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ORIGINAL RESEARCH

Problematic Smartphone Use and Social Media Fatigue: The Mediating Role of Self-Control

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Background: Excessive social media consumption leads to addiction and affects mental health. It is a phenomenon that is difficult to avoid. Previous research on the effects of excessive Internet use shows that people who engage in social media (SM) without restraint experience over-involvement, over-disclosure, technostress, and social media fatigue (SMF). SMF, conceptualized as an emotional and cognitive feeling of being overwhelmed, manifests itself in mindless browsing of content, limiting the amount of time spent on SM, or quitting SM altogether. Self-control, although present in the technology addiction literature and psychology research, has been rarely described in relation to both excessive SM use and SMF. Therefore, the main goal of the present study was to verify whether there is a direct relationship between problematic smartphone use and SMF, and whether this association is mediated by self-control.

Methods: The study included 210 respondents (M = 25.85, SD = 9.84) living in different Polish cities. The survey was conducted online, and the respondents consented to participate in the study. They completed the following measures: the Mobile Phone Problematic Use, the Self-Control Scale, the Social Media Fatigue Scale, and a brief questionnaire with socio-demographic data.

Results: Statistical analysis was performed to verify the relationship between problematic mobile phone use, level of self-control, and SMF. The outcomes indicate that there are significant interrelationships between the three studied variables. The association between problematic smartphone use and SMF is mediated by self-control.

Conclusion: A lack of impulse-inhibition skills, such as compulsive checking of notifications, can be a significant factor in SM exhaustion, fatigue, or frustration. SMF can also be understood as a natural defensive response, triggered in situations where individuals are overwhelmed, when the self-control is insufficient to stop the compulsion to use SM, and the use of a smartphone for this purpose is excessively engaging.

Keywords: social media fatigue, social media burnout, problematic phone use, self-control

Introduction

Technology itself appears to be neutral. It is up to people to decide how they implement technological means in their lives. Some individuals find the use of social media (SM) comfortable, enriching, and rewarding. Others feel SM as involving unpleasant experiences and detrimental in the long run. In this case, such users migrate from the platforms or quit SM. Despite theoretical works and numerous empirical studies on the topic of overdependence on the Internet,[1–4] SM[5–7] or cell phones,[8–10] the issue of human-technology relations remains complex and not fully understood.

Social media fatigue (SMF) is one of the newly described research phenomena.[11,12] In Poland, it was only in 2021 that a tool to measure its presence and severity among SM users was validated.[13] Along with the lack of research on SMF in the Polish context, other gaps in the available literature have also been noted. For example, the role of self-control in relation to SMF has not been sufficiently described so far. Furthermore, the question of whether self-control acts as a potential mediator between problematic smartphone use and SMF is still understudied. Therefore, the main purpose of this article was to analyze the relationship between problematic mobile phone use, SMF, and the level of self-control in the research group of Polish adults.

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Literature Review

Problematic Smartphone Use

The cell phone has evolved from a purely functional device into a source of easily accessible entertainment and a tool for almost unlimited communication that can be overly engaging. Park,[14] writes that the "use and the definition of mobile phone is undergoing reinterpretation as the mobile phone blurs the distinction between personal communicator and mass media." This obscures the concepts of "social media addiction" and "mobile phone addiction" to the point where one can even talk interchangeably about Internet, phone, or SM addiction as they do not yet function as separate concepts.

A consideration of the cut-off point in the use of the term "addiction" in relation to the DSM-IV criteria was carried out by Chóliz.[15] In the works of Polish authors, one can come across the term "phonoholism".[16–18] Although the word "addiction" in the context of SM appears in the articles from different parts of the world,[19–24] according to some researchers, the reference to "addiction" in the study of human-technology relations is not fully justified. A more appropriate term seems to be "problematic use",[25,26] because despite its undoubted harmfulness,[27] it does not pose an immediate threat to life and generally does not warrant medical intervention.

