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Social comparison orientation and fear of missing out as mediators between self-concept clarity and problematic smartphone use

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Abstract

The present study sought to provide empirical evidence for the sequential mediating role of social comparison orientation and fear of missing out (FoMO) in the relationship between self-concept clarity (SCC) and problematic smartphone use (PSU) within the framework of the Interaction of Person-Affect-Cognition-Execution (I-PACE) model. A sample of 474 Italian participants (M_{age} =

29.48; 52.7% females) completed a battery of self-report scales including the Self-Concept Clarity Scale, the Iowa–Netherlands Comparison Orientation, the Fear of Missing Out Scale, and the Smartphone Addiction Scale. Descriptive statistics, bivariate correlations, and structural equation modelling analyses were conducted. Results confirmed the hypothesized relationships and indicated that SCC was negatively associated with PSU use and that this association was partially and sequentially mediated by social comparison orientation and FoMO. Both mediators could therefore be considered as proximal factors of PSU. Implications and further research suggestions are provided.

Keywords: problematic smartphone use, self-concept clarity, fear of missing out, social comparison, mediation analysis

Introduction

Over the past decade, smartphones have become powerful, versatile, and arguably indispensable tools for rapid and easy communication among the general population. However, beyond the realm of information and communication, the use of smartphone may lead a minority of individuals to become over-attached and resulting in problematic or excessive/addictive use. Although problematic smartphone use (PSU) is not yet considered as a specific mental disorder in the *Diagnostic and Statistical Manual of Mental Disorders,* it comprises a pattern of behaviours reflecting a behavioural dependency (Yu & Sussman, 2020). Therefore, the construct has been generally conceptualized as a behavioural addiction caused by maladaptive smartphone use involving negative consequences (e.g., using the smartphone excessively during daily activities ignoring consequences or harm, being unable to maintain concentration in occupational and/or educational tasks, causing interpersonal relationship problems due to the need to constantly check smartphone notifications and/or applications) (Lopez-Fernandez, 2017; Elhai, Levine, & Hall, 2019, for a review).

Although the extant literature provides evidence concerning the existence of PSU (e.g., Jameel, Shahnawaz, & Griffiths, 2019; Panova & Carbonell, 2018), the lack of consensus in the conceptualization of the phenomenon has led to the proliferation of the terms that define it, including (among others) mobile phone addiction (Billieux, Maurage, Lopez-Fernandez, Kuss, & Griffiths, 2015), problematic mobile phone use (Beranuy, Chamarro, Graner, & Carbonell, 2009), and mobile phone dependence (Lopez-Fernandez, 2017). The issue has become further complicated due to the current debate as to whether excessive smartphone use should be investigated when taking into account the distinction between generalised problematic use (problematic use to the totality of an individual's smartphone use) or specific problematic use (problematic use of specific applications on the smartphone, such as Instagram and Facebook) (Griffiths, 2020). The present study uses the term 'problematic smartphone use' (PSU) as an umbrella term (like 'problematic internet use') that describes the totality of the problematic behaviour on the smartphone rather than

an addiction to the physical device itself (Kuss & Griffiths, 2017). As suggested by the literature, scales (such as the Smartphone Addiction Scale) are used as valid instruments to assess generalised problematic smartphone use (e.g., Fernandez, 2017).

Utilizing the Interaction of the Person-Affect-Cognition-Execution (I-PACE) model (Brand et al., 2019; Brand, Young, Laier, Wölfling, & Potenza, 2016), which was developed within the domain of excessive internet use, and in line with prior studies that have applied the model in investigating PSU (Elhai et al., 2020; Montag et al., 2019; Servidio, 2019), PSU may result from the interaction of individuals' characteristics (e.g., genetic and biological factors, personality, psychopathology, cognition, and internet use motives) with affective and cognitive responses to predisposition components. Such response variables include cognitive and attention bias, coping strategies, inhibitory control, and craving. Being conceptualized as mediators or moderators in the relationship between personal factors and internet-use applications, they can magnify or buffer the role of personal factors in leading to problematic internet use (like PSU).

