invariance across gender and cultural background in Spanish-speaking adolescents and young adults.

The final sample comprised 3,817 participants aged 14–22 years ( $M = 15.94$ ,  $SD = 1.44$ ) from educational institutions in Spain and Latin America. A competitive confirmatory factor analysis showed that the hierarchical second-order model, comprising Abuse, Abstinence, Lack of Control, and Escape, provided adequate fit and was retained over the alternative models ( $CFI = .935$ ,  $RMSEA = .066$ ,  $SRMR = .046$ ). Reliability estimates were adequate across all domains, and convergent and discriminant evidence supported score interpretation. Metric invariance supported comparable interpretation of the latent structure across gender and cultural background, whereas scalar invariance was only partially supported.

These findings support the AdiTec-I as a psychometrically sound multidimensional instrument for assessing SNA in Spanish-speaking adolescents and young adults. Its hierarchical structure supports both overall severity assessment and profile-based interpretation of domain scores, with potential usefulness in preventive and clinical settings. Future research should strengthen the Escape domain, extend cross-group evidence, and examine temporal stability, external criteria, and the practical utility of interpretive thresholds.

**Keywords:** social networking addiction, adolescents, psychometric properties, confirmatory factor analysis, measurement invariance

#### Resumen

La adicción a las redes sociales (SNA) no está reconocida formalmente como trastorno, aunque suele estudiarse desde una perspectiva adictiva. La mayoría de los instrumentos disponibles ofrecen puntuaciones unidimensionales, lo que puede limitar la caracterización de la heterogeneidad sintomática. El AdiTec-I se desarrolló como un instrumento multidimensional adaptado de criterios DSM-IV-TR para evaluar la SNA. Este estudio examinó evidencias de validez basadas en la estructura interna de sus puntuaciones, estimaciones de fiabilidad, evidencias de validez convergente y discriminante, e invarianza según género y contexto cultural en adolescentes y adultos jóvenes hispanohablantes.

La muestra final incluyó 3.817 participantes de 14 a 22 años ( $M = 15,94$ ;  $DT = 1,44$ ) de centros educativos de España y América Latina. Un análisis factorial confirmatorio competitivo mostró que el modelo jerárquico de segundo orden, compuesto por Abuso, Abstinencia, Falta de Control y Escape, presentó ajuste adecuado y fue retenido frente a los modelos alternativos ( $CFI = ,935$ ,  $RMSEA = ,066$ ,  $SRMR = ,046$ ). Las estimaciones de fiabilidad fueron adecuadas y las evidencias convergente y discriminante apoyaron la interpretación de las puntuaciones. La invarianza métrica apoyó una interpretación comparable según género y contexto cultural, mientras que la escalar solo se sostuvo parcialmente.

Estos hallazgos apoyan el AdiTec-I como un instrumento multidimensional psicométricamente sólido para evaluar la SNA en adolescentes y adultos jóvenes hispanohablantes. Su estructura jerárquica permite evaluar gravedad global e interpretar perfiles sintomáticos en contextos preventivos y clínicos. Futuros estudios deberían reforzar el dominio Escape y examinar estabilidad temporal, criterios externos y utilidad aplicada de los puntos de corte interpretativos.

**Palabras clave:** adicción a las redes sociales, adolescentes, propiedades psicométricas, análisis factorial confirmatorio, invarianza de medida

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**S**ocial networking sites (SNS) are deeply embedded in contemporary social life. In early 2024, more than five billion active social media user identities were recorded worldwide (Kemp, 2024). Within this context, excessive SNS engagement has been associated with addiction-like symptoms and functional impairment (Kuss & Griffiths, 2011; Tsilosani et al., 2023). Social networking addiction (SNA) has been conceptualized as excessive preoccupation with SNS, persistent urges to use SNS, and continued engagement despite interference with social, academic, occupational, or psychological functioning (Andreassen & Pallesen, 2014). Adolescents and young adults constitute a particularly relevant population, especially girls and young women, given their intensive SNS use and the association between maladaptive SNS use and poorer mental health indicators (Montag et al., 2024; Shannon et al., 2022; Su et al., 2020).

At present, SNA is not formally recognized as a disorder in either the Diagnostic and Statistical Manual of Mental Disorders (5th ed., text rev.; DSM-5-TR; American Psychiatric Association [APA], 2022) or the International Classification of Diseases (11th ed.; ICD-11; World Health Organization [WHO], 2019). Early research often framed SNS-related problems within the broader umbrella of “Internet addiction”, a construct that has been criticized as conceptually inadequate because it groups distinct online behaviors under an excessively broad label (Starcevic & Aboujaoude, 2017). More recent work suggests that maladaptive online behaviors are better understood as related but distinct conditions rather than as manifestations of a single undifferentiated disorder (Baggio et al., 2024; Billieux et al., 2015).

Broader formulations such as problematic SNS use have also been proposed as alternatives to addiction-based conceptualizations (Casale, 2020). However, when their boundaries with addiction-oriented constructs are not clearly specified, such formulations may contribute to conceptual heterogeneity (Das & Chaudhary, 2026; Varona et al., 2022). Despite these debates, addiction-based approaches remain highly influential in research on excessive SNS use. Within the so-called confirmatory framework, criteria and mechanisms originally developed for substance-related and behavioral addictions have been adapted to specific online behaviors (Billieux et al., 2015). This perspective has informed much of the SNA literature, particularly work drawing on Griffiths’ (2005) component model of addiction, developed in analogy with DSM-IV substance-dependence criteria.

