

ORIGINAL

Core vs. peripheral: Exploring social media overvaluation and problematic use in a longitudinal adolescent study

Criterios centrales vs. periféricos: Explorando la sobrevaloración de redes sociales y el uso problemático en un estudio longitudinal con adolescentes

VÍCTOR CIUDAD-FERNÁNDEZ*, **, ALFREDO ZARCO-ALPUENTE***; TAMARA ESCRIVÁ-MARTÍNEZ*, **, ****; MARCOS ROMERO-SUÁREZ*****; ROSA BAÑOS*, **, *****.

* Department of Personality, Evaluation, and Psychological Treatments, University of Valencia, Valencia, Spain.

** Polibienestar Institute, University of Valencia, Valencia, Spain.

*** Department of Basic Psychology, University of Valencia, Valencia, Spain.

**** CIBER of Physiopathology of Obesity and Nutrition (CIBEROBN), Instituto de Salud Carlos III, Madrid, Spain.

***** Department of Social Psychology and Methodology, Autonomous University of Madrid, Madrid, Spain.

Abstract

Individuals with Overvaluation of the Relative Utility of Social Media (ORUSM) overestimate the value of social media to meet needs, prioritizing it over alternative activities. ORUSM is a key mechanism in the development of Problematic Social Media Use (PSMU), frequently associated with mental health issues. The Plan-net 25 measures ORUSM but lacks evaluation of its longitudinal psychometric properties. PSMU is assessed using six criteria derived from substance use disorders, reclassified into core criteria (mood modification, withdrawal, conflict, relapse) as indicators of problematic use, and peripheral criteria (salience, tolerance) that reflect high engagement without pathology. This study examined the temporal stability and longitudinal invariance of the Plan-net 25, as well as its associations with PSMU criteria and various mental health indicators over six weeks. A sample of 294 adolescents (14–20 years old) completed measures of ORUSM, PSMU, depression, anxiety, loneliness, and life satisfaction. The results showed low to moderate temporal stability of the subscales and longitudinal invariance of the Plan-net 25. ORUSM domains related to emotional regulation, social expression, and boredom management were positively associated with both core and peripheral PSMU criteria. Core criteria predicted worse mental health outcomes, while peripheral criteria were positively associated with life satisfaction. These findings highlight the importance of distinguishing between core and peripheral PSMU criteria.

Keywords: Overvaluation of social media, problematic social media use, test-retest reliability, longitudinal invariance, components model of addiction

Resumen

Las personas con Sobrevaloración de la Utilidad Relativa de las Redes Sociales (ORUSM) sobreestiman el valor de las redes sociales para satisfacer necesidades, priorizándolas sobre otras actividades alternativas. La ORUSM es un mecanismo clave en el desarrollo del Uso Problemático de Redes Sociales (UPRS), frecuentemente asociado a problemas de salud mental. La Plan-net 25, mide la ORUSM pero carece de evaluación de sus propiedades psicométricas longitudinales. El UPRS se evalúa utilizando seis criterios derivados de los trastornos por consumo de sustancias, reclassificados en criterios centrales (modificación del estado de ánimo, abstinencia, conflicto, recaída) como indicadores de uso problemático, y criterios periféricos (saliente, tolerancia) que reflejan alta implicación sin patología. Este estudio examinó la estabilidad temporal y la invarianza longitudinal de la Plan-net 25, así como sus asociaciones con los criterios de UPRS y diversos indicadores de salud mental durante seis semanas. Una muestra de 294 adolescentes (14-20 años) completó medidas de ORUSM, UPRS, depresión, ansiedad, soledad y satisfacción con la vida. Los resultados mostraron una estabilidad temporal baja a moderada de las subescalas e invarianza longitudinal de la Plan-net 25. Los dominios de ORUSM relacionados con la regulación emocional, la expresión social y el manejo del aburrimiento se asociaron positivamente con criterios centrales y periféricos de UPRS. Los criterios centrales predijeron peores resultados en salud mental, mientras que los criterios periféricos se asociaron positivamente con satisfacción con la vida. Estos hallazgos destacan la importancia de distinguir entre los criterios centrales y periféricos del UPRS.

Palabras clave: Sobrevaloración de redes sociales, uso problemático de redes sociales, fiabilidad test-retest, invarianza longitudinal, modelo de componentes de la adicción

■ Received: January 2025; Accepted: May 2025.

■ ISSN: 0214-4840 / E-ISSN: 2604-6334

■ Corresponding author:

Tamara Escrivá-Martínez, Department of Personality, Evaluation, and Psychological Treatments, University of Valencia, Valencia, Spain.
Email: tamara.escriva@uv.es

Social media (SM) platforms are designed to facilitate interactions between individuals and have become especially popular among adolescents (e.g., Instagram, TikTok). In the United States, half of teenagers report near-constant use of SM (Pew Research Center, 2023). Similarly, in Spain, 98.5% of adolescents are registered on at least one SM app, with 83.5% using three or more (Andrade et al., 2021). This widespread adoption highlights the significant role that SM plays in adolescents' daily lives.

Problematic Social Media Use (PSMU) has emerged as a growing concern alongside the increasing popularity of SM (Fineberg et al., 2024). PSMU refers to excessive use of SM that leads to significant impairment in personal, social or academic functioning (Cataldo et al., 2022). PSMU is typically assessed following the Components Model of Addiction (Griffiths, 2005), which includes six criteria derived from substance use disorders: salience, tolerance, mood modification, withdrawal, relapse and conflict. The most widely used instrument to evaluate PSMU following this model is the Bergen Social Media Addiction Scale (BSMAS; Andreassen et al., 2016), which comprises one item to measure each criterion.

Despite its popularity, the Components Model of Addiction has faced criticism regarding the validity of applying substance use criteria to excessive behaviors such as PSMU or gaming disorder (Castro-Calvo et al., 2021; Lopez-Fernandez, 2018). Specifically, concerns have been raised about whether all six criteria are equally indicative of pathological behavior in PSMU. To address this issue, researchers have proposed distinguishing between core and peripheral criteria (Billieux et al., 2019; Charlton & Danforth, 2007). Core criteria—mood modification, withdrawal, conflict, and relapse—are considered essential indicators of a problematic behavior. In contrast, peripheral criteria—salience and tolerance—may reflect high engagement without necessarily indicating pathology (Billieux et al., 2019; Castro-Calvo et al., 2021; Flayelle et al., 2022).

Empirical studies on PSMU support this distinction. Fournier et al. (2023, 2024) found that modelling PSMU with correlated core and peripheral factors provided a better fit than a unidimensional model using the BSMAS. Additionally, Peng & Liao (2023) identified a subgroup of users exhibiting peripheral criteria without core criteria, indicating that peripheral criteria alone may not measure PSMU (Zarate et al., 2023). Moreover, peripheral criteria have shown non-significant associations with psychological distress, unlike the positive associations observed for core criteria (Fournier et al., 2023).

While meta-analytic evidence links PSMU to mental health issues such as depression or anxiety and reduced life satisfaction (Huang, 2022; Shannon et al., 2022), inconsistencies remain regarding the association of

peripheral criteria with these outcomes (Fournier et al., 2023; Peng & Liao, 2023). Additionally, the clinical utility of peripheral criteria to distinguish between problematic and healthy SM users remains limited (Stănculescu & Griffiths, 2022; Zarate et al., 2023). This line of research is currently generating extensive debate, which may shed light on the features of PSMU (Amendola, 2023; Griffiths, 2019).

The mechanisms underlying PSMU remain a matter of debate (Perales & Muela, 2019). Researchers have identified several risk factors, including impulsivity and difficulties in emotional regulation (Gioia et al., 2021; Lewin et al., 2023), but they have yet to establish a clear explanatory model.

One novel popularized mechanism which could account for the development of PSMU is the Overvaluation of the Relative Utility of Social Media (ORUSM) (Perales et al., 2020; Perales & Muela, 2019). ORUSM refers to a vulnerability in the decision-making process where individuals perceive the value of using SM to meet certain needs or goals as significantly higher than alternative activities. This leads to excessive reliance on these platforms for gratification (Ciudad-Fernández et al., 2024a). In essence, PSMU may develop when SM is perceived as the best or the only means to achieve specific reinforcers, especially when these reinforcers are otherwise unavailable through more adaptative activities (Flayelle et al., 2023; Perales & Muela, 2019; Perales et al., 2020).

