



Modelling the contribution of metacognitions and expectancies to problematic smartphone use

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FULL-LENGTH REPORT



ABSTRACT

Background and aims: In the current study we have sought to clarify the contribution of metacognitions concerning smartphone use relative to smartphone use expectancies in the relationship between well-established predisposing psychological factors and problematic smartphone use (PSU). We tested a model where psychological distress, impulsivity, and proneness to boredom predict metacognitions about smartphone use and smartphone use expectancies, which in turn predict PSU. *Methods:* A sample of 535 participants ($F = 71.2\%$; mean age = 27.38 ± 9.05 years) was recruited. *Results:* The model accounted for 64% of the PSU variance and showed good fit indices ($\chi^2 = 16.01$, $df = 13$, $P = 0.24$; $RMSEA [90\%CI] = 0.02 [0-0.05]$, $CFI = 0.99$; $SRMR = 0.03$). We found that: (i) when it comes to psychological distress and boredom proneness, negative metacognitions, and both positive and negative expectancies play a mediating role in the association with PSU, with negative metacognitions showing a dominant role; (ii) there is no overlap between positive expectancies and positive metacognitions, especially when it comes to smartphone use as a means for socializing; (iii) impulsivity did not show a significant effect on PSU. Direct effects of the predictors on PSU were not found. *Discussion and conclusions:* The current study found additional support for applying metacognitive theory to the understanding of PSU and highlight the dominant role of negative metacognitions about smartphone in predicting PSU.

KEYWORDS

anxiety, boredom proneness, depression, expectancies, metacognitions, problematic smartphone use

INTRODUCTION

Metacognitions in addictive behaviors

Metacognitions (also referred to as ‘metacognitive beliefs’) refer to the beliefs individuals hold about their own cognition and internal states (e.g., “It is bad to think that thought”), and about coping strategies that impact on both (e.g., “Worrying will help me solve the problem”) (Wells & Matthews, 1994, 1996; Wells, 2000). According to the metacognitive model of psychopathology (Wells & Matthews, 1996), metacognitions predispose to developing maladaptive response patterns to thoughts and internal events such as self-focused attention, pervasive thinking (i.e., worrying and rumination), threat monitoring, avoidance and thought suppression. Accordingly, metacognitions have been involved in different psychological disorders, including depression (e.g., Halvorsen et al., 2015), eating disorders (e.g., Olstad, Solem, Hjemdal, & Hagen, 2015), obsessive-compulsive disorder (Tumkaya, Karadag, Yenigun, Ozdel, & Kashyap, 2018), generalized anxiety disorder (e.g., Wells & Carter, 2001), and psychosis (e.g., Morrison & Wells, 2003).

Metacognitions have also been applied to conceptualizing and treating addictive behaviors (Spada, Caselli, Nikčević, & Wells, 2015). Individuals who engage in addictive behaviors hold dysfunctional generic metacognitions about cognitive-affective states and about engagement in addictive behaviors. Depending on their content, metacognitions can be

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separated into two factors: positive and negative metacognitions. Positive metacognitions concern the beneficial effects of engaging in addictive behavior to regulate cognition (e.g., “Smoking helps me control my thoughts”) and affect (e.g., “Gambling will improve my mood”), and appear to be involved in the initiation of addictive behavior. Negative metacognitions refer to the perception of the lack of executive control over engagement in the addictive behavior (e.g., “My smoking habit persists no matter how much I try to control it”), uncontrollability of thoughts related to the addictive behavior (“The thought of gambling is stronger than my will”), thought–action fusion (“Thinking about using alcohol can make me drink”), and the negative impact of the engagement in the addictive behavior on cognitive functioning (“Drinking will damage my mind”). When activated, negative metacognitions increase the perception of failure in self-regulation and the harmful effects of addictive behavior on functioning, which in turn promote negative repetitive thinking and negative emotions. Moreover, if individuals think they are unable to regulate their behavior, it is likely that they will limit their attempts to control it (Raylu & Oei, 2004). Thus, negative metacognitions appear to be predominantly involved in the perpetuation of addictive behaviors (Hamonniere & Varescon, 2018; Spada, Caselli et al., 2015). Several studies have empirically supported that metacognitions are implicated in addictive behaviors, including problematic drinking and smoking dependence (Nikčević & Spada, 2010; Spada, Caselli, & Wells, 2009; Spada, Nikčević, Moneta, & Wells, 2007), gambling (Spada, Giustina, Rolandi, Fernie, & Caselli, 2015; Spada & Roarty, 2015), problematic online gaming (POG; Akbari, Bahadori, Milan, Caselli, & Spada, 2021; Aydın, Güçlüa, Ünal-Aydin, & Spada, 2020; Spada & Caselli, 2017), generalized problematic Internet use (PIU; Casale, Caplan, & Fioravanti, 2016; Spada, Langston, Nikčević, & Moneta, 2008), problematic social networking site use (PSNSU; Casale, Rugai, & Fioravanti, 2018; Marino et al., 2019; Ünal-Aydın, Obuca, Aydın, & Spada, 2021), and problematic smartphone use (PSU; Akbari, Zamani, Fioravanti, & Casale, 2021; Casale, Caponi, & Fioravanti, 2020). The available systematic reviews (Casale, Musicò, & Spada, 2021; Hamonniere & Varescon, 2018) broadly support the contention that positive metacognitions are linked to the engagement in a certain behavior, whilst negative metacognitions are linked to the escalation of addictive behavior. When it comes to technological addictions (e.g., POG, PSNSU) metacognition appear to play a role as a robust mediating factor in the association between psychological risk factors (e.g., anxiety, depressive symptoms) and the compulsive use of technology. In detail, individuals presenting high levels of negative cognitive-affective states appear to be at risk of developing unregulated use of online gaming or social networking sites as they believe that engaging in such behaviors might be helpful in finding relief and gaining control over such states. Moreover, the belief of not having control over the behavior reinforces the addictive behavior itself. Accordingly, Marino et al. (2020) showed that negative metacognitions concerning online gaming