These conceptual debates have direct implications for assessment. In the absence of formal SNA diagnostic criteria, most instruments have adapted addiction-based models. Two of the most widely used measures are the Bergen Social Media Addiction Scale (BSMAS; Andreassen et al., 2016), based on the component model of addiction

(Griffiths, 2005), and the Social Media Disorder Scale (SMD Scale; van den Eijnden et al., 2016), derived from the DSM-5 Internet Gaming Disorder criteria (APA, 2013). Both primarily yield a single global severity score and have shown robust psychometric performance across different contexts. For example, the SMD Scale has shown cross-national validity in adolescents from 44 countries, whereas the BSMAS has shown evidence of validity across multiple national contexts, together with evidence of cross-cultural and gender invariance (Boer et al., 2022; Brailovskaia & Margraf, 2024; Leung et al., 2020; Yue et al., 2022).

However, recent work has also highlighted limitations of predominantly unidimensional approaches. In particular, scales derived from classic addiction-component models may blur potentially central and peripheral symptoms when applied to SNA, which may in turn inflate the risk of overpathologizing high but nonimpairing engagement (Cataldo et al., 2022; Fournier et al., 2023). This concern is especially relevant when the aim is not only to screen for severity but also to characterize the internal organization of the construct. A multidimensional approach may therefore be better suited to differentiate symptom domains and capture heterogeneity in the expression of SNA (Billieux et al., 2015; Griffiths, 2005).

Evidence from Spanish-speaking contexts is consistent with this multidimensional perspective. For example, in Spain, the Social Network Addiction Scale (SNAddS-6S) supported a multidimensional structure based on addiction components and organized under a higher-order solution (Cuadrado et al., 2020). Likewise, the Adicción a Redes Sociales scale (ARS), originally developed in Peru, was also conceived as a multidimensional instrument (Escurrea-Mayate & Salas-Blas, 2014), and subsequent evidence in Mexican adolescents supported a multidimensional re-specification of the ARS together with measurement invariance across gender (González-Alcántara et al., 2021). Taken together, these findings suggest that SNA may be better represented by differentiated symptom domains than by a single undifferentiated score, supporting the potential value of multidimensional assessment (Billieux et al., 2015; Cataldo et al., 2022). At the same time, because available evidence in Spanish-speaking contexts comes largely from single-country studies, comparability across Spanish-speaking populations should not be assumed a priori, and further psychometric evaluation of multidimensional SNA instruments across these populations is still needed (e.g., Machimbarrena et al., 2023).

Within this context, the AdiTec-I was developed to assess SNA in Spanish-speaking adolescents and young adults (Chóliz et al., 2016). Derived from the Internet Dependence Test, the instrument adapts DSM-IV-TR substance abuse and dependence criteria to SNS use (APA, 2000; Chóliz & Marco, 2012). Although DSM-5 reorganized substance-related diagnoses by merging abuse

and dependence into a single disorder and introducing craving, substantial continuity in the underlying addiction-related construct remains (APA, 2013, 2022). Retaining the DSM-IV-TR-derived framework therefore preserves central addiction domains such as impaired control, withdrawal-like symptoms, and functional interference, which remain theoretically aligned with contemporary addiction models.

The AdiTec-I has a hierarchical structure comprising four first-order factors—Abuse, Abstinence, Lack of Control, and Escape—under a higher-order SNA factor, and yields both a total score and domain-specific scores. In this way, it responds to two needs highlighted in the field: moving beyond purely global severity indices and testing a multidimensional model in Spanish-speaking populations. It also allows profile-based interpretation in preventive and clinical contexts. The original instrument further includes gender-specific interpretive thresholds intended to distinguish normative, at-risk, and potentially addictive patterns (Chóliz et al., 2016).

The aim of the present study was to provide additional evidence supporting the interpretation of AdiTec-I scores in a large sample of Spanish-speaking adolescents and young adults. Specifically, evidence of validity based on internal structure was examined through a competitive confirmatory factor analysis (CFA), comparing the hypothesized hierarchical second-order model with alternative structures, including a unidimensional model and a four-factor correlated first-order model. Score reliability and evidence of convergent and discriminant validity based on the internal structure were also evaluated. Finally, measurement invariance across gender and cultural background (Spain vs. Latin America) was tested. It was hypothesized that (1) the hierarchical second-order model would show adequate fit and outperform the alternative models; (2) AdiTec-I scores would demonstrate satisfactory reliability and evidence of convergent and discriminant validity; and (3) the model would show at least metric, and ideally partial scalar, invariance across gender and cultural background.

## Method

### Participants and procedure

The initial sample comprised 4,013 participants recruited from educational institutions in Spain and several Latin American countries between 2017 and 2021. This study used a nonprobabilistic sampling strategy and a cross-sectional design. Students completed the AdiTec-I either individually, in cases of suspected problematic or addictive use, or collectively as part of the AdiTec universal prevention program. Questionnaires were administered by authorized school staff (teachers or educational psychologists) in accordance with the procedures specified

in the AdiTec user's manual (Chóliz et al., 2016). Responses were subsequently entered into the TEA Ediciones online platform. The present study was based on the anonymized database generated during this period.