This vulnerability has been reported in qualitative research, where users express overreliance on SM to interact with people or manage emotions (Aksoy, 2018; Chegeni et al., 2021; Ciudad-Fernández et al., 2024b). Quantitative studies have found moderate associations between PSMU and viewing SM as essential for communication (Aparicio-Martínez et al., 2020). Additionally, a preference for SM over other communication methods is positively linked to loneliness and PSMU, while negatively associated with life satisfaction (Lyyra et al., 2022; van Duin et al., 2021). However, research on ORUSM has been scarce due to the lack of specific measurement tools.

To address this gap, Ciudad-Fernández et al. (2024a) developed the Plan-net 25 scale, the first instrument designed to measure ORUSM. This scale consists of seven factors that measure different utility domains of ORUSM: interacting socially, meeting new people, regulating unpleasant emotions, feeling socially accepted, keeping up with what is happening, expressing socially, and managing boredom. In the original validation study, these domains showed moderate associations with PSMU and were positively related to depression, anxiety and loneliness while negatively associated with self-esteem and life satisfaction. Although the Plan-net 25 scale demonstrated promising psychometric properties, data regarding its temporal stability or longitudinal latent structure are lacking. Understanding the stability of ORUSM over time

is crucial for determining whether it is a consistent trait or a fluctuating state before using it in experimental or longitudinal designs. Given the novelty of this variable in the context of SM, no specific hypotheses are formulated regarding temporal stability or longitudinal invariance of ORUSM.

Building on the conceptualization of ORUSM as a key mechanism in the development of PSMU, it is essential to examine how ORUSM contributes to the emergence of PSMU and, in turn, how PSMU may impact mental health. ORUSM leads individuals to excessively prioritize SM as a means to achieve certain reinforcers (e.g., feeling calm or avoiding boredom) (Kardefelt-Winther, 2014). This overreliance can foster PSMU, which is characterized by core criteria (pathological involvement and negative consequences), as well as peripheral criteria (high engagement without necessarily negative outcomes). It is hypothesized that all domains of ORUSM will predict both core and peripheral PSMU criteria (Lyyra et al., 2022; van Duin et al., 2021). However, it is proposed that core criteria will be uniquely associated with mental health issues such as depression, anxiety, loneliness and reduced life satisfaction, while peripheral criteria will not (Fournier et al., 2023). This distinction aligns also with findings that peripheral criteria are not inherently pathological in other problematic behaviors such as gaming disorder or binge-watching (Infanti et al., 2023; Orosz et al., 2016).

Therefore, this study aims to examine the longitudinal psychometric properties of the Plan-net 25 and to assess the associations between its domains and both core and peripheral criteria of PSMU, and in turn, how these latter variables predict a range of mental health outcomes.

Methods

Participants

The inclusion criteria for participation in this study were: a) being 14 years old during the first assessment b) being fluent in Spanish and c) having access to SM. The final sample consisted of 294 participants, with a mean age of 15.78 years ($SD = 1.37$). The sample included a nearly equal proportion of boys (50.68%) and girls (47.96%). The vast majority of participants used SM more than three times a week (98.98%). See Table 1 for a more detailed description. All participants completed both the first and the second assessment, which were conducted between November 2023 and June 2024.

Measures

Plan-net 25 (Ciudad-Fernández et al., 2024a). This questionnaire evaluates seven domains of ORUSM: Interact socially (e.g., If I didn't have access to social media, I would have a lot of difficulty staying in touch with my classmates), Meet new people (e.g., If I didn't have access

Table 1

Sociodemographic characteristics of the sample

	Mean (SD) or n (%)
Age	15.78 (1.37)
Course	
3 rd year of Compulsory Secondary Education	40 (13.61%)
4 th year of Compulsory Secondary Education	126 (42.86%)
1 st year of Baccalaureate	78 (26.53%)
2 nd year of Baccalaureate	0 (0%)
Intermediate Vocational Training	24 (8.16%)
Advanced Vocational Training	16 (5.44%)
Other	10 (3.4%)
Gender	
Boy	149 (50.68%)
Girl	141 (47.96%)
Non-binary	1 (.34%)
Other	1 (.34%)
Prefer not to answer	2 (.68%)
Nationality	
Spanish	254 (86.05%)
Other	41 (13.95%)
Do you have access to social media on your phone, computer, or your parents'/ guardians' device?	
Yes	294 (100%)
No	0 (0%)
Do you frequently use social media, such as WhatsApp, TikTok, Instagram, Twitch, Youtube... more than 3 times a week?	
Yes	291 (98.98%)
No	2 (.68%)

Note. Having access to social media was an inclusion criterion; therefore, the entire sample answered "Yes" to that question. Only the mean and standard deviation are reported for age. SD = Standard deviation.

to social media, I would have a lot of difficulty making new friends), Regulate unpleasant emotions (e.g., If I didn't have access to social media, I would have a lot of difficulty calming myself down when I feel nervous), Feel socially accepted (e.g., If I didn't have access to social media, I would have a lot of difficulty feeling included in my group of friends), Keep up with what is happening (e.g., If I didn't have access to social media, I would have a lot of difficulty finding out what people around me are doing), Express socially (e.g., If I didn't have access to social media, I would have a lot of difficulty expressing my emotions), Manage boredom (e.g., If I didn't have access to social media, I would have a lot of difficulty having fun). It consists of 25 items rated on a 6-point Likert scale (0 = Completely

disagree, 5 = Completely agree). Ciudad-Fernández et al. (2024a) reported Cronbach's α coefficients ranging from .87 to .93 and McDonald's ω coefficients ranging from .88 to .94. McDonald's ω coefficients in this sample range between .83 (Plan-net 2) and .95 (Plan-net 3).

Bergen Social Media Addiction Scale (BSMAS) (Andreassen et al., 2012; Brailovskaia & Margraf, 2024). This scale assesses social media problematic use through six items. In this study we employed a 6-point Likert scale (0 = Completely disagree, 5 = Completely agree), with an overall score ranging from 0 to 30. A 6-point Likert scale was employed and not the traditional 5-point Likert scale. Since this study is part of a larger project this decision was made (see OSF for more details). Following previous research (Fournier et al., 2023, 2024), BSMAS was not conceptualized as a one factor measure. Instead, this measure was divided into two factors: peripheral criteria, comprising two items assessing salience and tolerance (e.g., How often during the last year have you spent a lot of time thinking about social media or planning how to use it?); and core criteria, comprising items evaluating mood modification, relapse, conflict, and withdrawal (e.g., How often during the last year have you become restless or troubled if you have been prohibited from using social media?). Cronbach's α when treated as a single factor ranged from .81 to .90 (Brailovskaia & Margraf, 2024). McDonald's ω for the peripheral factor was .76 and for the core factor .72 (Fournier et al., 2023). In the current study, McDonald's ω coefficient for the core factor is .80. Additionally, the Spearman-Brown coefficient for the peripheral factor is .80.

Patient Health Questionnaire-9 (PHQ-9) (Diez-Quevedo et al., 2001; Kroenke et al., 2001). This questionnaire is a 9-item scale which assesses depression symptoms (e.g., little interest or pleasure in doing things). Each item is scored from 0 (not at all) to 3 (nearly every day). This version was adapted by Diez-Quevedo et al. (2001). The adolescent version was obtained from the AIDS Education & Training Center Program (www.aidsetc.org). In the original validation, this measure obtained Cronbach's α coefficients ranging from .86 to .89 (Kroenke et al., 2001). McDonald's ω coefficient is .89 in this sample.

Generalized Anxiety Disorder (GAD-7) (Crockett et al., 2022; Mossman et al., 2017). This tool evaluates the presence and severity of generalized anxiety disorder symptoms. It consists of 7 items rated on a 4-point ordinal scale (from 0 = never to 3 = almost every day). This measure obtained a .86 Cronbach's α and a .82 Spearman-Brown coefficient in previous literature (Crockett et al., 2022). McDonald's ω coefficient in this sample is .93.

Three-Item Loneliness Scale (TILS) (Trucharte et al., 2023; Hughes et al., 2004) measures the perception of social loneliness (e.g., How often do you feel left out?). Respondents rate three items on a 3-point Likert scale from

1 (hardly ever) to 3 (often), with higher scores indicating greater loneliness (range from 3 to 9). This measure obtained a moderate internal consistency in the Spanish validation ($\alpha = .82$; Trucharte et al., 2023). McDonald's ω coefficient in this sample is .85.