Based on the I-PACE model, the present study examined the effects of the interaction between individual components on PSU by considering the following constructs: self-concept clarity (SCC) as a personality predisposition component, social comparison orientation (SCO) as the tendency to learn about the self through comparison with others, and fear of missing out (FoMO), which is the individual's desire to remain informed and connected with other people's experiences online. Therefore, the present study examined how individuals with low levels of SCC are more likely to engage in PSU. Consequently, the direct association between SCC on PSU was examined by considering the mediating roles of FoMO and SCO.

The relationship between self-concept clarity and problematic smartphone use

The construct of SCC, which derives from the multidimensional and dynamic perspective of self-concept, describes an organized knowledge structure that involves individuals' traits, values, and episodic and semantic memories which control the processing of self-relevant specific or

general information (Campbell et al., 1996). Within this theoretical framework, SCC refers to the extent to which the contents of self-concept (e.g., perceived personal attributes) are clearly and confidently articulate, consistent, and temporally stable (Campbell et al., 1996). Research into technological addictions had paid increasing attention to SCC, showing its strong relationship with Internet addiction among teenagers (Israelashvili, Kim, & Bukobza, 2012), and its direct and indirect effects on compulsive internet use among adults via preference for virtual interactions (Quinones & Kakabadse, 2015). Further researches into gaming disorder (GD) have found that gamers with a low level of SCC spend more time playing videogames (Lee, Aiken, & Hung, 2012) and that lower SCC is both directly and indirectly (via escape motives) associated with problematic online gaming (Šporčić & Glavak-Tkalić, 2018). Recently, some studies have demonstrated the mediating role of SCC between avatar identification and problematic gaming (Green, Delfabbro, & King, 2021), as well as between social anxiety and smartphone dependence (Kong, Lan, Zhang, Sun, & Zhang, 2021). These findings generally support the empirical evidence of the construct of SCC on psychological vulnerabilities related to online problematic/addictive behaviours, and providing useful insights as to why individuals with lower levels of SCC are more likely to engage in PSU.

The mediating role of social comparison and fear of missing out

The constructs SCO and FoMO can be considered due to their theoretical link between SCC and PSU. In line with social comparison theory that describes how individuals learn about themselves through comparison with others (Festinger, 1954), SCO represents the tendency to engage in social comparisons (Gibbons & Buunk, 1999). This predisposition is typically accompanied by an unstable self-clarity. Consequently, individuals who are more uncertain about aspects of their lives, such as the perceived feeling of inadequacy concerning their self-concept and their increased sensitivity to the behaviour of others, are more likely to engage in social comparisons (Campbell et al., 1996; Gibbons & Buunk, 1999). This conjunction can also be utilized

in online environments, where low levels of self-clarity associated with a high tendency to social comparison can be applied to online social interactions. Social networking sites (SNSs; e.g., Facebook, Instagram, etc.) provide a wide range of possibilities for self-presentation, and facilitate social comparison. Indeed, individuals share many of their social relationships in SNSs from private to the public sphere, exposing themselves to a continuous flow of information (e.g., Lee, 2020; Wang, Wang, Gaskin, & Hawk, 2017), which in turn could lead to potential dysfunctional smartphone use. Based on prior studies, low levels of SCC have been hypothesized to precede and predict social comparison, and individuals with an unclear self-concept are more likely to use SNSs via smartphone (Schmuck, Karsay, Matthes, & Stevic, 2019). According to the I-PACE model, social comparison represents a cognitive response to the external stimuli that may link SCC to smartphone overuse (Brand et al., 2019). Therefore, SCO could play a mediating role in the relationship between SCC and PSU.