Analyses were restricted to adolescents and young adults aged 14–22 years, the primary target population of the instrument (Chóliz, 2010; Chóliz et al., 2016). Inclusion criteria were (a) completion of the AdiTec-I questionnaire and (b) age within the 14–22 range. Gender and country of origin data were used for subgroup analyses when available. Participants outside this age range or with incomplete questionnaire data were excluded.

After applying the eligibility criteria, the final sample comprised 3,817 participants. Gender data were available for 3,803 participants (99.6% of the total sample), including 2,216 men (58.3%) and 1,585 women (41.7%). Mean age was 15.94 years ( $SD = 1.44$ ). Country of origin data were available for 2,391 participants (62.6% of the total sample). Of these, 1,325 (55.4%) were from Spain and 1,066 (44.6%) from Latin American countries, including Guatemala, Panama, Colombia, Ecuador, Paraguay, Bolivia, Costa Rica, the Dominican Republic, Honduras, Mexico, and El Salvador.

All procedures complied with the Declaration of Helsinki and Spanish legislation on biomedical research, bioethics, and data protection. The protocol was approved by the Ethics Commission of University of Valencia (procedure number: H1482079199937).

### Instruments

The AdiTec-I is a self-administered questionnaire requiring approximately 10–15 minutes to complete. It comprises 23 items rated on a 5-point ordinal scale according to degree of agreement (Items 1–11) or frequency of use (Items 12–23): 0 = *strongly disagree/never*, 1 = *disagree/rarely*, 2 = *neutral/sometimes*, 3 = *agree/often*, and 4 = *strongly agree/very often*. Although some items retain Internet-related wording inherited from the source instrument, the questionnaire was designed to assess SNA, as specified in its instructions (Chóliz et al., 2016). It also collects sociodemographic data, including gender, age, educational institution, and country of origin.

The internal structure of the AdiTec-I comprises four interrelated factors associated with SNA: Abuse (7 items; “excessive SNS use affecting the ability to engage in healthy and routine activities”), Abstinence (7 items; “emotional discomfort or irritability when it is not possible to connect to SNS”), Lack of Control (7 items; “inability to stop using SNS despite negative psychosocial consequences”), and Escape (2 items; “use of SNS to avoid dysphoria”) (Chóliz et al., 2016).

These four first-order factors yield four domain scores that allow profile-based interpretation and, when combined, form a total score for interpretive classification.

Throughout the manuscript, these scores are referred to as domain scores. The instrument manual proposes percentile-based interpretive thresholds intended to distinguish at-risk and potentially addictive patterns; however, the empirical evaluation of these thresholds was beyond the scope of the present study.

Previous studies reported adequate internal consistency estimates for AdiTec-I scores (Chóliz et al., 2016). Cronbach's alpha coefficients ( $\alpha$ ) were .93 for the total score and .86, .83, .81, and .79 for Abuse, Abstinence, Lack of Control, and Escape, respectively.

### Statistical analysis

All statistical analyses were conducted using RStudio and SPSS Statistics 28. Missing sociodemographic data were examined prior to group-specific analyses. Missing values were present in 0.4% of cases ( $n = 14$ ) for gender and 37.4% ( $n = 1,426$ ) for country of origin. Cultural background was operationalized as a dichotomous grouping variable based on country of origin (Spain vs. Latin America). For analyses involving gender or cultural background, cases with missing values on the relevant grouping variable were excluded using listwise deletion. Consequently, gender-based analyses were conducted on 3,803 participants, whereas cultural comparisons were conducted on participants with available country of origin data ( $n = 2,391$ ). Missing data for country of origin were relatively high because this variable was not systematically recorded during all administrations of the program across participating educational centers. No extreme values requiring exclusion were detected in the analyzed variables.

To examine the internal structure of the AdiTec-I (Hypothesis 1), confirmatory factor analysis (CFA) was conducted within a structural equation modeling (SEM) framework. A competitive CFA was used to compare the hypothesized hierarchical second-order model of SNA with a four-factor first-order model and a unidimensional alternative. Alternative bifactor specifications were also considered; however, all solutions showed empirical and conceptual limitations, including Heywood cases, unstable or negative loadings, low residual variances, and orthogonality constraints inconsistent with the construct's interdependent subdimensions, and were therefore not retained (Bonifay et al., 2017; Reise et al., 2010; Rodriguez et al., 2016). Robust diagonally weighted least squares (DWLS) estimation was used given the ordinal nature of the items and the large sample size ( $N > 2,000$ ) (Míndrila, 2010). Model fit was evaluated using the  $\chi^2$  statistic, comparative fit index (CFI; acceptable  $\geq .90$ , excellent  $\geq .95$ ), root mean square error of approximation (RMSEA; good  $< .06$ , acceptable  $< .08$ ), and standardized root mean square residual (SRMR; acceptable  $< .08$ ) (van de Schoot et al., 2012).

Additional evidence regarding score reliability and convergent and discriminant validity based on the internal structure (Hypothesis 2) was examined. Convergent validity was assessed through standardized factor loadings ( $\lambda \geq .40$ ), explained variance ( $R^2$ ), and average variance extracted ( $AVE \geq .50$ ) (Hair et al., 2019). Following the Fornell and Larcker (1981) criterion, AVE values below .50 were considered acceptable when composite reliability (CR) exceeded .70. Discriminant validity was evaluated through correlations among domain scores. Internal consistency was estimated using Cronbach's  $\alpha$ , McDonald's  $\omega$ , and CR, with values above .80 indicating satisfactory score reliability (Hayes & Coutts, 2020). Corrected item-total correlations (CTICs) and  $\alpha$  if item deleted were also computed.