Satisfaction with Life Scale (SWLS-3) (Jovanović et al., 2022; Kjell & Diener, 2021) evaluates overall life satisfaction through 3 items (e.g., In most ways my life is close to my ideal). Items are rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). This measure obtained a high internal consistency ($\omega = .88$; Kjell & Diener, 2021). McDonald's ω coefficient in this study is .89.

Procedure

First, public and private educational centres were contacted to participate in a study (see the preregistration in <https://osf.io/wc4ev/> for details). During the first evaluation, participants completed a series of questionnaires, including Plan-net 25 and BSMAS along with other measurement tools. Subsequently, participants aged 14 years or older were invited to retake the survey in their classroom after five to seven weeks from the first assessment. This was proposed to avoid overlapping with any events or school holidays. Thus, after an average of six weeks, some participants from the initial study completed the Plan-net 25, PHQ-9, GAD-7, TILS and SWLS-3 at a second assessment.

These questionnaires were administered either on paper or using available technological devices, with researchers present in the classroom whenever possible to assist. When researchers were unavailable to attend, teachers addressed students' questions regarding the questionnaires. Data were collected using the Qualtrics platform, with data collection starting in November 2023 and concluding in June 2024. Participating centres were offered an incentive in the form of a personalized report comparing their mental health scores and PSMU scores with those of other centres, while maintaining the anonymity of the other participating centres.

Data analysis

First, internal consistency was evaluated using McDonald's ω coefficient. Additionally, to report internal consistency of the peripheral factor (comprised by two items) Spearman-Brown coefficient was computed (Eisinga et al., 2013).

Second, to assess the temporal reliability of the Plan-net 25 scale, intraclass correlation coefficients (ICCs) were calculated for each subscale. The ICC estimates and their 95% confidence intervals were computed using a single-measurement, absolute-agreement, two-way mixed-effects model. According to Koo and Li (2016), ICC values less than .50 indicate poor reliability, values between .50 and .75 indicate moderate reliability, values between .75 and .90 indicate good reliability, and values greater than .90 indicate excellent temporal reliability.

Third, the longitudinal measurement invariance of the seven-factor correlated model was tested across two time points. Initially, the same measurement model was fitted separately at each time point (T1 and T2). The measurement model was a seven-factor correlated model. Measurement invariance testing was then conducted by sequentially evaluating configural, metric, and scalar invariance models. Configural invariance examines whether the same factor structure holds across time points, allowing all parameters to vary freely. Metric invariance assesses whether factor loadings are equivalent across time points by constraining factor loadings while allowing intercepts and residuals to vary. Scalar invariance tests whether both factor loadings and intercepts are equivalent across time points by constraining both, while allowing only residuals to vary. Achieving scalar invariance suggests that the measurement model operates consistently over time, allowing for meaningful comparison across different time points (Meredith, 1993).

To evaluate the goodness of fit χ^2 statistic and its associated *p*-value, Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI) were reported. Values above .95 for CFI and TLI were considered excellent, and values above .90 were deemed acceptable. Additionally, the Root Mean Square Error of Approximation (RMSEA) and its 90% confidence interval was reported. RMSEA values below .06 were considered adequate. The Standardized Root Mean Square Residual (SRMR) was also reported, and it was deemed acceptable with a cutoff lower than .08. Cutoff scores were following the guidelines of Hu and Bentler (1999). To compare nested models and assess longitudinal invariance, Chen's (2007) guidelines were followed, using changes in CFI ($\Delta\text{CFI} \leq .01$) and RMSEA ($\Delta\text{RMSEA} \leq .015$) to determine whether to accept or reject invariance between models. Maximum likelihood estimation with robust standard errors (MLR) was employed to correct for the lack of multivariate normality.

Fourth, a structural equation model (SEM) was conducted. Given the sample size achieved, a SEM with latent variables could not be performed. Instead, factor scores for each variable were computed using the regression method to be included in the model, aiming to reduce measurement error (McNeish, 2023). The same cut-off criteria were employed for fit indexes as in longitudinal invariance testing. Results of each CFA are included in supplementary materials.

Therefore, the 7 subscales of the Plan-net 25 scale were included as exogenous variables and were considered predictors of both subscales of BSMAS. Depression, anxiety, loneliness, and life satisfaction were included as endogenous variables. These mental health variables were hypothesized to be temporally associated only with the two PSMU subscales. Additionally, indirect effects from ORUSM subscales to the mental health variables through

both peripheral and core criteria were computed. Only statistically significant indirect effects are reported in the manuscript due to limited space.

Fifth, to assess whether this model had sufficient statistical power to detect potential model misspecification, a *post hoc* power analysis was conducted following the guidelines of Jobst et al. (2023). Statistical power refers to the probability of correctly rejecting a false null hypothesis ($1 - \beta$), where β represents the probability of a Type II error—failing to detect an actual effect when one exists. Considering both Type I (α) and Type II (β) errors is crucial because insufficient power (i.e., a high β error) may lead to incorrect conclusions by not detecting meaningful effects (Maxwell, 2004).

For the power analysis, RMSEA from the SEM was selected as the effect size measure, with lower values indicating a better fit (MacCallum et al., 1996). Using the RMSEA value yielded in the model, along with the model's degrees of freedom ($df = 28$), sample size ($N = 294$), and significance level ($\alpha = .05$), the analysis indicated a power of .87, exceeding the conventional threshold of .80 for adequate power (Cohen, 1992). This suggests that the sample size was sufficient to detect model misspecification.

Missing data did not exceed the commonly accepted cutoff point of 5% in any item from T1 or T2 (Schafer, 1999). Missing values were handled using full information maximum likelihood (FIML) in the longitudinal invariance and SEM models. However, missing values were not addressed in test-retest reliability analysis.

All analyses were conducted using R version 4.4.1 and RStudio. The packages were *ir*, *lavaan*, *psych*, *semPower*, *gtExtras* and *MplusAutomation* (Gamer, 2019; Hallquist & Wiley, 2018; Mock, 2023; Moshagen & Erdfelder, 2016; Revelle, 2024; Rosseel, 2012).

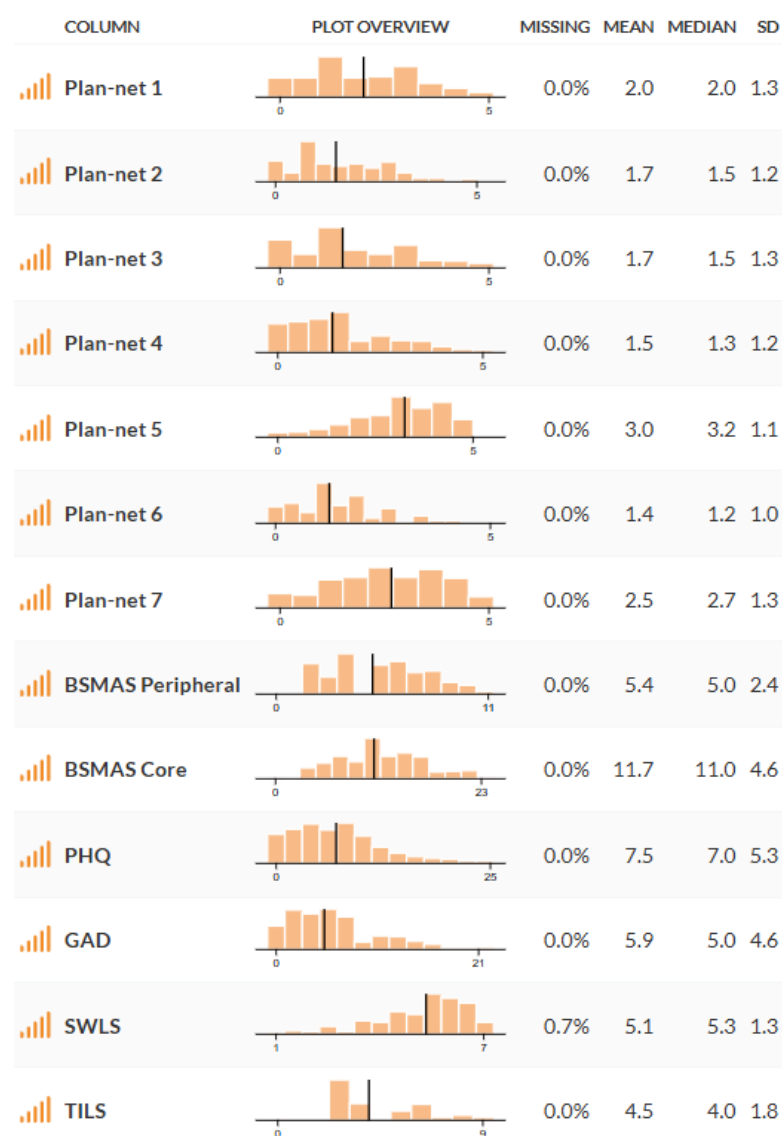
Ethics

This study was preregistered in April 2022 on the Open Science Framework (<https://osf.io/wc4ev/>). Prior to participation, all individuals provided informed consent and were allowed to withdraw at any time. Additionally, passive informed consent was obtained by notifying teachers and parents in advance. The study was approved by the Ethics Committee of the University of Valencia (approval number 2039883). Following the study, informational sessions on PSMU were offered to any participating centre that requested them. The full dataset from the first assessment was employed in the initial validation study (Ciudad-Fernández et al., 2024a).