A further psychological construct that may also be included in the relationship between SCO and PSU is FoMO, which can be taken into account as a response variable of social comparison (He, Shen, & Liu, 2020; Schmuck et al., 2019). Drawing upon the framework of self-determination theory (SDT; Deci & Ryan, 2010), FoMO has been conceptualized as a self-regulating limbo derived from situational or chronic deficits in the satisfaction of psychological needs. More specifically, psychological well-being, motivation, and behaviour adjustment depend on three basic psychological needs: competence, autonomy, and relatedness-closeness (i.e., connectedness). Research within gaming domains has reported that the basic need satisfaction is strongly associated with proactive behavioural regulation (Przybylski, Murayama, DeHaan, & Gladwell, 2013). Therefore, FoMO been described as the apprehension of missing out on rewarding experiences, leading to a corresponding need by individuals to stay persistently connected to their social networks (Przybylski et al., 2013). The construct has been also related to the 'need-to-belong theory,' according to which FoMO is driven by uncertainty regarding social belonging, and where

the higher the degree of need to belong, the higher the probability of experiencing FoMO (Alutaybi, Al-Thani, McAlaney, & Ali, 2020).

Prior studies have reported direct and indirect associations of FoMO with PSU (e.g., Elhai, Dvorak, Levine, & Hall, 2017; Elhai, Levine, Dvorak, & Hall, 2016; Przybylski et al., 2013; Rozgonjuk, Sindermann, Elhai, & Montag, 2020; Servidio, 2019, 2021; Wang et al., 2019). Moreover, SCO has been recently demonstrated to be associated with FoMO, given the underlying relationship with the social comparison process (Reer, Tang, & Quandt, 2019). Indeed, FoMO involves a social comparison between an individual's own vs. others' experiences, therefore resulting in feelings of envy, because other individuals are considered as doing better or having more rewarding social and personal experiences (Reer, Tang, & Quandt, 2019).

However, to the best of the authors' knowledge, no prior studies have examined the association of SCC with FoMO. Based on the self-concept framework, individuals normally tend to process their self-concepts by interfacing with external information. The well-articulated beliefs about the self are characterized by high levels of certainty, consistency, and stability and tend to reduce the experiences of feeling to be "left behind" in social contexts. This may drive individuals to be more active on SNSs to avoid experiencing FoMO referring to the fear of missing the ability to be popular and interesting to others (Alutaybi et al., 2020). Such preferences for online social interactions have been found to predict the level of compulsive internet use, which can coexist with smartphone addiction (Jin Jeong et al., 2020).

In light of previous empirical findings, the following hypotheses were formulated: SCC will be negatively associated with PSU (H1a) and SCO (H1b), which in turn will be positively associated with PSU (H2). Consequently, SCO will mediate the association between SCC and PSU (H3). Additionally, SCC will be negatively associated with FoMO (H4a), which in turn will be positively associated with PSU (H4b). Therefore, FoMO will mediate the relationship between SCC and PSU (H5). The present study also explores how SCO and FoMO are related to each other.

Consequently, SCO and FoMO will sequentially mediate the relationship between SCC and PSU (H6).

Method

Participants

An initial sample of 481 Italian participants was recruited. They were undergraduate students enrolled in humanistic, psychological, and social sciences degrees, and postgraduate students enrolled in specialising masters, continuing education programs, and postgraduate degree courses (PhD). Seven participants were excluded from the dataset because their questionnaires were incomplete. The final sample comprised 474 participants (52.7% females; $M = 29.48$ years, $SD = 10.32$).

Measures

The self-report survey comprised the following sections:

Socio-demographic information: Participants were asked about their gender and age. They also indicated on two separate forms (ranging 0 to 12), the number of daily hours spent on the most popular and commonly used social platforms in Italy (i.e., Facebook and Instagram).