played the strongest mediating role in the relationship between social anxiety and POG. Similarly, various studies (e.g., Akbari, 2017; Casale et al., 2016) have shown that emotional dysregulation predicts problematic Internet use through its effect on positive metacognitions about Internet use. Positive metacognitions have also been found to mediate the association between the fear of missing out on positive recreational experiences of others and PSNSU among both men and women (Casale et al., 2018).

Metacognitions in Problematic Smartphone Use (PSU)

Although evidence supporting problematic smartphone use (PSU) as an addictive behavior is still scarce (see Billieux, Maurage, Lopez-Fernandez, Kuss, & Griffiths, 2015; Kardefelt-Winther et al., 2017; Panova & Carbonell, 2018), there is a growing consensus that PSU shares some core features with substance and behavioral addictions, including abstinence symptoms in the voluntary and involuntary ‘separation’ period, withdrawal (when separated from the smartphone), tolerance (the desire to engage in ever more frequent smartphone use), use despite adverse effects, difficulty controlling use, and social impairment (e.g., Billieux et al., 2015; Clayton, Leshner, & Almond, 2015).

A body of research has investigated the psychological and psychopathological factors associated with PSU. Personality variables linked with PSU comprise neuroticism, conscientiousness (for a meta-analysis, see Marengo et al., 2020) and impulsivity (for a meta-analysis see Carvalho, Sette, & Ferrari, 2018). Moreover, a predictive role was found for the trait-based tendency to experience boredom or boredom proneness (Elhai, Vasquez, Lustgarten, Levine, & Hall, 2018; Lepp, Barkley, & Li, 2017). Boredom-prone individuals engage in PSU to relieve their boredom and to cope with the attention deficits and the negative affect associated with the experience of boredom (Elhai et al., 2018). Regarding psychopathology, most research has found PSU to be related to depression symptom severity with medium effect sizes (Elhai, Dvorak, Levine, & Hall, 2017), and to anxiety symptoms with small to moderate effects (Elhai, Levine, & Hall, 2019; Vahedi & Saiphoo, 2018).

Research on metacognition in this field is still at its early stages. Casale et al. (2020) showed that positive and negative metacognitions about smartphone use were positively associated to PSU independently of anxiety and depressive symptoms. A subsequent study by Akbari et al. (2021) supported the role of positive metacognitions about the usefulness of smartphone to control emotion and cognition and to help in socializing, and negative metacognitions about uncontrollability and cognitive harm of smartphone use in predicting PSU beyond anxiety and depression. Recently, Throuvala et al. (2021) highlighted moderate correlations between smartphone distraction (i.e., the use of the smartphone as an emotion regulation coping strategy) and both positive and negative metacognitions about the social use of the smartphone (i.e., reflective beliefs related to cognitive and emotional responses to social

media use, and the difficulty in controlling social media use, respectively).