The accumulated knowledge on smartphone use seems to be quite extensive, ranging from studies on social relationships to indicators of mental disorders. Excessive cell phone use affects basic interpersonal relationships and health across generations.[28] According to Bilieux,[29] problematic smartphone use is linked to neuroticism, extraversion, and impulsivity. Studies using various measures of psychological well-being conducted on Australian adults show statistically significant correlations of problematic smartphone use with negative affect, environmental mastery, and sense of autonomy.[30] In another study, it has been found that 74% of smartphone-dependent users were characterized by psychiatric symptoms.[31] In the same study, the authors have identified as many as four other distinct, but simultaneously occurring, types of problematic cell phone use: difficulties with self-control, anxiety, depressive symptoms, and impulsivity. In contrast, a healthy, secure attachment model has been identified as an important protective factor against excessive cell phone use.[32] Moreover, smartphone use is associated with uncertainty tolerance,[33] sedentary behavior,[34] sleep disturbance,[35] alcohol consumption, and low academic achievement.[36] When discussing cell phone addiction, it is hard to ignore the aspect of overusing social media and the fatigue associated with excessive engagement with social networking sites.

Social Media Fatigue

The average Internet user in Poland spends roughly 6 hours and 39 minutes a day using the Internet.[37] If SM use is indicated as an integral part of people's daily lives,[38] then, like other daily activities, excessive amounts of such stimulation can become overwhelming. The effect of this overwhelming feeling has been given its own name and characterization in recent years. In the simplest terms, SMF can be depicted as "a subjective sense of physical and mental exhaustion, lassitude, and irritation, caused by social media use".[39] Another definition indicates the consequence of entering this state, eg, withdrawal from SM activity: "social media users' tendency to withdraw from social media due to feeling overwhelmed is closely related to individuals' social life and well-being".[40] Problematic, compulsive SM use contributes to SMF which, in turn, is associated with increased levels of anxiety and depression.[41]

Research conducted in the context of the COVID-19 pandemic indicates that high levels of worry increase SM information overload, leading to SMF.[42] SMF positively correlates with measures of Internet addiction. Moreover, anxiety, which accompanies anticipated distress, a negative interpretation of events, and fear of being left out (FoMO—Fear of Missing Out) of interpersonal relationships or SM events, has been shown to contribute to a sense of SMF.[43]

It is worth noting that the causes of SMF mainly include internal factors (eg FoMO), rather than external factors (eg related to the presence and intrusiveness of advertisements) as was initially assumed.[44] In addition to personality variables (eg high neuroticism), SM features, such as information overload and intrusiveness into one's private life, contribute to the experience of SMF.[45] More precisely, communication overload appears to have a more significant impact on SMF than information overload alone.[46] A similar conclusion has been drawn from other research reports.[47] It seems that people who focus more on online self-presentation are more likely to feel higher SMF, which results in a more passive use of SM in the form of not initiating activity or responding to displayed content. As for protective factors against SMF,[48] four umbrella factors have been identified: cognitive, personality, environmental, and social.

At this point, the question arises as to what may mediate between immoderate phone use and a state of social media burnout. We chose self-control as it is considered one of the most constructive personality traits which "facilitates both the inhabitation of undesirable behavior and the promotion of desirable behavior to the same extent".[49] Moreover, it connotes the motivation to refrain from temptation[50] despite excessive engagement in smartphone use.

Self-Control

Self-control is considered an intrinsic antecedent of social network fatigue.[51] In fact, most research shows that the physical and mental exhaustion caused by SM use differs depending on the specific characteristics of the individual.[39] At the same time, accessibility to smartphones and mobile Internet challenges social media users' self-control. In the present study, we adopted the operational definition proposed by Gillebaart,[52] who conceptualizes self-control as: "the set of skills, capacities, and behaviors that we need to 'operate' in a self-regulation feedback loop."

It is known that a lowered behavioral inhibition system is associated with problematic cell phone use by men.[53] In the case of women, the time since acquiring the phone was found to be more important along with the level of self-control, that is, the longer the time of phone ownership and the higher the self-control women declared, the lower were their scores on the scale of problematic cell phone use. According to Adriaanse et al,[54] a high degree of self-control is important for forming healthy habits (in this case, refraining from eating unhealthy food), and habits translated into the participants' behavior. In the aforementioned study, self-control inhibited the consumption of unhealthy food, but did not necessarily promote healthy eating habits (choosing fruit).