Self-Concept Clarity Scale (SCCS): The 12-item Italian version of the SCCS (Scalas et al., 2013; original version: Campbell et al., 1996) was used to assess the extent to which self-beliefs are clearly and confidently defined, internally consistent, and stable. The scale comprises two non-reversed items (e.g., "In general, I have a clear sense of who I am and what I am") and 10 reversed items (e.g., "On one day I might have one opinion of myself and on another day I might have a different opinion") rated on a five-point Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Item 6 ("I seldom experience conflict between the different aspects of my

personality") was removed in the Italian validation because there was no clear indication of the SCC. Higher scores indicate greater SCC. Cronbach's α in the present study was .88.

Fear of Missing Out Scale (FoMOS): The 10-item Italian version of the FoMOS (Casale & Fioravanti, 2020; original version: Przybylski et al., 2013) was used to assess disposition towards fear of missing out. The scale comprises 10 items (e.g., "I fear others have more rewarding experiences than me") rated on a five-point Likert type from 1 (*not at all true of me*) to 5 (*extremely true of me*). Higher scores indicate higher levels of FoMO. Cronbach's α in the present study was .82.

Iowa–Netherlands Comparison Orientation Measure (INCOM): The Italian version of the INCOM (Ruggieri, Ingoglia, Bonfanti, & Lo Coco, 2021; original version: Gibbons & Buunk, 1999) was used to assess social comparison orientation (SCO). The scale assesses the tendency to engage in social comparison by capturing central aspects of the self, the other, and the psychological interaction between the two. The items (e.g., "I always like to know what others in a similar situation would do") are rated on a five-point Likert-type scale ranging from 1 (*I disagree strongly*) to 5 (*I agree strongly*). Higher scores indicate greater social comparison behaviours. Cronbach's α in the present study was .78.

Smartphone Addiction Scale–Short Version (SAS–SV): The 10-item Italian version of the SAS-SV (De Pasquale, Sciacca, & Hichy, 2017; original version: Kwon, Kim, Cho, & Yang, 2013) was used to assess problematic smartphone use. Items (e.g., "Feeling impatient and fretful when I am not holding my smartphone") are rated on a six-point Likert scale from 1 (*strongly disagree*) to 6 (*strongly agree*). Higher scores indicate higher problematic smartphone use. Cronbach's α in the present study was .83.

Procedure and ethics

A cross-sectional web-based survey was used to collect the data. A snowball procedure was applied

to recruit participants. Information about the research objectives and a link to the survey was emailed to potential participants. The link was also posted on a Facebook wall and shared with students during regular university teaching activities. All participants were aware that participation was voluntary and anonymous and none of them received any kind of remuneration. The online survey took approximately 20 minutes to be completed. All the main measures were randomized. Participants were included in the study if they were aged ≥18 years. This study was conducted according to the Helsinki Declaration and the ethical standards laid out by the Italian Psychological Association, as well as being approved by the research team's university ethics committee.

Statistical analyses

Before performing the data analyses, univariate normality (skewness and kurtosis), multivariate outliers, and cases with missing values were checked. The scatterplot of standardised predicted values versus standardised residuals showed that the data met the assumptions of linearity and the residuals were normally distributed. Following the general recommendations for skewness and kurtosis, the variables of interest were not severely non-normally distributed (Tabachnick & Fidell, 2014). The highest value for skewness was 0.78 for FoMO, and for kurtosis was -0.24 for PSU. No multivariate outliers among the cases were identified. An examination of tolerance statistics confirmed no violations of multicollinearity because all tolerance values were between 0.71 and 0.82. No variance inflation factor (VIF) values exceeded 5 (the largest being 1.41). Daily time spent on Facebook and Instagram was also calculated. Descriptive statistics and bivariate Pearson's correlation analyses were computed using a bootstrap sample of 5000 with 95% bias-corrected and accelerated (BCa) confidence intervals. Finally, gender and age effects were analysed given the inconsistent results reported by literature (e.g., Busch & McCarthy, 2021). SPSS 25 was used to run the preliminary statistical procedures.