Measurement invariance across gender and cultural background was examined to test Hypothesis 3. Multigroup CFA was conducted to evaluate configural, metric, and scalar invariance (Byrne, 2013). When full invariance was not supported, partial invariance was tested by freeing the parameters of noninvariant items (Hirschfeld & Von Brachel, 2014). Partial scalar invariance is considered sufficient for meaningful group comparisons (Putnick & Bornstein, 2016). Invariance was considered supported when  $\Delta CFI \leq .01$ ,  $\Delta RMSEA < .015$ , and  $\Delta SRMR < .03$  for metric models and  $< .01$  for scalar models. Finally,  $t$  tests were conducted to compare domain scores across gender and cultural background groups, and effect sizes were estimated using Hedges'  $g$  (trivial: .00–.19; small: .20–.49; medium: .50–.79; large:  $\geq .80$ ) (Cohen, 1992).

## Results

### Descriptive analysis

Descriptive statistics indicated adequate variability across the response scale (Table 1). Among the three seven-item domains, Abuse showed the highest mean score, followed by Abstinence and Lack of Control. Skewness and kurtosis values at the domain-score level did not indicate severe distributional problems. At the item level, distributions showed mild-to-moderate asymmetry in both directions, with no evidence of extreme deviations likely to compromise subsequent analyses.

### Competitive Confirmatory Factor Analysis

A competitive CFA was conducted to compare the hierarchical second-order model of AdiTec-I with alternative models. The unidimensional model (Model 1) showed inadequate fit,  $\chi^2(230) = 7298.50$ ,  $p < .001$ , CFI = .878, RMSEA = .090 [.088, .092], SRMR = .060. In contrast, the hierarchical second-order model (Model 2) showed adequate fit,  $\chi^2(226) = 3976.67$ ,  $p < .001$ , CFI = .935, RMSEA = .066 [.064, .068], SRMR = .046.

A four-factor correlated first-order model (Model 3) was also estimated for comparison. This model showed similarly

**Table 1**Descriptive statistics for *AdiTec-I* items and domain scores

	<i>Mean</i>	<i>SD</i>	<i>sk</i>	<i>ks</i>
<b>Abuse</b>	15.74	7.00	-0.20	-0.75
<b>Item 9.</b> <i>I think I use the Internet too much.</i>	2.86	1.49	0.12	-1.40
<b>Item 12.</b> <i>The first thing I do when I wake up on weekends is connect to the Internet.</i>	3.18	1.36	-0.18	-1.16
<b>Item 13.</b> <i>I have been connected to the Internet for &gt; 3 hours at a time.</i>	2.54	1.37	0.44	-1.04
<b>Item 15.</b> <i>When I am bored I connect to the Internet.</i>	2.29	1.37	0.68	-0.85
<b>Item 16.</b> <i>I have gone to bed later or slept less because I was using the Internet.</i>	3.29	1.41	-0.30	-1.20
<b>Item 17.</b> <i>I access the Internet several times a day to see if I have any messages or mail from friends.</i>	2.34	1.25	0.56	-0.71
<b>Item 20.</b> <i>The first thing I do when I get home from school is go online.</i>	2.56	1.37	0.38	-1.12
<b>Abstinence</b>	11.57	6.19	0.27	-0.49
<b>Item 1.</b> <i>If the Internet does not work at home, I try to connect somewhere else.</i>	2.06	1.25	0.94	-0.25
<b>Item 2.</b> <i>It affects me a lot when I want to connect to the Internet but it is not working.</i>	3.19	1.34	-0.19	-1.11
<b>Item 3.</b> <i>Every time I think about the Internet, I feel the need to go online.</i>	2.45	1.35	0.50	-0.97
<b>Item 4.</b> <i>If I am without Internet for a while, I find myself feeling empty and I do not know what to do.</i>	2.51	1.46	0.45	-1.21
<b>Item 5.</b> <i>It irritates me when the Internet does not work properly because of a problem with the computer or the network.</i>	3.12	1.42	-0.09	-1.27
<b>Item 6.</b> <i>It is no longer sufficient for me to connect for the same amount of time as before.</i>	3.22	1.48	-0.12	-1.39
<b>Item 8.</b> <i>I am obsessed with downloading files, searching for links, participating in chats, or posting photos or videos.</i>	2.32	1.31	0.68	-0.67
<b>Lack of Control</b>	9.09	5.96	0.59	-0.13
<b>Item 7.</b> <i>I spend less time doing other activities because the Internet takes up a lot of my time.</i>	3.66	1.23	-0.57	-0.65
<b>Item 10.</b> <i>I find it very difficult to close the Internet browser once I start surfing, even if my parents or friends call me or I have to go somewhere.</i>	3.18	1.44	-0.14	-1.30
<b>Item 14.</b> <i>I have argued with my parents, family, or friends because they think I spend too much time on the Internet.</i>	3.34	1.36	-0.29	-1.12
<b>Item 18.</b> <i>I have been late (to class, meeting friends, etc.) because I was connected to the Internet.</i>	1.86	1.18	1.33	0.80
<b>Item 19.</b> <i>When I am connected to the Internet I lose track of time.</i>	2.85	1.35	0.18	-1.11
<b>Item 21.</b> <i>I have lied to my family or others about how long I have been online.</i>	3.03	1.40	-0.01	-1.26
<b>Item 22.</b> <i>Even when I am doing other tasks (in class, with my friends, studying, etc.) I think about the Internet (downloading files, visiting sites, uploading photos or videos, etc.).</i>	2.02	1.23	1.03	0.16
<b>Escape</b>	3.27	2.56	0.37	-1.02
<b>Item 11.</b> <i>When I feel bad, I take refuge in the Internet.</i>	2.03	1.19	1.01	0.07
<b>Item 23.</b> <i>When I have a problem I connect to the Internet to distract myself.</i>	2.75	1.40	0.27	-1.18
<b>SNA</b>	39.65	18.40	0.18	-0.40