Interestingly, none of the mentioned studies examined metacognitions as a potential mediator in the association between well-established psychological risk factors (e.g., impulsivity, boredom proneness) and PSU. Drawing from findings in related fields (e.g., PIU, POG), we expected that beliefs about smartphone-related thoughts and smartphone use as cognitive-affective control strategy (i.e. positive metacognitions about the usefulness of smartphone use, and negative metacognitions about uncontrollability and the dangers of smartphone use) might serve a function in explaining the association between established psychological risk factors (i.e., psychological distress, impulsivity, and boredom proneness) and PSU. Boredom proneness and psychological distress may be linked to activation of positive metacognitions pertaining to the utility of smartphone in alleviating boredom, distracting the mind from sadness and distress or to control disturbing thoughts, thus leading to using the smartphone as a means of cognitive-affective self-regulation. Moreover, impulsiveness and/or boredom proneness may be linked to the activation of metacognitions, such as not being able to control involvement in the smartphone (i.e., negative metacognitions) which, in turn, may lead individuals to be stuck in the smartphone as a means of controlling the detrimental effects of smartphone use itself.

As we will sum up in the following paragraph, hypothesizing that beliefs that the smartphone is helpful to distract one's own mind from negative thoughts (i.e., positive metacognitions) are associated with PSU is consistent with studies showing that expectancies and false beliefs about the effect of smartphone use contribute to PSU (Brand, Young, Laier, Wolfling, & Potenza, 2016; Elhai, Yang, Dempsey, & Montag, 2020). This is also consistent with the psychodynamic perspective that people suffering from addictive disorders may use substances or excessive behaviors as an external regulator and a self-medication for their dysregulated feelings and painful states of mind (see for example Musetti, Brazzi, Folli, Plazzi, & Franceschini, 2020; Schimmenti & Caretti, 2010). Moreover, this perspective is in line with the compensatory Internet use theory (Kardefelt-Winther et al., 2017), which suggests that the perceived compensatory potential of online technology should be taken into account in order to get a broader understanding of Internet-related disorders.

Distinguishing between expectancies and metacognitions in addictive behaviors

Expectancies refer to a person's evaluation of an anticipated outcome (Tolman, 1932), therefore smartphone expectancies refer to an individual's explicit or implicit set of beliefs about the effects of smartphone use. The construct of smartphone expectancies is multidimensional, and it includes positive and avoidance expectancies related to smartphone use. Positive expectancies (e.g., "I use my smartphone to experience pleasure") reflect positive

reinforcement of smartphone use, whilst avoidance expectancies refer to the negative reinforcement of smartphone use (e.g., "I use my smartphone to avoid loneliness"). Both positive and avoidance expectancies regarding smartphone use have been found to be related to PSU severity (Elhai et al., 2020).

A key difference between expectancies and metacognitions is that the latter clearly refers to beliefs concerning the usefulness of the object of the addiction "as a cognitive control and self-regulation tool (i.e., specific beliefs regarding problem-solving, thought control, attention regulation, and self-image control arising from alcohol use)" (Spada, Moneta, & Wells, 2007, p. 568), whilst expectancies refer to the positive effects of the substance/behavior anticipated by an individual. In other words, positive metacognitions differ from positive expectancies (e.g., the smartphone user's general perception of the positive outcomes of using the smartphone) in their explicit focus on how the use of the substance/engagement in the behavior can help to achieve mental control and self-regulation by enhancing problem-solving, helping to regulate attention, and acting as a form of thought control (Spada et al., 2007, 2015). Negative metacognitions concern the uncontrollability and dangers of thoughts about addictive behavior and engagement in addictive behavior. Avoidance expectancies differ from such beliefs in as much as they mainly measure positive expectancies of smartphone use, albeit declined as negative reinforcements.

These key differences have led some authors to model the relative contribution of metacognitions and expectancies in various addictive behaviors. Research in related fields has indicated that metacognitions about alcohol use are an independent predictor of drinking behavior when controlling for alcohol expectancies (Spada, Moneta et al., 2007), and similar results have been obtained for smoking behavior (Nikčević et al., 2017).

The current study

In view of the metacognitive model of addictive behaviors (Spada, Caselli et al., 2015) and previous studies on metacognitions in PSU (Akbari, et al., 2021; Casale et al., 2020; Throuvala et al., 2021), we believe that additional research is required that may contribute to our understanding of the relative contribution of metacognitions about smartphone use to PSU.