Since the constructs are unidimensional, solutions based on item parcelling rather than on individual items are more appropriate to reduce the risk of convergent problems and to improve

model fits (Sterba & Rights, 2016). The factorial structure of each measure was tested using confirmatory factor analysis (CFA). The hypotheses were then tested using structural equation modelling (SEM). The comparison between the partial and the full mediating model has examined following James, Mulaik and Brett's (2006) procedures for SEM. After constraining the path from SCC to PSU to zero in the baseline model, the fit of the model was compared with a second model where the path was freely estimated. Based on the parsimonious principle, full mediation is supported if there are no significant differences between the models. All mediating models were evaluated by using a chi-square (χ^2) difference test, which provides a statistical test of whether the constraints are justified (Kline, 2016). To establish significant differences between models, at least two out of three criteria have to be satisfied: $\Delta\chi^2$ significant at, $p < .05$, ΔCFI $\leq .005$, and ΔRMSEA $\leq .010$ (Chen, 2007). All the statistical analyses were controlled for age, gender, and daily time spent on Facebook and Instagram.

Both confirmatory and SEM analyses were estimated using the maximum-likelihood parameter with standard errors and a mean-adjusted chi-square test statistic that was robust to non-normality (MLMV), as Maydeu-Olivares (2017) suggested. The MLMV chi-square test statistic is also referred to as the Satorra-Bentler (S-B) chi-square. As Hu and Bentler (1999) recommended, multiple indices were used to evaluate fit indices (adopted cut-offs in brackets): the chi-square (χ^2) test value with the associated p-value $> .05$), comparative fit index (CFI $\geq .95$), Tucker–Lewis Index (TLI $\geq .95$), the root-mean-squared error of approximation (RMSEA $\leq .06$) and its 90% confidence interval, and standardized root mean square residual (SRMR $< .08$). CFA and SEM were performed using Mplus 7.04 (Muthén & Muthén, 2014).

Results

Descriptive and correlations

The average daily time spent on Facebook was 2.08 hours (range 1-12 hours; $SD = 1.88$) and on Instagram was 2.86 hours (range 1-12 hours; $SD = 2.08$). The descriptive statistics including

means, standard deviations, and bootstrapping Pearson bivariate correlations of all variables are presented in Table 1. The proposed relationships between the variables were statistically significant. Low levels of SCC were associated with higher levels of FoMO, SCO, and PSU.

The *t*-test analysis showed no gender differences on SCC (M_m = 3.47, *SD* = .786; M_f = 3.32, *SD* = .816, *t*[472] = 1.953, *p* = .051); SCO (M_m = 3.04, *SD* = .659; M_f = 3.05, *SD* = .715, *t*[472] = -.147, *p* = .883); FoMO (M_m = 1.96, *SD* = .686; M_f = 1.92, *SD* = .677, *t*[472] = .597, *p* = .551; and PSU (M_m = 2.33, *SD* = .879; M_f = 2.49, *SD* = .934, *t*[472] = -1.833, *p* = .067).

Table 1. Means, standard deviations, and bootstrapped bivariate correlation matrix with 95% bias-corrected and accelerated (BCa) confidence intervals (bootstrap sample of 5000) among all variables (N = 474)

	M	*SD*	2	3	4	5
1. Age	29.48	10.32	.095[*] [.00, .18]	-.140[**] [-.23, -.05]	-.198[***] [-.28, -.11]	-.143[**] [-.23, -.06]
2. SCC	3.39	.81	-	-.385[***] [-.46, -.31]	-.347[***] [-.43, -.26]	-.396[***] [-.48, -.31]
3. FoMO	1.94	.68		-	.490[***] [.42, .55]	.489[***] [.42, .56]
4. SCO	3.05	.69			-	.437[***] [.35, .51]
5. PSU	2.42	.91				-

Note. SCC = Self-Concept Clarity; FoMO = Fear of Missing Out; SCO = Social Comparison Orientation; PSU = Problematic Smartphone Use. Values in square brackets indicate the 95% BCa confidence interval (lower and upper limit) for each correlation value.
[*]*p* < .05. [**]*p* < .01. [***]*p* < .001.