Note. SD, standard deviation; sk, asymmetry; ks, kurtosis. All items were translated into English from the original language (Spanish).

adequate fit,  $\chi^2(224) = 4010.52$ ,  $p < .001$ , CFI = .934, RMSEA = .067 [.065, .068], SRMR = .045. Standardized latent correlations among the first-order factors in Model 3 ranged from .68 to .84 (F1–F2 = .76, F1–F3 = .82, F1–F4 = .70, F2–F3 = .84, F2–F4 = .68, F3–F4 = .71), indicating substantial shared variance among the dimensions.

Given the high latent correlations observed in Model 3 and the comparable fit of Models 2 and 3, the hierarchical second-order model was retained as the more parsimonious representation of the latent structure. Accordingly, Model 2 was used in the subsequent validity and measurement invariance analyses (see Figure 1).

### Evidence of Validity Based on Internal Structure and Internal Consistency

Item- and domain-level results were then examined to evaluate the internal structure of *AdiTec-I* scores and their internal consistency. Standardized factor loadings, explained variance, and residual variances supported item-level convergent validity, indicating that all items contributed meaningfully to their corresponding first-order factors (Table 2). At the construct level, AVE values exceeded .50 for Abuse and Escape, whereas Abstinence and Lack of Control showed lower AVE values; however, CR

**Figure 1**

*Hierarchical second-order model of AdiTec-I*



Source: Elaborated by the authors.

**Table 2**

*Item-level indices for AdiTec-I scores*

Domain	Item	CTIC	$\alpha$ -item	$\lambda_e$	$\epsilon_e$	$R^2$
Abuse	9	.433	.915	.741	.45	.494
	12	.548	.912	.724	.48	.458
	13	.565	.912	.684	.53	.407
	15	.549	.912	.714	.49	.431
	16	.517	.913	.730	.47	.470
	17	.479	.913	.630	.6	.347
	20	.569	.912	.755	.43	.506
Abstinence	1	.453	.914	.529	.72	.245
	2	.628	.911	.672	.55	.389
	3	.530	.913	.694	.52	.415
	4	.550	.912	.685	.53	.391
	5	.589	.911	.649	.58	.346
	6	.557	.912	.598	.64	.295
	8	.539	.912	.592	.65	.259
Lack of Control	7	.557	.912	.682	.54	.403
	10	.602	.911	.637	.59	.345
	14	.521	.913	.656	.57	.365
	18	.465	.914	.592	.65	.265
	19	.547	.912	.641	.59	.375
Escape	21	.622	.911	.605	.63	.282
	22	.480	.913	.676	.54	.376
	11	.577	.912	.809	.35	.569
	23	.583	.911	.838	.3	.647

Note. CTIC, corrected item–total correlation;  $\alpha$ -item,  $\alpha$  if item deleted;  $R^2$ , explained variance;  $\lambda_e$ , standardized factor loading,  $\epsilon_e$ , residual variance.

coefficients remained above .70 for all factors, supporting acceptable score interpretation across dimensions (Table 3).

Discriminant validity was supported by the pattern of correlations among domain scores, which indicated related yet empirically distinguishable dimensions (Table 3). Internal consistency estimates were also satisfactory. Across the first-order factors, Cronbach’s  $\alpha$  ranged from .755 to .847, McDonald’s  $\omega$  from .772 to .848, and CR from .799 to .877, whereas the total score showed high internal consistency ( $\alpha = .916$ ,  $\omega = .915$ , CR = .945) (Table 3). At the item level, corrected item–total correlations and  $\alpha$  if item deleted further indicated that all items contributed meaningfully to their respective dimensions and that deleting any item would not improve score reliability (Table 2).

Overall, these results provide evidence of validity based on the internal structure of AdiTec-I scores together with adequate internal consistency.

### Measurement Invariance Across Gender and Cultural Background

Measurement invariance across gender and cultural background was then examined. Prior to the multigroup analyses, the hierarchical second-order model was estimated separately within each subgroup to verify that the proposed structure showed adequate fit. The model fit was adequate for women,  $\chi^2(226) = 1730.66$ ,  $p < .001$ , CFI = .945, RMSEA = .065 [.062, .068], SRMR = .046; for men,  $\chi^2(226) = 2580.89$ ,  $p < .001$ , CFI = .922, RMSEA = .069 [.066, .071], SRMR = .051; for Spanish participants,  $\chi^2(226) = 1406.07$ ,  $p < .001$ , CFI = .943, RMSEA = .063 [.060, .066], SRMR = .046; and for Latin American participants,  $\chi^2(226) = 1033.65$ ,  $p < .001$ , CFI = .943, RMSEA = .058 [.054, .062], SRMR = .048. These results supported proceeding with multigroup invariance analyses.