The present study has two main aims. First, metacognitions have never been theoretically positioned as a potential explanatory mediating variable in the association between maladaptive cognitive and emotional processes and PSU, despite several empirical studies in related fields (e.g., problematic Internet use). Based on robust findings on the link between PSU and depression, anxiety, stress, impulsivity, and boredom proneness, we aimed to explore whether metacognitions might represent one possible mediating factor in these relationships. We hypothesized that scores on the above-mentioned factors would be associated with positive and negative metacognitions about smartphone, which,

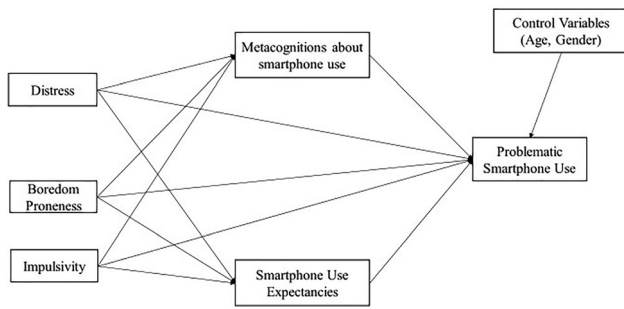


Fig. 1. Proposed theoretical model

in turn, would be associated with PSU. Second, we aimed to test this hypothesis by also clarifying the contribution of metacognitions relative to expectancies about smartphone use. We hypothesized that metacognitions would contribute, independently of expectancies, to PSU. With these aims in mind, we propose to test a model (Fig. 1) where both metacognitions and expectancies about smartphone mediate the association between psychological distress, impulsivity, boredom proneness, on the one hand, and PSU, on the other.

METHODS

Participants and procedure

A sample of 535 participants ($F = 71.2\%$; mean age = 27.38 ± 9.05 years; age range: 18–65 years) agreed to participate in the study. Participants were required to: (1) be at least 18 years of age; (2) own a smartphone; and (3) give their consent to participate. The majority of the sample (99%) self-reported as Caucasian. Participants were recruited using advertisements on social network groups and thematic forums and were informed that participation was voluntary and anonymous. An online study format was used to collect data. The first page of the study website explained the general aim of the study: “To investigate psychological predictors of problematic smartphone use”. Participants were then directed, if consenting to participate in the study, to a second page containing basic demographic questions and the self-report questionnaires. No payments were made for participation.

Measures

Psychological distress. The Italian 21-item version (Bottesi et al., 2015) of the Depression Anxiety Stress Scales-21 (DASS-21; Lovibond & Lovibond, 1995) was used to measure distress along the three axes of depression, anxiety, and stress. This self-report measure encompasses 21 items rated over the past week from 0 (“Did not apply to me at all”) to 3 (“Applied to me very much or most of the time”). Total score is computed by summing the responses to all of the items included in the scale (score range: 0–63). Higher

scores indicate higher levels of distress. The Italian DASS-21 showed very good reliability (Bottesi et al., 2015). In the current sample, Cronbach’s alpha was 0.94.

Impulsivity. The Italian 15-item version (BIS-15; Spinella, 2007) of the Barratt Impulsivity Scale (Patton, Stanford, & Barratt, 1995) was used to measure impulsivity. The BIS-15 retains the 3-factor structure (non-planning, motor impulsivity, and attention impulsivity) of the original 30-item version, and maintained good reliability and validity (Spinella, 2007). A sample item is “I do things without thinking”. Items are rated on a 4-point Likert-type scale (1 = rarely/never, 4 = almost always). There are six reversed items. Total score is computed by summing the responses to all of the items included in the scale (score range: 1–60). Higher scores indicate higher level of impulsivity. In the current sample Cronbach’s alpha was 0.77.

Boredom proneness. The Boredom Proneness Scale–Short Form (BPS-SF; Struk, Carriere, Cheyne, & Danckert, 2017) is an 8-item short version of the original BPS (Farmer & Sundberg, 1986), measuring an individual’s tendency toward experiencing boredom. Items are rated on a Likert-type scale ranging from 1 = highly disagree to 7 = highly agree. This self-report measure includes items such as “I find it hard to entertain myself” and “I often find myself at loose ends, not knowing what to do.” Total score is computed by summing the responses to all of the items included in the scale (score range: 8–56). Higher scores indicate higher boredom proneness. The BPS-SF has demonstrated good internal consistency and construct validity comparable to the original BPS score (Struk et al., 2017). Reliability analyses of the Italian BPS indicated acceptable internal consistency (Craparo, Faraci, Fasciano, Carrubba, & Gori, 2013). In the current sample Cronbach’s alpha was 0.88, and a one-factor solution was confirmed ($\chi^2 = 54.86$, $df = 17$, $P < 0.001$; $RMSEA [90\%CI] = 0.06 [0.04–0.08]$, $CFI = 0.99$; $SRMR = 0.03$).