Main results

The results of CFA for the four-factors structural model, including SCC, FoMO, SCO, and PSU showed a good fit with the data, and robust χ^2 (1, N = 474) =.010, *p* = .922, CFI = 1.00, TLI = 1.02, RMSEA = .000 90% CI [.000, .044], SRMR = .001. Therefore, the full four-model was retained for the next SEM analysis. The hypothesized model was fitted with SCC as an exogenous variable, SCO and FoMO as mediators, and PSU as the outcome variable. The effect of time spent on Facebook and Instagram was controlled only on PSU, whereas the effect of age was controlled on

mediators and the outcome variable. The results of the SEM measurement model indicated an excellent fit, robust χ^2 (80, $N = 474$) = 125.81, $p = .008$, CFI = .977, TLI = .971, RMSEA = .035, 90% CI [.023, .046], SRMR = .041. Figure 1 shows the tested model.

Figure 1. Results of the SEM model among the key variables
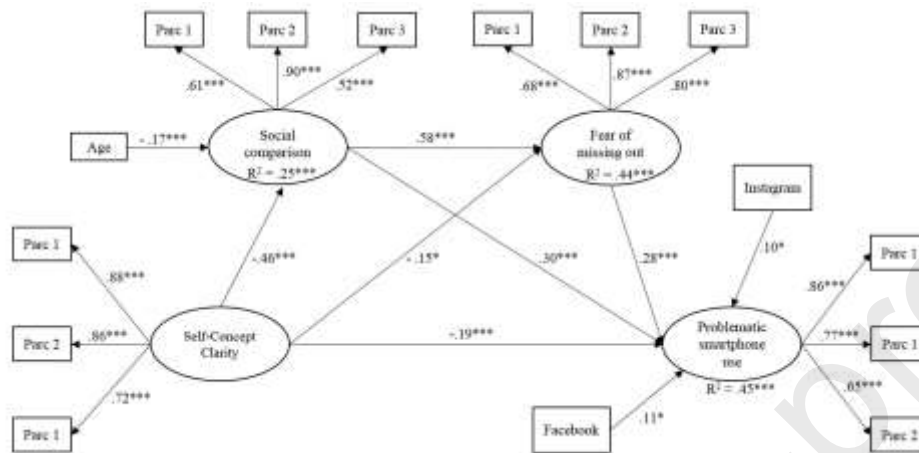
Note. The path coefficients are standardized. For clarity, only the significant paths are shown.
*$p < .05$. ***$p < .001$

The results showed that SCC was negatively related to PSU, $\beta = -.191$, $SE = .055$, $p < 001$ (H1a supported) and SCO, $\beta = -.464$, $SE = .051$, $p < 001$ (H1b supported). SCO was positively related to PSU, $\beta = .304$, $SE = .072$, $p < 001$ (H2 supported). SCC was negatively associated with FoMO, $\beta = -.151$, $SE = .062$, $p < 001$ (H4a supported). FoMO was positively associated with PSU, $\beta = .278$, $SE = .063$, $p < 001$ (H4b supported). SCO was positively associated with FoMO, $\beta = .577$, $SE = .054$, $p < 001$.

Mediation analysis

Table 2 shows the results of the mediational analysis. The relationship between SCC and PSU was partially mediated by SCO (H3 partially supported), as well as by FoMO (H5 partially supported). Finally, based on the analysis, SCO and FoMO partially mediated the association between SCC and PSU in a sequential way (H6 partially supported).