**Table 3**

*Domain-level evidence based on internal structure and internal consistency estimates for AdiTec-I scores*

	<b>Abuse</b>	<b>Abstinence</b>	<b>Lack of Control</b>	<b>Escape</b>	<b>SNA</b>
Abuse	1				
Abstinence	.619	1			
Lack of Control	.655	.660	1		
Escape	.540	.512	.530	1	
SNA	.876	.857	.869	.689	1
$\alpha$	.847	.775	.787	.755	.916
$\omega$	.848	.772	.787	-	.915
CR	.877	.823	.829	.799	.945
AVE	.507	.402	.412	.678	.461
$\lambda_e$	.872	.882	.940	.777	-
$\epsilon_e$	.24	.22	.12	.4	-
$R^2$	.747	.790	.873	.578	-

*Note.*  $\alpha$ , Cronbach's alpha;  $\omega$ , McDonald's omega; CR, composite reliability; AVE, average variance extracted;  $R^2$ , explained variance;  $\lambda_e$ , standardized factor loading,  $\epsilon_e$ , residual variance. McDonald's  $\omega$  could not be estimated for Escape with the SPSS procedure used in the present study because this factor comprised only two items. Correlation coefficients were obtained from bivariate Pearson correlations among domain scores. All correlations were statistically significant ( $p < .001$ ).

**Table 4**

*Results of measurement invariance analysis of AdiTec-I*

<b>Model</b>	<b>Variable</b>	<b>Group</b>	$\chi^2$	<b>DF</b>	<b>p</b>	<b>CFI (<math>\Delta</math>CFI)</b>	<b>SRMR (<math>\Delta</math>SRMR)</b>	<b>RMSEA (<math>\Delta</math>RMSEA)</b>
Configural	Gender	W	1,331.49	448	< .001	.934	.049	.066
		M	1,831.13					
	Cultural background	S	1,291.39	448	< .001	.945	.047	.060
		L	1,023.69					
Metric	Gender	W	1,122.26	467	< .001	.947 (.013)	.050 (.001)	.058 (.008)
		M	1,520.72					
	Cultural background	S	1,105.64	467	< .001	.954 (.009)	.049 (.002)	.055 (.005)
		L	949.67					
Scalar	Gender	W	1,498.22	532	< .001	.930 (.017)	.049 (.001)	.063 (.005)
		M	1,915.22					
	Cultural background	S	1,526.02	532	< .001	.931 (.023)	.047 (.002)	.062 (.007)
		L	1,368.74					

*Note.* W, women; M, men; S, Spanish; L, Latin American; DF, degrees of freedom.

As shown in Table 4, metric invariance was supported across both gender and cultural background. In both comparisons, CFI and RMSEA improved from the configural to the metric model, whereas SRMR changed only slightly. Full scalar invariance was not supported, as  $\Delta$ CFI exceeded the prespecified criterion in both cases. Partial scalar invariance was therefore examined. For gender, freeing the intercept of Item 13 (Abuse) yielded the selected partial scalar model (CFI = .900,  $\Delta$ CFI = .004; RMSEA = .057,  $\Delta$ RMSEA = .001). For cultural background, freeing the intercepts of Items 3 (Abstinence), 5 (Abstinence), and 19 (Lack of Control) yielded the

selected partial scalar model (CFI = .901,  $\Delta$ CFI = .010; RMSEA = .056,  $\Delta$ RMSEA = .002). Overall, these findings indicate that the hierarchical second-order structure was comparable across groups at the metric level, whereas scalar equivalence was only partially supported.

Group comparisons based on AdiTec-I domain scores are presented in Table 5. Women scored significantly higher than men on all domain scores and on the total score, although effect sizes were trivial. Regarding cultural background, Spanish participants scored higher on Abuse, whereas Latin American participants scored higher on Abstinence and Escape; no significant differences emerged

**Table 5**

Results of *t*-tests of AdiTec-I domain and total scores

	Score	Group	Mean (SD)	<i>t</i> (DF)	<i>p</i>	95% CI	Hedges' <i>g</i>
Gender	Abuse	W	16.51 (7.12)	-5.74 (3,332.68)	< .001	-1.78, -0.87	-.19
		M	15.18 (6.86)				
	Abstinence	W	12.17 (6.29)	-5.08 (3,345.24)	< .001	-1.44, -0.64	-.17
		M	11.13 (6.09)				
	Lack of Control	W	9.39 (6.96)	-2.69 (3,799)	.007	-0.91, -0.14	-.09
		M	8.86 (5.88)				
	Escape	W	3.45 (2.68)	-3.66 (3,240.04)	< .001	-0.48, -0.14	-.12
		M	3.14 (2.47)				
	SNA	W	41.51 (18.97)	-5.26 (3,285.51)	< .001	-4.40, -2.01	-.18
		M	38.31 (17.87)				
Cultural background	Abuse	S	15.91 (6.05)	2.96 (2,389)	.003	0.28, 1.40	.12
		L	15.07 (6.74)				
	Abstinence	S	11.12 (6.31)	-4.51 (2,389)	< .001	-1.63, -0.06	-.19
		L	12.25 (5.89)				
	Lack of Control	S	9.11 (5.99)	-0.04 (2,340.09)	.967	-0.47, 0.45	-.002
		L	9.12 (5.56)				
	Escape	S	3.12 (2.54)	-3.25 (2,389)	.001	-0.54, -0.13	-.13
		L	3.45 (2.51)				
	SNA	S	39.25 (18.63)	-0.89 (2,345.21)	.375	-2.09, 0.79	-.04
		L	39.90 (17.17)				

Note. W, women; M, men; S, Spanish; L, Latin American; SD, standard deviation; *t*, Student's *t*-test statistic; DF, degrees of freedom; CI, confidence interval; *g*, Hedges' *g*; *p* values are based on two-tailed tests.

for Lack of Control or the total score. Taken together, these findings suggest that group comparisons should be interpreted with caution, particularly for dimensions linked to noninvariant items.