Metacognitions about smartphone use. The Metacognitions about Smartphone use Questionnaire (MSUQ; Casale et al., 2020) consists of 24 items measuring positive and negative metacognitions concerning smartphone use. A three-factor structure was identified: positive metacognitions about emotional and cognitive regulation (MSUQ-PM ECR); positive metacognitions about the social advantages of smartphone use (MSUQ – PM SR); and negative metacognitions about uncontrollability and cognitive harm of smartphone excessive use (MSUQ – NM UH). Sample items are “using my smartphone reduces my anxious feelings”, “using my smartphone helps me fit in socially”, and “using my smartphone will damage my mind”, respectively. Participants were asked to report the extent of their agreement on a 4-point Likert-type scale (from 1 = “Do not agree” to 4 = “Agree very much”). Subscales scores are calculated by summing the scores for the relevant items (MSUQ-PM ECR score range: 11–44; MSUQ – PM SR score range: 3–12; MSUQ – NM UH score range: 10–40). Higher scores

indicate higher levels of dysfunctional metacognitions associated with smartphone use. The MSUQ showed good internal consistency and predictive validity (Casale et al., 2020). In the current sample Cronbach's alphas were 0.93 for MSUQ-PM ECR, 0.74 for MSUQ – PM SR, and 0.90 for MSUQ – NM UH.

Smartphone use expectancies. The Smartphone Use Expectancies Scale (SUES; Elhai et al., 2020) was used. This self-report measure comprises eight items rated from 1 (“Completely disagree”) to 6 (“Completely agree”) derived from the Internet use Expectancies Scale (Brand, Laier, & Young, 2014). This scale measures positive and avoidance expectancies concerning smartphone use, with 4 items for each dimension. Sample items are “I use my smartphone to experience pleasure”, and “I use my smartphone to avoid loneliness”. Subscales scores are calculated by summing the scores for the relevant items (score range: 4–24). Higher scores indicate higher levels of expectancies associated with smartphone use. Cronbach's alphas were good for the original version (Elhai et al., 2020). The scale was translated from English into Italian according to the recommendations of the International Test Commission (2005). In the current sample Cronbach's alphas were 0.86 for positive smartphone use expectancies, and 0.83 for negative smartphone use expectancies. Confirmatory factor analysis showed a two-factor solution ($\chi^2 = 39.88$, $df = 16$ $P < 0.001$; $RMSEA [90\%CI] = 0.05 [0.03–0.07]$, $CFI = 0.99$; $SRMR = 0.03$).

Problematic smartphone use. The Italian version (De Pasquale, Sciacca, & Hichy, 2017) of the 10 item-Smartphone Addiction Scale (SAS, Kwon, Kim, Cho, & Yang, 2013) was used. Participants gave their answers on a six-point Likert scale (from 1 = “strongly disagree” to 6 = “strongly agree”). A sample item is “I have used my Smartphone for longer than I had intended”. Total score is computed by summing the responses to all of the items included in the scale (score range: 10–60). Higher scores indicate higher PSU. The SAS showed good reliability and validity for the assessment of PSU, with the Italian version also showcasing good psychometric (see also Servidio, 2019). In the current sample Cronbach's alpha was 0.87.

Data analyses

Descriptive statistics and Pearson's Product Moment correlations between the study variables were computed. The pattern of relationships specified by our hypothesized model (Fig. 1) was tested through path analysis, using LISREL 8.8 with the Robust Maximum Likelihood (RML) estimation method (Jöreskog & Sörbom, 2006). In our model, distress, impulsivity, and boredom proneness were the independent variables; metacognitions about smartphone use and smartphone use expectancies were the mediators; and PSU was the dependent variable. Age and gender were included as covariates of the dependent variable, as previous studies have shown that women and younger people report higher levels of PSU (Elhai et al., 2017; van Deursen, Bolle, Hegner, & Kommers, 2015). The mediating role of metacognitions about smartphone use and smartphone use expectancies was evaluated using the Sobel tests for mediation (Baron & Kenny, 1986; Hayes, 2009). We first tested the full model and then subsequently removed step-by-step path coefficients not significant at the 5% level in order to select the most plausible model. To evaluate the model's goodness of fit we considered the χ^2 (and its degrees of freedom and P -value), the Standardized Root Mean Square Residual ($SRMR$ — Jöreskog & Sörbom, 1993) “close to” 0.09 or lower, the Comparative Fit Index (CFI —Bentler, 1995) “close to” 0.95 or higher (Hu & Bentler, 1999), and the Root Mean Square Error of Approximation ($RMSEA$ — Steiger, 1990) less than 0.08 (Browne & Cudeck, 1993).