Results

Descriptives

Descriptive statistics of the psychological variables assessed are reported in Figure 1.

Figure 1*Descriptives of the psychological variables*

Note. SD = Standard Deviation. Plan-net 1 = ORUSM for interacting socially; Plan-net 2 = ORUSM for meeting new people; Plan-net 3 = ORUSM for regulating unpleasant emotions; Plan-net 4 = ORUSM for feeling socially accepted; Plan-net 5 = ORUSM for keeping up with what is happening; Plan-net 6 = ORUSM for expressing oneself socially; Plan-net 7 = ORUSM for managing boredom; BSMAS Peripheral = Tolerance and salience items from the Bergen Social Media Addiction Scale; BSMAS Core = Mood modification, withdrawal, conflict and relapse items from the Bergen Social Media Addiction Scale; PHQ = Patient Health Questionnaire-9; GAD = Generalized Anxiety Disorder-7; SWLS = Satisfaction With Life Scale-3; TILS = Three-item Loneliness Scale.

Test-retest reliability

Results in Figure 2 show values of test-retest reliability assessed through ICC. Overall, the results indicate that the confidence intervals range from poor to moderate temporal reliability for most subscales. Both Plan-net 3 and Plan-net 7 subscales show moderate temporal reliability, and their confidence intervals do not include values considered poor (i.e., below .50). However, the remaining subscales exhibited higher variability in scores.

Longitudinal invariance

Regarding the longitudinal invariance of the seven-factor correlated model, the results indicate minimal loss of fit across all levels of invariance. Although the change in the χ^2 statistic is significant when comparing metric and scalar constrained models, the change in misfit indicated by the fit indices is minimal among these models, as shown in Table 2. Specifically, the change in RMSEA is less than .001 in both comparisons. Accordingly, the change in CFI between the metric and configural models is -.0001, and the change between the scalar and metric models is -.003. Neither fit index surpasses the selected cut-offs, thus providing evidence in favor of the scalar invariance of the measurement model.

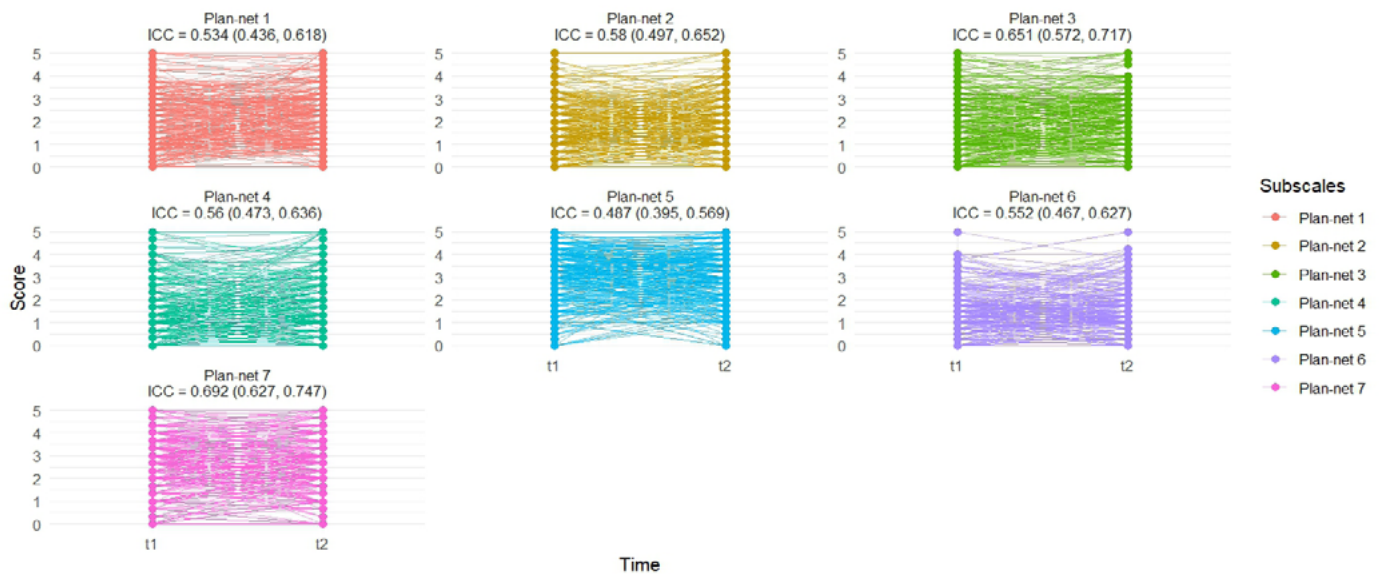
Structural equation modelling of the hypothesized model

The proposed model provides a good fit to the data [$\chi^2(28) = 53.901, p = .002$; CFI = .973; TLI = .945; RMSEA = .058, 90% CI [.034, .082]; SRMR = .054]. Plan-net 3, 6, and 7 positively predict both PSMU core criteria and PSMU peripheral criteria (β values ranging from .196 to .316). Additionally, Plan-net 4 negatively predicts PSMU peripheral criteria ($\beta = -.195$). In turn, after six weeks, the PSMU core factor is temporally associated with depression ($\beta = .420$), anxiety ($\beta = .369$), loneliness ($\beta = .318$), and life satisfaction ($\beta = -.397$). None of the relationships between the PSMU peripheral factor and depression, anxiety, and loneliness were significant. However, PSMU peripheral criteria are temporally associated with life satisfaction ($\beta = .230$). The model is depicted in Figure 3.

Indirect effects of the Plan-net 25 subscales on life satisfaction, loneliness, depression, and anxiety through both peripheral and core criteria of PSMU were examined. Table 3 presents all significant indirect effects. Notably, significant indirect effects were primarily observed for the Plan-net 3, 6, and 7 factors mediated through the core criteria of PSMU across all four mental health variables. Specifically, these indirect effects were positive for depression, anxiety, and loneliness, indicating that higher scores on these Plan-net subscales are associated with increased levels of these mental health issues through the mediation of the core criteria of PSMU. In other words, the PSMU core subscale explains part of the relationship between the Plan-net subscales and these negative mental health outcomes.

Figure 2

Test-retest reliability of the Plan-net 25 subscales



Note. ICC values show the estimate of the value, with its confidence interval in parentheses. According to Koo and Li (2016), ICC values less than .50 indicate poor reliability, values between .50 and .75 indicate moderate reliability, values between .75 and .90 indicate good reliability, and values greater than .90 indicate excellent temporal reliability. Plan-net 1 = ORUSM for interacting socially; Plan-net 2 = ORUSM for meeting new people; Plan-net 3 = ORUSM for regulating unpleasant emotions; Plan-net 4 = ORUSM for feeling socially accepted; Plan-net 5 = ORUSM for keeping up with what is happening; Plan-net 6 = ORUSM for expressing oneself socially; Plan-net 7 = ORUSM for managing boredom.