We suppose that self-control may be the primary link between mobile phone problematic use (MPPU) and SMF, since it is through self-regulation that users can develop the habit of refraining from unconstructive phone use. This would be in line with the insights of Brevers and Turel,[55] who concluded that low rates of self-control predict higher scores when measuring SM use as a habit. Referring to the research of Adriaanse et al,[54] it may be more important in the short term to develop the habit of control over smartphone use than to promote health-promoting habits. Hypothetically, for example, giving up Internet access directly on the phone—if it were necessary to turn on the computer every time to connect with others, maybe people would reflect on whether it is really all that necessary to check their notifications at that very moment. The idea of the Joy of Missing Out (JOMO),[56] while sounding appealing, in a situation where even employers or teachers are starting to treat SM as an official information medium, is nonetheless quite unrealistic.

Summing up the theoretical part, we presented the definitions of individual variables and briefly looked at research in their area. The results do not clearly show that SMF is a direct consequence of SM addiction. Moreover, it is not known whether self-control inhibits the development of SMF symptoms or arises in response to experiencing them. An analysis of potential mediations could provide some answers to these questions. Therefore, the present study aims to fill the gap in the current knowledge on the phenomenon of SMF, in the context of the effectiveness of the level of self-control and in relation to cell phone abuse.

Based on the existing literature and evidence from empirical research, the following hypotheses were put forward.

Smartphone Addiction and Self-Control

Some researchers show a significant correlation between smartphone addiction and low self-control.[57] It has also been found that low self-control is related to problematic cell phone use through interpersonal and transactional patterns of phone use. In contrast, people who use their phone primarily for conscious information seeking are characterized by higher levels of self-control.[58] Moreover, Bhargava and Velasquez[59] notice that the inability to control oneself is one of the components of all addictions. Therefore, we hypothesized (H1) that high rates of problematic smartphone use are negatively associated with self-control.

Smartphone Addiction vs Social Media Fatigue

Several studies suggest that problematic SM use is more strongly related to cell phone use than directly to SM itself.[60] This is an interesting conclusion, as it seems that the smartphone has become the main tool of excessive (active as well as passive) SM use. As is well known, the negative comparisons accompanying SM use, disruption of interactions, social and information overload, self-efficacy, and impression management contribute to the severity and spread of SMF.[61] There is also a report that indicates that compulsive SM use promotes elevated rates of SMF.[62] Hence, in the second

hypothesis (H2), we assumed that there is a positive correlation between excessive engagement in smartphone use and higher levels of SMF.

Self-Control and SMF

Luqman et al,[63] based on the stimulus-organism-response (SOR) paradigm, proved that the consequences of excessive SM activity, such as technostress and burnout, force users to limit or stop using Facebook. Indeed, excessive use of social platforms contributes to different types of conflict, such as task, process, and relationship conflict).[64] The overuse of technology can also be associated with individual deviant behaviors in the light of the theory of conservation of resources (COR).[65,66] If it is necessary to stop an overexploiting activity to protect a resource, then how do we justify why people decide to limit their SM activity? For example, in a study from 2018,[67] a discontinuance model of using social networking sites was proposed, referring to the self-determination theory (SDT) and the theory of planned behavior (TPB). According to the TPB, it is the perceived control of behavior that translates into behavioral intention (eg readiness to engage in action) and specific behavior (eg temporary or complete withdrawal from SM). Combining the knowledge presented in the Literature review section with the above, we assumed (H3) that self-control negatively correlates with high levels of SMF.

Why Might Self-Control Function as a Mediator?

Not much research has been found on SMF within a mediating context. Regarding the three variables studied, based on the data presented earlier, the mediating relationship could be twofold. On the one hand, problematic smartphone use could be associated with increased rates of SMF mediated by low self-control. On the other hand, low self-control could be associated with problematic cell phone use and mediated by fatigue levels (the higher the SMF, the more pronounced the negative impact of excessive phone use could be on well-being and daily functioning). Masood et al[68] investigated the determinants of excessive SM use based on the transactional model of stress and the stressor-strain-outcome framework (SSO). Cao et al,[69] explaining the relationship between SM abuse and low academic achievement, also refer to the SSO theory. It can be assumed that this theory largely explains how the abuse of technology contributes to the symptoms of SMF. Moreover, self-control functions as a mediator in both of the abovementioned studies. Therefore, we hypothesized (H4) that self-control would be a mediator between problematic cell phone (or smartphone) use and SMF.