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The Institutional Review Board of the London South Bank University, Division of Psychology approved the study. All subjects were informed about the study, and all provided informed consent.

RESULTS

Descriptive and correlational analyses

Table 1 shows the means, standard deviations, and inter-correlations for all the study variables. With regard to PSU,

Table 1. Means, standard deviations, and inter-correlations of study variables

	<i>M</i>	<i>SD</i>	2	3	4	5	6	7	8	9
1. Distress	26.71	13.45	0.55**	0.31**	0.25**	0.47**	0.35**	0.39**	0.23**	0.36**
2. Boredom Proneness	23.96	10.24		0.51**	0.26**	0.53**	0.31**	0.44**	0.15**	0.43**
3. Impulsivity	31.03	5.73			0.06	0.21**	0.12**	0.28**	-0.005	0.23**
4. Positive Expectancies	13.59	4.32				0.58**	0.63**	0.22**	0.57**	0.43**
5. Avoidance Expectancies	12.75	5.27					0.61**	0.50**	0.45**	0.57**
6. PM- ECR	21.70	7.94						0.34**	0.54**	0.42**
7. NM- UH	16.83	6.43							0.26**	0.75**
8. PM- SR	5.75	2.20								0.38**
9. PSU	23.08	9.58								–

Note. ** $P < 0.001$. PM-ECR = Positive Metacognitions about emotional and cognitive regulation; NM-UH = Negative Metacognitions about uncontrollability and cognitive harm of smartphone excessive use; PM-SR = positive metacognitions about the social advantages of smartphone use; PSU = Problematic Smartphone Use.



13.4% of the women sample ($n = 51$) and 22% of the men sample ($n = 33$) scored above the SAS cut-off score (33 and 31, respectively; De Pasquale et al., 2017; Kwon et al., 2013).

Distress and boredom proneness were positively and significantly correlated with positive and avoidance expectancies about smartphone use, positive and negative metacognitions about smartphone use, and PSU. Impulsivity was positively and significantly correlated with avoidance expectancies concerning smartphone use, positive metacognitions about emotional and cognitive regulation, negative metacognitions about the uncontrollability and cognitive harm of smartphone use, and PSU. Both positive and negative smartphone expectancies, and positive and negative metacognitions about smartphone use, were positively and significantly correlated with PSU.

Path analysis

A first version of the model was tested including all the variables of interest. However, several path coefficients were not significant at the $P < 0.05$ level, and were removed step by step (i.e., the paths between distress and PSU; the paths between boredom proneness and positive metacognitions about the social advantages of smartphone use, and PSU; the paths between impulsivity and positive and negative metacognitions, positive and negative expectancies, and PSU; the path between positive metacognitions about emotional and cognitive regulation and PSU; the path between age and PSU).

Therefore, the final model included all the significant paths and is depicted in Fig. 2. In this model, distress was positively associated with positive metacognitions about emotional and cognitive regulation and positive metacognitions about the social advantages of smartphone use, negative metacognitions, avoidance expectancies about smartphone use, and positive expectancies about smartphone use. Boredom proneness was positively associated

with positive and negative smartphone expectancies, positive metacognitions about emotional and cognitive regulation, and negative metacognitions. All the mediators (i.e., metacognitions and expectancies about smartphone use), except positive metacognitions about emotional and cognitive regulation, were positively associated with PSU, with negative metacognitions about the uncontrollability and cognitive harm of excessive smartphone use showing the strongest association. Regarding control variables, gender (i.e., women) was linked to problematic smartphone use. None of the independent variables had a direct effect on PSU. The Sobel test indicated the mediating role of negative metacognitions between boredom proneness and PSU ($\beta = 0.20$, $SE = 0.03$, $z = 6.29$, $P < 0.001$), and between distress and PSU ($\beta = 0.13$, $SE = 0.02$, $z = 4.83$, $P < 0.001$). Positive expectancies mediated the relationship between boredom proneness and PSU ($\beta = 0.03$, $SE = 0.01$, $z = 2.60$, $P = 0.009$), and between distress and PSU ($\beta = 0.03$, $SE = 0.01$, $z = 2.26$, $P = 0.02$). Moreover, avoidance expectancies about smartphone use mediated the relationship between boredom proneness and PSU ($\beta = 0.04$, $SE = 0.01$, $z = 3.42$, $P < 0.001$), and between distress and PSU ($\beta = 0.03$, $SE = 0.01$, $z = 2.95$, $P = 0.003$). Finally, positive metacognitions about the social advantages of smartphone use did not mediate the relationship between distress and PSU ($\beta = 0.01$, $SE = 0.005$, $z = 1.70$, $P = 0.08$).