Table 2. *Total, direct, and indirect effects of the pathways tested*

Pathway	*Estimate*	*SE*	*Z*	*p*
Total	-.450	.046	-9.663	.000
Direct effect SCC→PSU	-.191	.055	-3.502	.000
SCC→SCO →PSU				
Specific indirect effect	-.141	.038	-3.730	.000
SCC→FoMO →PSU				
Specific indirect effect	-.042	.020	-2.063	.039
SCC→SCO→FoMO→PSU				
Specific indirect effect	-.075	.020	-3.786	.000

SCC = Self-concept clarity; PSU = Problematic smartphone use; SCO = Social comparison orientation; FoMO = Fear of missing out.

Results from the mediational analysis indicated that the difference between the models with and without a direct path between SCC and PSU was significant, $\Delta\chi^2(1) = 11.00$, $p < .001$, ΔCFI = .005, and ΔRMSEA = .003. Therefore, the larger model with more free parameters fit the data better than the smaller model in which the parameter was fixed.

Discussion

The purpose of the present study was to provide empirical evidence for the mediating role of social comparison orientation (SCO) and fear of missing out (FoMO) in the relationship between self-concept clarity (SCC) and PSU (problematic smartphone use) utilizing the I-PACE model. Overall, the results of the present study confirmed the hypothesized relationships and indicated that SCC was negatively associated with PSU and that this association was partially and sequentially mediated by SCO and FoMO. The results of the *t*-tests showed no significant differences among gender and the main variables of the present study.

As expected, H1a was supported, with SCC being negatively associated with PSU. Therefore, the role of SCC as a potential antecedent of dysfunctional use of smartphones was confirmed. Low scores on SCC were associated with higher scores of PSU. That is, individuals with a less clear self-concept tended to be more sensitive to socio-environmental feedback and consequently, much more engaged in using smartphones to process self-relevant specific

information and achieve a more stable self-concept. This finding is in line with prior studies (e.g., Israelashvili, Kim, & Bukobza, 2012; Quinones & Kakabadse, 2015; Šporčić & Glavak-Tkalić, 2018). The conjunction between the two constructs appeared to be consistent with the psychological mechanisms identified in the I-PACE model, where affective and cognitive responses to situational factors are perceived as stressful (e.g., cue reactivity, need to regulate negative emotions). This may influence the individual's decision to use smartphone applications to cope with negative emotional states (Brand et al., 2019, 2016).

The negative association between SCC and SCO confirmed H1b. This suggests that individuals with low SCC tend to engage in social comparison (Campbell et al., 1996; Quinones & Kakabadse, 2015; Reer et al., 2019). As expected, SCO was positively associated with PSU (H2), indicating that the tendency of individuals to compare themselves to others leads to more extensive use of smartphones. This positive relationship replicates prior studies showing that individuals who are exposed to social comparisons in online environments might experience negative emotions such as envy, frustration, low self-esteem and/or depression, which could cause negative problematic online behaviours (He et al., 2020; Schmuck et al., 2019). The mediating role of SCO within the SCC-PSU relationship was also supported (H3), although the relationship was found to be partial. Individuals characterized by low levels of self-concept tended to be more vulnerable to social comparison behaviors, which in turn may determine a higher risk of problematic smartphone use. The partial mediation was explained by the direct path from SCC to PSU, which remained significant.

As for the relationship between SCC and FoMO, the findings were in line with the theoretically formulated hypothesis (H4a). Indeed, individuals characterized by low-articulated self-beliefs may increase feelings of being ignored in social contexts, and this, in turn, could cause the disposition to use the smartphone in a dysfunctional way. In other words, those individuals who dislike being perceived as an alien would tend to maintain a positive self-concept by conforming