Methods and Materials

Participants

The study group consisted of 210 participants between the ages of 18 and 62 ($M = 25.85$, $SD = 9.84$), 85% of whom were women. A significant proportion of the participants (49%) indicated a city of more than 200,000 people as their place of residence. This was followed by 22.9%—a city of up to 50,000 people, 17.6%—a rural area, and 10.5%—a city of 50,000 to 200,000 people. In terms of education, the people reported primary education (1.9%), vocational education (3.3%), secondary education (34.8%), and higher education (23.8%). The remaining participants (36.2%) were still in higher education. When asked "What social media sites do you use?" the survey participants indicated 14 different SM sites. The most frequently used sites were: Messenger (201 people), Facebook (192), Instagram (158), WhatsApp (115), TikTok (97), Pinterest (91), Snapchat (88), Twitter (56) and Discord (53). Less popular sites were: Twitch.tv (14), Telegram (4), Tumblr (2), YouTube (1) and Vk (1). The participants were also asked at what age they started using social media. Again, the responses varied considerably. Most people started between the age of 12 and 14 (47.1%). The smallest number of people indicated the age between 7 and 8 years old (2.4%) and over 40 years old (2.5%). As for the number of hours spent daily on social networks, most participants indicated a range of up to 3h (59.5%) and between 4 and 6 hours (31%). The remaining 9.5% said they spend more than 6 hours using social media sites.

Procedure

The study was conducted after receiving prior approval from the Ethical Committee for Scientific Research of the Institute of Psychology at the University of Szczecin (KB 2/2021), and was performed according to the ethical guidelines of the Declaration of Helsinki. The study was questionnaire-based and was conducted once, via the Internet. Individuals

who indicated their willingness to participate in the study and gave their conscious and written consent completed an online questionnaire. The participants were given information about the voluntary nature, anonymity, and confidentiality, as well as the ability to opt out at any time while completing the test battery. After a predetermined period, the researchers closed access to the online battery and the content of the link was no longer available. The respondents were also given the opportunity to get in touch after the testing procedure if they had any questions about the content of the battery or were interested in the results.

Measures

In addition to a metric containing questions about basic sociodemographic data, the subjects completed three psychological questionnaires measuring the constructs described above: mobile phone problematic use, social media fatigue, and self-control.

The Mobile Phone Problematic Use Scale (MPPUS-10) is a 10-item tool developed by a four-person research team led by Foerster[70] and adapted to the Polish context by Mach et al.[71] It is a short, clear scale with high discriminatory power to assess the risk of harmful, excessive use of cell phones. The tool consists of 10 statements, to which respondents answer by choosing one response, where 1 = "Not true at all", and 10 = "Extremely true." The authors of the Polish adaptation note that the MPPUS-10 scale "was developed when the amount on bills reflected the intensity of use of the device. Nowadays, a bill does not reflect the frequency of use of the phone. Most users have unlimited access to phone calls, text messages, and the Internet with their plan"[71] so they left it up to researchers and diagnosticians to omit the 10th statement. We decided to use the scale in its original version because owning a prepaid or postpaid phone with a predetermined limit is admittedly increasingly rare but still practiced in Poland and does not necessarily exclude the appropriateness of the statement. The authors of the Polish version do not propose cut-off thresholds for the Polish population. They treat problematic phone use as a continuum; that is, the higher the score (obtained by adding up the points), the higher the probability of excessive cell phone use. In the studied group, the tool showed a very good reliability coefficient of $\alpha = 0.81$.

The Self-Control Scale (S-CS) is a tool created by a research team led by Tangney.[72] In the current study, we used its Polish adaptation.[73] The S-CS serves to measure self-control and includes various manifestations that are recognized as indicators of the effectiveness of self-control. These manifestations can be put into two groups, namely primary (such as the ability to defer gratification, eg, most strongly related to the general factor) and secondary (or indirect, such as maintaining a healthy lifestyle). The tool has 36 statements to which respondents reply using a 5-point response scale. The lowest point value for each statement is 1 = "Not at all like me", and the highest is 5 = "Very much like me." Although the scale contains 5 components (general capacity for self-discipline, inclination toward deliberate/non-impulsive action, healthy habits, self-regulation in service of a work ethic, work reliability), we were interested in the overall level of self-control, calculated by adding the scores received by the respondent. A high overall score of the S-CS indicates high levels of self-control. In the present study, the Cronbach's alpha coefficient was $\alpha = 0.90$.