Table 2

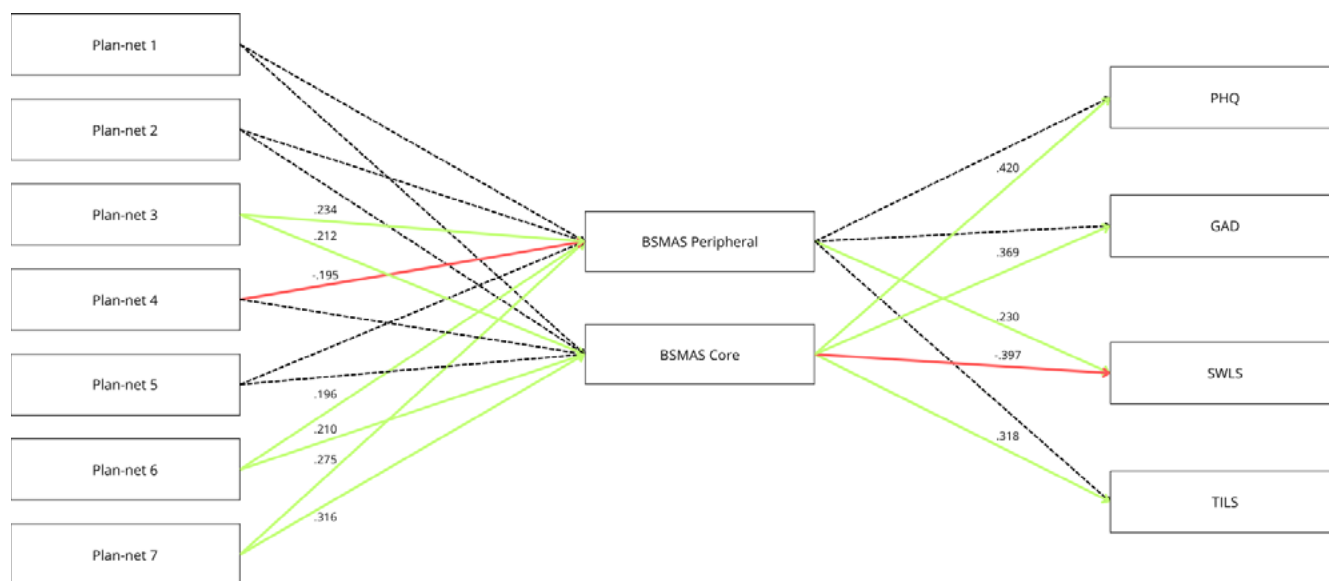
Fit indices for the longitudinal invariance models

Model fit values							Models compared	Differences in fit				
Model	χ^2	df	CFI	TLI	RMSEA	SRMR		$\Delta \chi^2$	<i>p</i> -value	Δ df	Δ CFI	Δ RMSEA
Time 1	554.093*	254	.929	.916	.063 [.056, .071]	.067		-	-	-	-	-
Time 2	511.284	254	.940	.929	.059 [.052, .065]	.057		-	-	-	-	-
Configural	1975.953*	1084	.912	.900	.053 [.049, .057]	.060		-	-	-	-	-
Metric	2003.223*	1102	.911	.901	.053 [.049, .056]	.060	Configural vs. Metric	25.540	.1107	18	-.001	.000
Scalar	2045.789*	1120	.908	.900	.053 [.049, .057]	.060	Metric vs. Scalar	45.977*	.0003	18	-.003	.000

Note. χ^2 values marked with an asterisk are statistically significant at $p < .05$. Model fit values are provided for each model tested: Time 1, Time 2, Configural, Metric, and Scalar models. Differences in fit between nested models are also included (Configural vs. Metric and Metric vs. Scalar), with $\Delta\chi^2$ tests for each model comparison, along with p -values, differences in degrees of freedom (Δdf), ΔCFI , and $\Delta RMSEA$. The configural model serves as the baseline model, and subsequent models are compared to assess measurement invariance across time. Metric invariance model constrains factor loadings, while scalar invariance model constrains factor loadings and item intercepts.

Conversely, the indirect effects were negative for life satisfaction. Higher scores on Plan-net 3, 6, and 7 are linked to lower life satisfaction via the core criteria of PSMU. This suggests that the detrimental impact on life satisfaction is partially explained by the PSMU core

subscale. Interestingly, there was also a significant positive indirect effect from Plan-net 7 on life satisfaction through the peripheral criteria of the BSMAS.

Figure 3*Structural equation model*

Note. Dashed lines are non-significant relationships. Green lines indicate positive significant associations and red lines indicate negative significant associations among variables. Regression paths estimations are depicted using the beta standardized value. Path analysis variable included were factor scores of each questionnaire using the regression method. Plan-net 1 = ORUSM for interacting socially; Plan-net 2 = ORUSM for meeting new people; Plan-net 3 = ORUSM for regulating unpleasant emotions; Plan-net 4 = ORUSM for feeling socially accepted; Plan-net 5 = ORUSM for keeping up with what is happening; Plan-net 6 = ORUSM for expressing oneself socially; Plan-net 7 = ORUSM for managing boredom; BSMAS Peripheral = Tolerance and salience items from the Bergen Social Media Addiction Scale; BSMAS Core = Mood modification, withdrawal, conflict and relapse items from the Bergen Social Media Addiction Scale; PHQ = Patient Health Questionnaire-9; GAD = Generalized Anxiety Disorder-7; SWLS = Satisfaction With Life Scale-3; TILS = Three-item Loneliness Scale.

Table 3*Indirect effects from Plan-net 25 subscales to Mental health indicators through PSMU core and peripheral criteria*

Indirect effects	Estimate	SE	z	p-value	Standardized estimate
Plan-net 3 - BSMAS Core - PHQ	.042	.017	2.433	.015	.089
Plan-net 6 - BSMAS Core - PHQ	.066	.028	2.331	.020	.088
Plan-net 7 - BSMAS Core - PHQ	.064	.024	2.702	.007	.133
Plan-net 3 - BSMAS Core - GAD	.042	.018	2.271	.023	.078
Plan-net 6 - BSMAS Core - GAD	.065	.029	2.294	.022	.077
Plan-net 7 - BSMAS Core - GAD	.063	.023	2.789	.005	.117
Plan-net 7 - BSMAS Peripheral - SWLS	.068	.034	2.014	.044	.063
Plan-net 3 - BSMAS Core - SWLS	-.089	.038	-2.318	.020	-.084
Plan-net 6 - BSMAS Core - SWLS	-.139	.059	-2.345	.019	-.083
Plan-net 7 - BSMAS Core - SWLS	-.134	.051	-2.611	.009	-.125
Plan-net 3 - BSMAS Core - TILS	.025	.012	2.058	.040	.067
Plan-net 6 - BSMAS Core - TILS	.039	.019	2.024	.043	.067
Plan-net 7 - BSMAS Core - TILS	.038	.014	2.627	.009	.100

Note. Only significant indirect effects were reported due to the length of the table. *SE* = Standard Error. Plan-net 3 = ORUSM for regulating unpleasant emotions; Plan-net 6 = ORUSM for expressing oneself socially; Plan-net 7 = ORUSM for managing boredom. BSMAS Core = Mood modification, withdrawal, conflict and relapse items from the Bergen Social Media Addiction Scale; BSMAS Peripheral = Tolerance and salience items from the Bergen Social Media Addiction Scale; PHQ = Patient Health Questionnaire-9; GAD = Generalized Anxiety Disorder-7; SWLS = Satisfaction With Life Scale-3; TILS = Three-item Loneliness Scale.

Discussion

This study aimed to examine the longitudinal psychometric properties of the Plan-net 25 scale, which measures ORUSM, and to assess the associations between its domains and both core and peripheral criteria of PSMU, as well as how these criteria predict mental health outcomes. It was hypothesized that all domains of ORUSM would predict both core and peripheral PSMU criteria (Lyyra et al., 2022; van Duin et al., 2021). Additionally, it was proposed that core criteria would be uniquely associated with negative mental health outcomes, such as increased depression, anxiety, loneliness, and reduced life satisfaction, whereas peripheral criteria would not show these associations (Fournier et al., 2023; Infanti et al., 2023; Orosz et al., 2016).

Regarding the first aim, the temporal stability and longitudinal measurement invariance of the Plan-net 25 scale were investigated. Findings indicated that the scale exhibits low to moderate temporal stability across its seven domains, with variability among them. Specifically, the domains related to regulating unpleasant emotions (Plan-net 3) and managing boredom (Plan-net 7) demonstrated moderate temporal reliability, whereas domains such as interacting socially (Plan-net 1) and meeting new people (Plan-net 2) showed lower stability.