## Discussion

The present study examined the psychometric properties of the AdiTec-I in Spanish-speaking adolescents and young adults. Overall, the findings supported the hypothesized hierarchical second-order structure, provided evidence regarding the internal structure of AdiTec-I scores together with adequate reliability, and indicated metric invariance across gender and cultural background, with only partial scalar invariance. Taken together, these findings supported the AdiTec-I as a multidimensional measure of SNA comprising distinguishable but closely related symptom domains.

The hierarchical second-order model provided an adequate fit and a more parsimonious representation of the covariance structure among the domains, while outperforming the unidimensional alternative. Although the correlated four-factor model also showed acceptable fit, the substantial latent intercorrelations indicated that the

common variance across domains is meaningfully captured by a higher-order SNA factor. This pattern supports the view that SNA is not adequately captured as a single undifferentiated continuum, but instead involves related yet distinguishable components, a perspective broadly consistent with recent work on problematic online behaviors and addiction models (Baggio et al., 2024; Griffiths, 2005).

This result is consistent with recent multidimensional conceptualizations of SNA, as well as broader conceptual critiques of behavioral addictions, which emphasize heterogeneity in symptom expression and caution against relying exclusively on global representations (Billieux et al., 2015; Cataldo et al., 2022; Fournier et al., 2023). Widely used instruments such as the BSMAS and the SMD Scale have shown robust psychometric properties across different populations and settings (Boer et al., 2022; Brailovskaia & Margraf, 2024; Leung et al., 2020; Yue et al., 2022), and both instruments have also shown promise as screening tools (Schlossarek et al., 2023). However, their reliance on a single composite score may provide a less differentiated characterization of symptom patterns than multidimensional approaches (Cataldo et al., 2022; Fournier et al., 2023). In contrast, the hierarchical structure of the AdiTec-I supports both global severity assessment and

profile-based interpretation of domain scores, which may be especially useful for refining conceptual understanding and supporting individualized assessment.

The results provided favorable evidence regarding the internal structure of *AdiTec-I* scores. All items showed meaningful associations with their respective factors, and the four domains were empirically distinguishable despite their strong interrelations. At the construct level, the pattern of AVE and CR coefficients suggests that the domains do not show the same degree of psychometric strength, although all retained acceptable levels of composite reliability according to conventional criteria (Fornell & Larcker, 1981). Together with the satisfactory reliability estimates, this pattern suggests that the *AdiTec-I* captures differentiated symptom domains rather than a fully undifferentiated continuum. From a measurement perspective, this highlights the need to interpret domain scores with appropriate nuance rather than assuming equivalent psychometric strength across dimensions.

The Escape factor warrants particular attention. Although it showed acceptable support at both the factor and item levels, its two-item composition suggests more limited content coverage of the underlying domain (Robinson, 2018). Despite this limitation, the process it captures—using SNS to regulate negative affect or cope with distress—remains theoretically central in both addiction-based and broader problematic-use frameworks (Griffiths, 2005; Varona et al., 2022). Mood modification and coping-oriented SNS use have been consistently identified as core mechanisms in the development and maintenance of maladaptive digital behaviors, particularly through negative-reinforcement processes (Moretta et al., 2023; Wegmann et al., 2023). Retaining the Escape domain therefore appears justified because it captures a clinically and theoretically meaningful dimension that is not reducible to the other components. Future revisions of the *AdiTec-I* should strengthen this domain by developing additional indicators that better capture the range of affect-regulation processes involved in SNA.

Measurement invariance findings were mixed. These findings are especially relevant in Spanish-speaking contexts, where several instruments have shown adequate psychometric properties in single-country samples, but evidence on cross-group comparability remains less developed (Cuadrado et al., 2020; Escurra-Mayaute & Salas-Blas, 2014; González-Alcántara et al., 2021; Machimbarrena et al., 2023; Valencia-Ortiz & Cabero-Almenara, 2019). Against this background, the invariance findings support broad comparability of the latent structure across gender and cultural background, although the partial scalar results indicate that mean-level comparisons require cautious interpretation (Putnick & Bornstein, 2016; Vandenberg & Lance, 2000). Even so, once noninvariant items are identified, partial scalar invariance remains

adequate for many comparative purposes, provided that conclusions are appropriately qualified (Byrne, 2013; Putnick & Bornstein, 2016).