The model accounted for 64% of the variance of problematic smartphone use and showed good fit indices: $\chi^2 = 16.01$, $df = 13$, $P = 0.24$; $RMSEA [90\%CI] = 0.02 [0-0.05]$, $CFI = 0.99$; $SRMR = 0.03$.

DISCUSSION

The aim of the current study was to broaden our understanding of the contribution of metacognitions to smartphone use in the relationship between some well-established PSU psychological correlates (i.e., psychological distress, impulsivity, boredom proneness) and PSU levels, also by considering the role of smartphone use expectancies.

The path analysis of our hypothesized model and the high amount of variance explained in PSU scores revealed that the model fits the data very well, thus suggesting that it is sustainable. We found support for previous findings on the positive association between PSU and psychological distress (Elhai et al., 2017, 2019), and boredom proneness (Elhai et al., 2018; Lepp et al., 2017). Our findings also found support for a recent study (Elhai et al., 2020) which has shown that both positive and avoidance expectancies are associated with PSU levels, thus supporting the contention that cognitive bias influences PIU. Beyond supporting previous findings, our study extends them by focusing attention on other potential underlying mechanisms (i.e., metacognitions) that have already been found to explain various addictive behaviors but have been scarcely addressed in the current field. In detail, we found that: (i) when it comes to psychological distress and boredom proneness, negative metacognitions, and both positive and negative expectancies

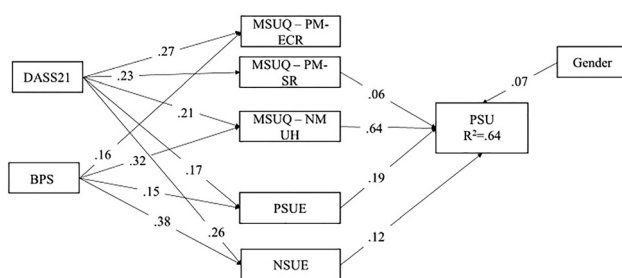


Fig. 2. Results of the path analysis.

Notes. DASS21 = Depression Anxiety Stress Scales-21; BPS = Boredom Proneness Scale; MSUQ-PM-ECR = Metacognitions about Smartphone use Questionnaire-Positive Metacognitions about emotional and cognitive regulation; MSUQ-PM-SR = Metacognitions about Smartphone use Questionnaire - Positive Metacognitions about the social advantages of smartphone use; MSUQ-NM-UH = Metacognitions about Smartphone use Questionnaire - Negative Metacognitions about uncontrollability and cognitive harm of smartphone excessive use; PSUE = Positive smartphone use expectancies; NSUE = Negative smartphone use expectancies; PSU = Problematic Smartphone Use

play a mediating role in the association with PSU, with negative metacognitions showing a dominant role; (ii) there is no overlap between positive expectancies and positive metacognitions, especially when it comes to the smartphone use to help in socializing; and (iii) impulsivity has not direct and indirect (via expectancies and metacognitions about smartphone use) effects on PSU. We discuss each of these findings below.

The first result indicates that people experiencing high levels of distress and boredom are predisposed to PSU because they use their smartphone to ‘feel good’ and experience pleasure (i.e., positive expectancies), to avoid unpleasant feelings (i.e., negative expectancies) and they hold specific beliefs about the uncontrollability and the cognitive harm of their smartphone use (i.e., negative metacognitions). This means that smartphone expectancies and metacognitions about smartphone use, as assessed by existing measures, are, to a degree, distinct constructs and that the latter plays an important role in predicting PSU beyond what has already been highlighted (Elhai et al., 2020) for the former. On the one hand, this provides further support to the assumption that the cognitive and meta-cognitive beliefs domain need to be distinguished as they may be linked to psychopathology in different degrees (Wells, 2000). On the other hand, our findings add to the argument that metacognitive theory should be applied to the understanding of PSU (Casale et al., 2020), akin to what has been done for other addictive behaviors (Spada, Caselli et al., 2015; Spada, Moneta et al., 2007). Parenthetically, these results should not be considered in contrast with other theoretical perspectives on addictive behaviors development. The positive link between expectancies to avoid unpleasant feelings and PSU is consistent with the psychodynamic view of technological addictions as a means of avoiding trauma-related emotions and memories (Schimmenti & Caretti, 2010). Similarly, this result adds further empirical support to the compensatory Internet use model (Kardefelt-Winther et al., 2017).