The higher stability of Plan-net 3 and Plan-net 7 may be attributed to the consistency of emotional regulation strategies in adolescents during this period (Izadpanah et al., 2019). In contrast, the lower stability in social domains could reflect the dynamic nature of adolescent social relationships and SM use patterns (Boyd et al., 2012). Adolescents frequently experience changes in their social circles and interests, which may influence their use of SM for social purposes.

Furthermore, the Plan-net 25 scale demonstrated scalar longitudinal measurement invariance, indicating that the factor structure, factor loadings, and item intercepts remained consistent. This finding supports the use of the Plan-net 25 scale in longitudinal research, as it ensures that changes in scores reflect true changes in ORUSM rather than measurement artifacts (Millsap & Cham, 2012).

Addressing the second aim, the relationships between ORUSM domains, PSMU factors and mental health outcomes were examined. The hypothesis that all domains of ORUSM would predict both core and peripheral PSMU criteria was partially supported. Specifically, the ORUSM domains of regulating unpleasant emotions (Plan-net 3), expressing oneself socially (Plan-net 6) and managing boredom (Plan-net 7) were significantly and positively associated with both core and peripheral PSMU criteria.

These findings indicate that overreliance on SM to regulate emotions, as well as to express thoughts or opinions, may pave the way for high involvement in SM or even problematic use. Kardefelt-Winther (2014) further

proposed that overreliance on technological devices as coping mechanisms might contribute to problematic use. These results are supported by previous literature on overvaluation of SM (Aparicio-Martínez et al., 2020; Lyyra et al., 2022; van Duin et al., 2021).

Conversely, other domains such as interacting socially (Plan-net 1), meeting new people (Plan-net 2), or keeping up with what is happening (Plan-net 5) did not significantly predict PSMU criteria, while feeling accepted (Plan-net 4) showed a negative association with peripheral criteria. These findings suggest that using SM primarily for social communication and information gathering may not contribute to problematic use. Such activities might reflect normative SM engagement among adolescents, emphasizing the platform's role in facilitating social connections without necessarily leading to impairment (e.g., after recently moving to a different country).

Concerning the next hypothesis, stating that core PSMU criteria would be uniquely associated with negative mental health outcomes, whereas peripheral criteria would not, was supported by the findings. Results showed that core criteria of PSMU are significantly associated with higher levels of depression, anxiety, and loneliness, and with lower life satisfaction. Conversely, peripheral criteria were not significantly associated with depression, anxiety or loneliness. Interestingly, they were positively associated with life satisfaction. This finding suggests that high engagement with SM, as captured by the peripheral criteria of salience and tolerance, may not be inherently harmful and could even be linked to positive well-being outcomes in some contexts. This aligns with the notion that not all intensive SM use is problematic and that high engagement can coexist with healthy functioning (Billieux et al., 2019; Peng & Liao, 2023).

Meta-analytic studies indicate an association between PSMU and poorer mental health and lower well-being (Huang, 2022; Shannon et al., 2022). However, in the scarce longitudinal designs, this relationship appears less evident (Beeres et al., 2021; Kelly et al., 2018; Twigg et al., 2020). Nonetheless, our findings are consistent with prior research using item-level analysis or distinguishing between core and peripheral criteria in PSMU, obtaining no association or even negative associations with psychopathology for peripheral criteria (Fournier et al., 2023; Peng & Liao, 2023), being thus considered poor indicators of PSMU (Abal et al., 2024; Zarate et al., 2023).

Concerning the indirect effects of the model, Plan-net 3 (regulating unpleasant emotions), Plan-net 6 (expressing oneself socially), and Plan-net 7 (managing boredom) had indirect effects on mental health outcomes through core PSMU criteria. Specifically, these ORUSM domains were associated with increased depression, anxiety, and loneliness, and decreased life satisfaction, mediated by core PSMU criteria. This underscores the role of core PSMU

symptoms in linking the overvaluation of SM for certain purposes to negative mental health consequences (Perales et al., 2020; Perales & Muela, 2019). This supports the notion of ORUSM as a relevant explanatory mechanism in the emergence of PSMU and the negative psychological consequences derived from this issue. In contrast, peripheral PSMU criteria did not mediate the relationship between ORUSM domains and negative mental health outcomes, except for a positive indirect effect of managing boredom (Plan-net 7) on life satisfaction.

Implications

These findings have relevant implications, highlighting the importance of addressing specific ORUSM domains in prevention and intervention efforts. Interventions targeting the overvaluation of SM for emotional regulation and boredom management, rather than other utility domains, may help reduce the risk of developing PSMU and its associated mental health problems. Additionally, the differential associations of core and peripheral PSMU criteria with mental health outcomes support the idea of distinguishing between these criteria. Core criteria appear to capture the pathological aspects of PSMU that are linked to psychological distress, while peripheral criteria reflect high engagement that may not be harmful and can even be beneficial.

Limitations

This study has several limitations. First, the selection of participants for the second data collection was determined by the school, which decided whether it was willing to collaborate again. This may bias the type of students who participated in the second point, as schools with greater SM-related issues or more interest in research might have been more likely to contribute to a second measurement without receiving anything in return. Second, all measures were self-reported, relying heavily on participants' perceptions of themselves and potentially introducing bias due to social desirability.

Future lines

Regarding future studies, several avenues of research can build upon these results. First, given the low stability of the scores, future research could evaluate some domains of the Plan-net 25 in an ecological momentary assessment context to assess their fluctuations and understand which events cause increases or decreases in scores over short periods. Second, other relevant dependent variables that are not self-reported, such as participants' academic performance, could be incorporated into the model. Third, given the results obtained with the distinction between peripheral and core criteria, it is pertinent to expand this distinction to other domains, which according to current research is feasible (e.g., gaming disorder, Ballou & Van Rooij,

2021). Finally, since ORUSM has been identified as a key mechanism in the development of PSMU, future studies could focus on designing interventions that directly address this mechanism. For instance, promoting alternative behaviors that compete with the use of SM. These activities could be designed to provide similar reinforcements that users seek in SM but through more adaptive and healthy means.

Conclusions

This study provides evidence that the Plan-net 25 scale might be a promising instrument for evaluating a key mechanism in the development of PSMU. In addition, given the increasing attention to problematic behaviors associated with internet use, these results shed light on the distinction between users who genuinely exhibit a problematic profile associated with mental health problems and those who can be categorized as highly involved users but with low negative consequences. This distinction, along with a better understanding of the causal mechanisms of PSMU, could enable clinicians and professionals to refine prevention programs and individualized interventions more effectively.

Acknowledgements

We would like to express our gratitude to all the participants in the study.

Funding

This work was supported by CIBEROBN, an initiative of the ISCIII (ISC III CB06 03/0052), Spain. VC-F and AZ-A are supported by the FPU grants FPU21/00527 and FPU22/01588, respectively, funded by the Ministry of Science, Innovation and Universities, Spain.

Conflict of interest

The authors report no potential conflict of interest.

References

- Abal, F. J. P., Sánchez González, J. F. & Attorresi, H. F. (2024). Adaptation of the Bergen Instagram addiction scale in Argentina: calibration with item response theory. *Current Psychology*, 43(2), 1794-1805. <https://doi.org/10.1007/s12144-023-04257-1>
- Aksoy, M. E. (2018). A qualitative study on the reasons for social media addiction. *European Journal of Educational Research*, 7(4), 861-865. <https://doi.org/10.12973/eu-jer.7.4.861>