Comparisons by cultural background should be interpreted in light of the identified noninvariant items. Specifically, noninvariance was concentrated in Item 19 (Lack of Control) and Items 3 and 5 (Abstinence). This pattern suggests that cross-cultural differences may be concentrated in specific indicators and domains rather than in overall SNA severity (Atroszko et al., 2022). This interpretation is compatible with the observed score pattern, with higher Abuse scores in Spain and higher Abstinence and Escape scores in Latin America. Similar item- and dimension-level differences have been reported in prior cross-cultural work with Spanish-speaking adolescents (Machimbarrena et al., 2023). Accordingly, these interpretations remain tentative, and future research should determine whether these items function differently across Spanish-speaking cultural groups because their endorsement is shaped by contextual or cultural factors despite comparable levels of the underlying construct.

Gender comparisons should be interpreted in light of the largely invariant measurement structure. Noninvariance was limited to Item 13 (Abuse), suggesting localized item-level nonequivalence rather than a broader lack of equivalence in the latent structure. Similar research with the SMD scale has also reported gender-related variation in item thresholds, indicating that some indicators may be endorsed differently despite comparable levels of the latent construct (Šabláturová et al., 2022). In the present study, however, this localized deviation did not translate into meaningful domain-level differences: women scored slightly higher across all domains and on the total SNA score, but effect sizes were trivial. Thus, although the direction of the differences is consistent with studies reporting higher SNA among girls and young women (Andreassen et al., 2016; Bányai et al., 2017; Su et al., 2020), their magnitude suggests limited practical relevance. Accordingly, gender-related variation in *AdiTec-I* scores appears better interpreted as trivial mean-level differences together with mild noninvariance in a specific item than as evidence of meaningful differences in the latent structure across gender groups. In line with these findings, future studies should examine the interpretive utility of gender-specific score profiles and thresholds against external clinical or functional criteria.

The multidimensional structure of the *AdiTec-I* has clear applied implications. Beyond yielding a total severity score, the instrument allows profile-based interpretation of domain scores that may help identify potentially relevant targets in preventive, clinical, and assessment contexts (Chóliz, 2010; Chóliz & Marco, 2012; Chóliz et al., 2016). Elevated Lack of Control scores may indicate self-regulatory difficulties and may therefore point to the

relevance of behavioral self-management strategies or executive control training. High Escape scores may reflect greater reliance on SNS for emotion regulation, pointing to the potential relevance of coping skills, distress tolerance, or mindfulness-based components. Elevated Abstinence scores may indicate difficulties disengaging from SNS and the need to develop alternative routines, whereas high Abuse scores may reflect functional interference requiring behavioral or environmental adjustments.

This domain-level interpretation is consistent with recent intervention literature suggesting that approaches targeting underlying cognitive, behavioral, and emotional mechanisms may be more informative than those based solely on reducing screen time or imposing generalized abstinence (Nagata et al., 2025; Plackett et al., 2023; Pérez-Wiesner et al., 2025). In school-based prevention, this approach may help prioritize the competencies to be targeted, although current evidence on digital well-being interventions remains heterogeneous (Žmavc et al., 2025). In more individualized assessment contexts, it may also contribute to case formulation and intervention planning (Chóliz & Marco, 2012). These potential applications of AdiTec-I domain profiles should be understood as complements to, rather than replacements for, comprehensive assessment procedures.

This study has several strengths, including the large sample, the inclusion of participants from multiple Spanish-speaking contexts, the use of appropriate estimators for ordinal data, and the examination of measurement invariance across relevant groups. Several limitations should also be acknowledged. The cross-sectional design precludes evidence on score stability over time and limits conclusions about predictive relations with clinically relevant outcomes. The nonprobabilistic, school-based sample restricts generalizability beyond similar populations, and missing data on cultural background reduced the effective sample for some subgroup analyses. In addition, the study focused primarily on validity evidence based on internal structure and did not examine validity evidence based on relations to other variables, score stability across time, or the classification accuracy of the proposed interpretive thresholds.

Future research should address these limitations by examining the temporal stability of AdiTec-I scores in longitudinal designs and testing their relations with external criteria, including mental health indicators, functional impairment, and other clinically relevant outcomes. Instrument refinement should also prioritize expansion of the Escape domain and further evaluation of the noninvariant items through differential item functioning analyses. Finally, the accuracy and practical utility of the proposed interpretive thresholds should be evaluated against external benchmarks before they are used in applied settings.

In conclusion, the present findings support the AdiTec-I as a psychometrically sound multidimensional instrument for assessing SNA in Spanish-speaking adolescents and young adults. Its hierarchical structure and the available evidence regarding internal structure and cross-group comparability support its use in research and assessment contexts. Importantly, its multidimensional design may facilitate the identification of heterogeneous symptom profiles and thereby contribute to more targeted prevention and intervention strategies.

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## Conflict of interest

The authors declare that TEA Ediciones had no role in the design, analysis, or interpretation of the study.

## Author contributions

**Amparo Luján-Barrera:** Conceptualization, Validation, Investigation, Data Curation, Methodology, Formal analysis, Writing - Original Draft, Visualization.

**Lydia Cervera-Ortiz:** Validation, Investigation, Writing - Review & Editing.

**Mariano Chóliz:** Conceptualization, Validation, Resources, Writing - Review & Editing, Supervision, Project administration, Funding acquisition.

## Generative AI disclosure

Generative artificial intelligence tools were used exclusively to support language editing and manuscript revision. Specifically, they were used to assist with improving clarity, wording, grammar, and style in selected passages of the manuscript. No generative AI tools were used to generate data, conduct analyses, interpret results, or draw scientific conclusions. All AI-assisted outputs were critically reviewed and edited by the authors, who take full responsibility for the final content of the manuscript.

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