Furthermore, while there may be a partial overlap between the content of metacognitions concerning emotional and cognitive self-regulation and some items in the positive smartphone expectancies scale, none of the expectancy items clearly identifies beliefs concerning the usefulness of smartphone as a social self-regulation tool. The findings about the role of the belief that the smartphone is useful to satisfy the need for belongingness emerged for the first time in the field of PSU, thus suggesting that specific metacognitions might aid profiling different addictive behaviors. Metacognitions about the usefulness of the smartphone as a means for controlling or regulating one’s own need to belong might play a central role in motivating individuals to engage in excessive smartphone use for social purposes, whilst these might be less fundamental in motivating individuals towards online gaming or gambling (Casale et al., 2020).

Our study also shows a path from psychological distress and intense boredom to PSU through beliefs about lacking control over one’s own smartphone use (i.e., negative

metacognitions) and about the impact of smartphone use on cognitive functioning. Specifically, in the current study negative metacognitions were found to have the stronger effect among the considered mediators. These results align themselves to previous studies which have shown that negative metacognitions about smartphone use have a stronger effect compared to positive metacognitions (Casale et al., 2020; Akbari, et al., 2021), probably because ‘addictive’ smartphone use has become a strategy with which to control unwanted thinking and emotional states, thus contributing to cause an escalation of negative affect and craving/urges to use. This same pattern has also been highlighted in other addictive behaviors, such alcohol dependence (Spada & Wells, 2010) and problematic Facebook use (Marino et al., 2016). More specifically Spada and Wells (2010) found that negative metacognitions about uncontrollability and cognitive harm differentiated between alcohol-dependent drinkers and both problem and non-problem drinkers, and that negative metacognitions about uncontrollability are the strongest predictors of alcohol-dependence. Future studies should compare problematic smartphone users from both high-risk users and normal users with a view to ascertain whether negative metacognitions may play the same role in PSU as is played in other addictive behaviors.

When it comes to impulsivity, no significant direct and indirect paths to PSU were found. This result was not expected as the link between impulsivity and PSU has been well-established by previous research (see Carvalho et al., 2018). On the one hand, a multicollinearity effect could explain our results. On the other hand, the association between impulsivity and PSU is generally explained through the integrative model (Billieux, 2012), which focuses attention on the lack of premeditation that characterizes impulsive individuals, which is related to poor self-control abilities (Billieux, 2012). According to this model, the more the individual is impulsive, the less they will think about the effects of smartphone use, and the more likely they will be to engage in compulsive smartphone use. The concept of metacognition implies, by definition, taking into account the consequences of an act before engaging in that act, which is what is scarce or lacking in impulsive individuals. Individuals who easily tend to be bored or feel distressed may actively search for the smartphone to regulate these feelings, whilst smartphone use might mainly represent an impulsive avoidance (i.e., more passive) strategy among individuals with low self-control abilities.

The present results are preliminary in nature and several limitations should be considered. First, data was solely based on self-report questionnaires, which may be subject to social desirability and self-report biases. The adoption of a cross-sectional design precludes causal inferences, the convenience sampling technique and a predominantly female participant sample prevents the generalizability of the results to the entire population. Moreover, potential confounders such as socio-economic status and education of the participants were not controlled for. Thus, the present findings need to be verified among more representative samples and by

controlling for background variables. Most importantly, future research focusing on the metacognitive theory applied to PSU will have to be conducted in clinical samples.

Despite the above limitations, we believe that the current study extends our understanding of the role of metacognitions in PSU and has potential clinical implications. Our findings suggest that providing intervention to distressed and boredom proneness young people might be important not only for directly targeting these symptoms but also indirectly to prevent PSU. In this regard, strategies aimed at ameliorating the degree of boredom proneness, such as behavioral activation interventions and cognitive-approach strategies (i.e., reappraisal) (Nett, Goetz, & Daniels, 2010), may be essential to decrease the levels of PSU. Moreover, positive expectancies and positive metacognitions may directly affect time spent on the smartphone, and negative metacognitions may exacerbate negative affective states (i.e., distress or boredom), in turn leading to increased engagement with the smartphone. In terms of assessment, this implies that information should be collected not only in relation to smartphone use expectancies, but also metacognitions about smartphone use. Moreover, developing interventions aimed at the modification of the specific beliefs and metacognitions that lead to problematic smartphone use might be valuable, in keeping with previous evidence showing that metacognitive interventions are beneficial for a broad spectrum of psychological disorders and dysfunctions (see, for example, Philipp et al., 2019), including addictive behaviors (e.g., Caselli, Gemelli, Spada, & Wells, 2016; Caselli, Martino, Spada, & Wells, 2018).

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