and adopting shared social norms, and therefore to be more active in the use of a smartphone (Alutaybi et al., 2020). This result is consistent with the data reported by a previous study in which adolescents with low SCC had a significant risk of being addicted to smartphones (Kong et al., 2021). Therefore, individuals with low SCC during face-to-face communication could increase the desire to use smartphone social applications to compensate for a poor self-related feedback, which in turn can potentially lead to an problematic use of smartphones. However, given the lack of prior data on this association, future research should support the preliminary finding in the present study. The relationship between FoMO and PSU was also confirmed (H4b), therefore replicating the results of previous studies (e.g., Elhai, Dvorak, Levine, & Hall, 2017; Elhai, Levine, Dvorak, & Hall, 2016; Przybylski et al., 2013; Rozgonjuk, Sindermann, Elhai, & Montag, 2020; Servidio, 2019, 2021; Wang et al., 2019).

The mediating role of FoMO within the SCC-PSU relationship was also supported (H5), although results indicated partial mediation. Individuals who scored low in SCC experienced more FoMO and may develop a dysfunctional use of the smartphone because they consider it as an important device for social media applications (Alutaybi et al., 2020; Wang et al., 2019). Due to FoMO, an individual may remain in a state of constant internet connection (Elhai et al., 2020). Nevertheless, the direct association between SSC and PSU was still significant after the mediator was modelled. Overall, both SCO and FoMO, when individually considered, resulted as significant mediators, therefore fitting the propositions in the I-PACE model.

Finally, when both mediators were assumed together and sequentially within the SCC-PSU relationship, they continued to be significant, therefore confirming H6. This result indicated that individuals characterized by low levels of SCC were more prone to greater social comparison behaviors, which in turn increased the fear of 'being left behind' in social contexts. Consequently, the risk escalation of PSU is more likely to develop. It should be noted that such mediation was found to be partial given that the direct path from individuals' predispositions to PSU remained

significant, therefore highlighting the focal role played by SCC in determining a potential behavioural addiction.

Although the present study has some strengths, it has some limitations. First, as the findings are cross-sectional, they cannot be used to infer causality among the constructs. Longitudinal studies are therefore required to examine causal associations. Second, since all the data were self-report, participants' responses may have been subject to well-known biases. Third, the sample size was modest and self-selected, therefore larger and more representative samples are needed to replicate the findings. Finally, the sample comprised Italian undergraduate and postgraduate students. Therefore, future research should replicate the study using individuals from other cohorts and countries to establish the generalizability of the findings. Overall, the findings of the present study advance the understanding of the interplay between predisposition and response variables related to PSU. A novel finding was the observed association between SCC and FoMO, although future studies are needed to confirm the findings reported here.

Given the widespread diffusion of smartphones in contemporary society and the adverse outcomes for a minority of individuals associated with the increasing daily use, the present study indicates that engendering greater levels of a cohesive and consistent conception of self-concept could present a viable prevention or a treatment strategy in reducing the maladaptive/dysfunctional use of the smartphone as well as the likelihood of being addicted to it for those individuals who, being highly engaged in social comparison, may experience envy and/or frustration.

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Highlights

- Problematic smartphone use (PSU) has many potential risk factors (e.g., fear of missing out; FoMO)

- Self-concept clarity (SCC) and social comparison orientation (SCO) are under-explored in PSU

- SCC was negatively associated with higher levels of PSU, SCO and FoMO

- SCO was positively associated with higher levels of FoMO and PSU

- SCO mediated the association between SCC and PSU

- FoMO mediated the relationship between SCC and PSU

Social comparison orientation and fear of missing out as mediators between self-concept clarity and problematic smartphone use

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Statement 2: CRediT authorship contribution statement

Rocco Servidio and Lucia Monacis: Conceptualization, Methodology. Rocco Servidio: Formal analysis. Rocco Servidio and Lucia Monacis: Writing- Original draft preparation. Maria Sinatra and Mark Griffiths: Writing-Review & Editing.

Statement 3: Conflict of Interest

All the authors declare that they have no conflicts of interest.

Statement 4: Informed consent

Informed consent was obtained from all individual participants included in the study and their parents.