- Amendola, S. (2023). Discussing evidence on the components model of addiction. A commentary on Fournier et al. (2023). *Addictive Behaviors*, 145, 107764. <https://doi.org/10.1016/j.addbeh.2023.107764>
- Andrade, B., García, I. G. & Rial Boubeta, A. (2021). *Estudio sobre el impacto de la tecnología en la adolescencia*. www.unicef.es/infancia-tecnologia.
- Andreassen, C. S., Billieux, J., Griffiths, M. D., Kuss, D. J., Demetrovics, Z., Mazzoni, E. & Pallesen, S. (2016). The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: A large-scale cross-sectional study. *Psychology of addictive behaviors*, 30(2), 252-262. <https://doi.org/10.1037/adb0000160>
- Andreassen, C. S., Torsheim, T., Brunborg, G. S. & Pallesen, S. (2012). Development of a Facebook addiction scale. *Psychological Reports*, 110(2), 501-517. <https://doi.org/10.2466/02.09.18.PR0.110.2.501-517>
- Aparicio-Martínez, P., Ruiz-Rubio, M., Perea-Moreno, A. J., Martínez-Jiménez, M. P., Pagliari, C., Redel-Macías, M. D. & Vaquero-Abellán, M. (2020). Gender differences in the addiction to social networks in the Southern Spanish university students. *Telematics and Informatics*, 46, 101304. <https://doi.org/10.1016/j.tele.2019.101304>
- Ballou, N. & Van Rooij, A. J. (2021). The relationship between mental well-being and dysregulated gaming: A specification curve analysis of core and peripheral criteria in five gaming disorder scales. *Royal Society Open Science*, 8(5), 201385. <https://doi.org/10.1098/rsos.201385>
- Beeres, D. T., Andersson, F., Vossen, H. G. & Galanti, M. R. (2021). Social media and mental health among early adolescents in Sweden: A longitudinal study with 2-year follow-up (KUPOL study). *Journal of Adolescent Health*, 68(5), 953-960. <https://doi.org/10.1016/j.jadohealth.2020.07.042>
- Billieux, J., Flayelle, M., Rumpf, H. J. & Stein, D. J. (2019). High involvement versus pathological involvement in video games: A crucial distinction for ensuring the validity and utility of gaming disorder. *Current Addiction Reports*, 6, 323-330. <https://doi.org/10.1007/s40429-019-00259-x>
- Boyd, D. R., Bee, H. L. & Johnson, P. A. (2012). *Lifespan development*. Pearson.
- Brailovskaia, J. & Margraf, J. (2024). Addictive social media use during Covid-19 outbreak: Validation of the Bergen Social Media Addiction Scale (BSMAS) and investigation of protective factors in nine countries. *Current Psychology*, 43(14), 13022-13040. <https://doi.org/10.1007/s12144-022-03182-z>
- Castro-Calvo, J., King, D. L., Stein, D. J., Brand, M., Carmi, L., Chamberlain, S. R.,... Billieux, J. (2021). Expert appraisal of criteria for assessing gaming disorder: An international Delphi study. *Addiction*, 116(9), 2463-2475. <https://doi.org/10.1111/add.15411>
- Cataldo, I., Billieux, J., Esposito, G. & Corazza, O. (2022). Assessing problematic use of social media: Where do we stand and what can be improved? *Current Opinion in Behavioral Sciences*, 45, 101145. <https://doi.org/10.1016/j.cobeha.2022.101145>
- Charlton, J. P. & Danforth, I. D. (2007). Distinguishing addiction and high engagement in the context of online game playing. *Computers in human behavior*, 23(3), 1531-1548. <https://doi.org/10.1016/j.chb.2005.07.002>
- Chegeni, M., Shahrabaki, P. M., Shahrabaki, M. E., Nakhaee, N. & Haghdoost, A. (2021). Why people are becoming addicted to social media: A qualitative study. *Journal of Education and Health Promotion*, 10(1). https://doi.org/10.4103/jehp.jehp_1109_20
- Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural equation modeling: a multidisciplinary journal*, 14(3), 464-504. <https://doi.org/10.1080/10705510701301834>
- Ciudad-Fernández, V., Zarco-Alpuente, A., Escrivá-Martínez, T., Gomis-Vicent, E., Espejo, B., Lecuona, O., Perales, J. C., Lopez-Fernandez, O. & Baños, R. M. (2024a). *The seven deadly sins: Measuring overvaluation of social media with the Plan-net 25 scale*. OSF Preprints. <https://doi.org/10.17605/OSF.IO/WC4EV>
- Ciudad-Fernández, V., Zarco-Alpuente, A., Escrivá-Martínez, T., Herrero, R. & Baños, R. (2024b). How adolescents lose control over social networks: A process-based approach to problematic social network use. *Addictive Behaviors*, 154, 108003. <https://doi.org/10.1016/j.addbeh.2024.108003>
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112(1), 155-159. <https://doi.org/10.1037/0033-2909.112.1.155>
- Crockett, M. A., Martínez, V. & Ordóñez-Carrasco, J. L. (2022). Propiedades psicométricas de la escala Generalized Anxiety Disorder 7-Item (GAD-7) en una muestra comunitaria de adolescentes en Chile. *Revista Médica de Chile*, 150(4), 458-464. <http://dx.doi.org/10.4067/S0034-98872022000400458>
- Diez-Quevedo, C., Rangil, T., Sanchez-Planell, L., Kroenke, K. & Spitzer, R. L. (2001). Validation and utility of the patient health questionnaire in diagnosing mental disorders in 1003 general hospital Spanish inpatients. *Psychosomatic Medicine*, 63(4), 679-686. <https://doi.org/10.1097/00006842-200107000-00021>
- Eisinga, R., Grotenhuis, M. T. & Pelzer, B. (2013). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown?. *International journal of public health*, 58, 637-642. <https://doi.org/10.1007/s00038-012-0416-3>
- Fineberg, N. A., Demetrovics, Z., Potenza, M. N., Mestre-Bach, G., Ekhtiari, H., Roman-Urrestarazu, A.,... Stein, D. J. (2024). Global action on problematic usage of the internet: Announcing a Lancet Psychiatry Commission. *The Lancet Psychiatry*.

- Flayelle, M., Brevers, D., King, D. L., Maurage, P., Perales, J. C. & Billieux, J. (2023). A taxonomy of technology design features that promote potentially addictive online behaviours. *Nature Reviews Psychology*, 2(3), 136-150. <https://doi.org/10.1038/s44159-023-00153-4>
- Flayelle, M., Schimmenti, A., Starcevic, V. & Billieux, J. (2022). The pitfalls of recycling substance-use disorder criteria to diagnose behavioral addictions. In *Evaluating the brain disease model of addiction* (pp. 339-349). Routledge.
- Fournier, L., Schimmenti, A., Musetti, A., Boursier, V., Flayelle, M., Cataldo, I.,... Billieux, J. (2023). Deconstructing the components model of addiction: An illustration through “addictive” use of social media. *Addictive Behaviors*, 143, 107694. <https://doi.org/10.1016/j.addbeh.2023.107694>
- Fournier, L., Schimmenti, A., Musetti, A., Boursier, V., Flayelle, M., Cataldo, I.,... Billieux, J. (2024). Further evidence for the bidimensionality of the components model of addiction: A reply to Amendola (2023). *Addictive Behaviors*, 150, 107914. <https://doi.org/10.1016/j.addbeh.2023.107914>
- Gamer, M. (2019). irr: Various coefficients of interrater reliability and agreement (Version 0.84. 1). *Computer Software and Manual*.
- Gioia, F., Rega, V. & Boursier, V. (2021). Problematic internet use and emotional dysregulation among young people: A literature review. *Clinical Neuropsychiatry*, 18(1), 41. <https://doi.org/10.36131/cnforitieditore20210104>
- Griffiths, M. (2005). A ‘components’ model of addiction within a biopsychosocial framework. *Journal of Substance Use*, 10(4), 191-197. <https://doi.org/10.1080/14659890500114359>
- Griffiths, M. D. (2019). The evolution of the ‘components model of addiction’ and the need for a confirmatory approach in conceptualizing behavioral addictions. *Düşünen Adam: The Journal of Psychiatry and Neurological Sciences*, 32, 179-184.
- Hallquist, M. N. & Wiley, J. F. (2018). MplusAutomation: An R package for facilitating large-scale latent variable analyses in M plus. *Structural equation modeling: a multidisciplinary journal*, 25(4), 621-638. <https://doi.org/10.1080/10705511.2017.1402334>
- Hu, L. T. & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55. <https://doi.org/10.1080/10705519909540118>
- Huang, C. (2022). A meta-analysis of the problematic social media use and mental health. *International Journal of Social Psychiatry*, 68(1), 12-33. <https://doi.org/10.1177/0020764020978434>
- Hughes, M. E., Waite, L. J., Hawkey, L. C. & Cacioppo, J. T. (2004). A short scale for measuring loneliness in large surveys: Results from two population-based studies. *Research on Aging*, 26(6), 655-672. <https://doi.org/10.1177/0164027504268574>
- Infanti, A., Valls-Serrano, C., Perales, J. C., Vögele, C. & Billieux, J. (2023). Gaming passion contributes to the definition and identification of problematic gaming. *Addictive Behaviors*, 147, 107805.
- Izadpanah, S., Barnow, S., Neubauer, A. B. & Holl, J. (2019). Development and validation of the Heidelberg Form for Emotion Regulation Strategies (HFERST): Factor structure, reliability, and validity. *Assessment*, 26(5), 880-906. <https://doi.org/10.1177/1073191117720283>
- Jobst, L. J., Bader, M. & Moshagen, M. (2023). A tutorial on assessing statistical power and determining sample size for structural equation models. *Psychological Methods*, 28(1), 207-221. <https://doi.org/10.1037/met0000423>
- Jovanović, V., Rudnev, M., Arslan, G., Buzea, C., Dimitrova, R., Góngora, V.,... Žukauskienė, R. (2022). The Satisfaction with Life Scale in adolescent samples: Measurement invariance across 24 countries and regions, age, and gender. *Applied research in quality of life*, 17(4), 2139-2161. <https://doi.org/10.1007/s11482-021-10024-w>
- Kardefelt-Winther, D. (2014). A conceptual and methodological critique of internet addiction research: Towards a model of compensatory internet use. *Computers in human behavior*, 31, 351-354. <https://doi.org/10.1016/j.chb.2013.10.059>
- Kelly, Y., Zilanawala, A., Booker, C. & Sacker, A. (2018). Social media use and adolescent mental health: Findings from the UK Millennium Cohort Study. *EClinicalMedicine*, 6, 59-68. <https://doi.org/10.1016/j.eclinm.2018.12.005>
- Kjell, O. N. E. & Diener, E. (2021). Abbreviated three-item versions of the satisfaction with life scale and the harmony in life scale yield as strong psychometric properties as the original scales. *Journal of Personality Assessment*, 103(2), 183-194. <https://doi.org/10.1080/00223891.2020.1737093>
- Koo, T. K. & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine*, 15(2), 155-163. <https://doi.org/10.1016/j.jcm.2016.02.012>
- Kroenke, K., Spitzer, R. L. & Williams, J. B. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine*, 16(9), 606-613. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>
- Lewin, K. M., Kaur, A. & Meshi, D. (2023). Problematic social media use and impulsivity. *Current Addiction Reports*, 10(3), 553-562. <https://doi.org/10.1007/s40429-023-00495-2>
- Lopez-Fernandez, O. (2018). Generalised versus specific internet use-related addiction problems: A mixed methods study on internet, gaming, and social networking behaviours. *International journal of environmental research and*

- public health*, 15(12), 2913. <https://doi.org/10.3390/ijer-ph15122913>
- Lyrra, N., Junttila, N., Gustafsson, J., Lahti, H. & Paakkari, L. (2022). Adolescents' online communication and well-being: Findings from the 2018 health behavior in school-aged children (HBSC) study. *Frontiers in psychiatry*, 13, 976404. <https://doi.org/10.3389/fpsyt.2022.976404>
- MacCallum, R. C., Browne, M. W. & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, 1(2), 130–149. <https://doi.org/10.1037/1082-989X.1.2.130>
- Maxwell, S. E. (2004). The Persistence of Underpowered Studies in Psychological Research: Causes, Consequences, and Remedies. *Psychological Methods*, 9(2), 147–163. <https://doi.org/10.1037/1082-989X.9.2.147>
- McNeish, D. (2023). Psychometric properties of sum scores and factor scores differ even when their correlation is 0.98: A response to Widaman and Revelle. *Behavior Research Methods*, 55(8), 4269–4290. <https://doi.org/10.3758/s13428-022-02016-x>
- Meredith, W. (1993). Measurement invariance, factor analysis and factorial invariance. *Psychometrika*, 58, 525–543. <https://doi.org/10.1007/BF02294825>
- Millsap, R. E. & Cham, H. (2012). Investigating factorial invariance in longitudinal data. In B. Laursen, T. D. Little & N. A. Card (Eds.), *Handbook of developmental research methods* (pp. 109–127). Guilford Press.
- Mock, T. (2023). *gtExtras: Extending 'gt' for Beautiful HTML Tables* (Version 0.5.0) [R package]. Retrieved from <https://CRAN.R-project.org/package=gtExtras>
- Moshagen, M. & Erdfelder, E. (2016). A new strategy for testing structural equation models. *Structural Equation Modeling: A Multidisciplinary Journal*, 23(1), 54–60. <https://doi.org/10.1080/10705511.2014.950896>
- Mossman, S. A., Luft, M. J., Schroeder, H. K., Varney, S. T., Fleck, D. E., Barzman, D. H.,... Strawn, J. R. (2017). The Generalized Anxiety Disorder 7-item (GAD-7) scale in adolescents with generalized anxiety disorder: Signal detection and validation. *Annals of clinical psychiatry: official journal of the American Academy of Clinical Psychiatrists*, 29(4), 227.
- Orosz, G., Vallerand, R. J., Bóthe, B., Tóth-Király, I. & Paskuj, B. (2016). On the correlates of passion for screen-based behaviors: The case of impulsivity and the problematic and non-problematic Facebook use and TV series watching. *Personality and Individual Differences*, 101, 167–176.
- Peng, P. & Liao, Y. (2023). Six addiction components of problematic social media use in relation to depression, anxiety, and stress symptoms: a latent profile analysis and network analysis. *BMC psychiatry*, 23(1), 321. <https://doi.org/10.1186/s12888-023-04837-2>
- Perales, J. C. & Muela, I. (2019). Adicciones tecnológicas: Mitos y evidencia. In M. González de Audikana de la Hera & A. Estévez Gutiérrez (Eds.), *Adicciones sin sustancia y otros trastornos del control de los impulsos* (pp. 19–33). Universidad de Deusto, Servicio de Publicaciones.
- Perales, J. C., King, D. L., Navas, J. F., Schimmenti, A., Sescousse, G., Starcevic, V.,... Billieux, J. (2020). Learning to lose control: A process-based account of behavioral addiction. *Neuroscience & Biobehavioral Reviews*, 108, 771–780. <https://doi.org/10.1016/j.neubiorev.2019.12.025>
- Pew Research Center. (2023, December 11). Teens, social media, and technology 2023. <https://www.pewresearch.org/internet/2023/12/11/teens-social-media-and-technology-2023/>
- Revelle, W. (2024). *psych: Procedures for Psychological, Psychometric, and Personality Research* (Version 2.4.3) [R package]. Northwestern University, Evanston, Illinois. Retrieved from <https://CRAN.R-project.org/package=psych>
- Rosseel, Y. (2012). lavaan: An R Package for Structural Equation Modeling. *Journal of Statistical Software*, 48(2), 1–36. <https://doi.org/10.18637/jss.v048.i02>
- Schafer, J. L. (1999). Multiple imputation: A primer. *Statistical methods in medical research*, 8(1), 3–15. <https://doi.org/10.1177/096228029900800102>
- Shannon, H., Bush, K., Villeneuve, P. J., Hellemans, K. G. & Guimond, S. (2022). Problematic social media use in adolescents and young adults: Systematic review and meta-analysis. *JMIR mental health*, 9(4), e33450. <https://doi.org/10.2196/33450>
- Stănculescu, E. & Griffiths, M. D. (2022). Social media addiction profiles and their antecedents using latent profile analysis: The contribution of social anxiety, gender, and age. *Telematics and Informatics*, 74, 101879. <https://doi.org/10.1016/j.tele.2022.101879>
- Trucharte, A., Calderón, L., Cerezo, E., Contreras, A., Peinado, V. & Valiente, C. (2023). Three-item loneliness scale: Psychometric properties and normative data of the Spanish version. *Current Psychology*, 42(9), 7466–7474. <https://doi.org/10.1007/s12144-021-02110-x>
- Twigg, L., Duncan, C. & Welch, S. (2020). Is social media use associated with children's well-being? Results from the UK Household Longitudinal Study. *Journal of Adolescence*, 80, 73–83. <https://doi.org/10.1016/j.adolescence.2020.02.002>
- van Duin, C., Heinz, A. & Willems, H. (2021). Predictors of problematic social media use in a nationally representative sample of adolescents in Luxembourg. *International Journal of Environmental Research and Public Health*, 18(22), 11878. <https://doi.org/10.3390/ijerph182211878>
- Zarate, D., Hobson, B. A., March, E., Griffiths, M. D. & Stavropoulos, V. (2023). Psychometric properties of the Bergen Social Media Addiction Scale: An analysis using item response theory. *Addictive Behaviors Reports*, 17, 100473. <https://doi.org/10.1016/j.abrep.2022.100473>