The Social Media Fatigue Scale (SMFS), authored by a team of researchers led by Zhang,[40] is a 15-item tool for measuring fatigue with social network use. In the study, we used its Polish adaptation.[13] The scale is designed in such a way that the statements it contains can be applied to one or more SM sites, no matter which one the respondent uses most often. The statements are grouped into three social media burnout factors: cognitive SMF, behavioral SMF, and emotional SMF. Each factor contains five statements to which respondents relate on a seven-point Likert scale, ranging from 1 = "Totally disagree" to 7 = "Totally agree." The tool does not have reversed items. The scores on the individual factors are summed by adding the scores obtained on each subscale, and the overall score is obtained by summing the scores of the three scales. The higher the total score, the higher the level of social media burnout experienced by the respondent. The reliability of the SMFS in our study for the entire tool was $\alpha = 0.86$ and for the individual subscales: $\alpha_{\text{cognitive SMF}} = 0.81$, $\alpha_{\text{behavioral SMF}} = 0.86$, and $\alpha_{\text{emotional SMF}} = 0.73$.

Statistical Analysis

Processing of the psychological data was performed using the IBM SPSS Statistics 23.0 software and the PROCESS macro for SPSS (version 3.2).[74] Descriptive statistics of the mean and standard deviation were reported along with skewness and kurtosis, with the assumption of normality not exceeding ± 2. The internal consistency was measured using Cronbach's α for all scales' dimensions. To measure the strength of the associations between factors, Pearson's correlation coefficient r was used. A regression equation was used to check for multicollinearity since we anticipated a rather high correlation between problematic cell phone use and SMF. A Variance Inflation Factor (VIF) cut-off point higher than 10 and a tolerance value less than 0.1[75] were assumed as showing problematic multicollinearity. The Mahalanobis ($p < 0.001$) and Cook's distance (less than 1) were used to screen for the presence of outliers that could affect the results.[76]

The participants' sex, age, place of residence, education, hours spent on social networks every day, number of social networks used, and age at which they started using social networks were considered to control whether any of them had a confounding influence on the relationship between mobile phone problematic use and SMF in its cognitive, behavioral, emotional dimensions, and its overall score. The abovementioned potentially confounding variables were selected on theoretical and empirical bases.[77,78] For example, it has been found that more problematic cell phone use is reported by females,[79–82] adolescents[83] and younger adults,[84,85] users with basic education,[79] people who spend increasing time on social networks,[81,84] and use many applications.[76] In terms of SMF, there are gender differences[85,86] which suggest that women tend to experience fatigue more than men.[87] There is also some evidence that there is a stronger effect of social media usefulness and SMF for young people between 28−37 years old compared to the other age groups.[87] SMF is related to the time spent on social media. According to Zhang et al,[88] time cost positively relates to media fatigue.

The PROCESS macro for SPSS was applied to evaluate whether and to what extent MPPU (the predictor variable) influences the dimensions of and overall SMF (the outcome variables) through self-control (the mediator). Therefore, MPPU was included as an independent variable, and overall SMF with its three dimensions (cognitive, behavioral, emotional fatigue) were considered as independent variables. Accordingly, four single-level mediation models no. 4 were computed with a 95% confidence interval for all the indirect effects, using 5000 bootstrap samples.

Results

Descriptive Statistics

The values for skewness were between −0.216 and 0.595, and for kurtosis between −0.856 and −0.157. Thus, the variation from the normal distribution was less than ± 2, indicating very little deviation from normality. The results for the individual factors are shown in Table 1.

Multicollinearity, Outliers, and Confounders

Multiple regression showed that neither a VIF of 1.05−7.14, nor a tolerance rate of 0.14−0.94 indicated a multicollinearity problem in the sample. The Mahalanobis distance revealed only one observation that differed

Table 1 Descriptive Statistics of MPPU, SC, and Dimensions/Total of SMF

Variable	*M*	*SD*	Skewness	Kurtosis
MPPU	34.41	15.66	0.530	−0.347
SC	114.75	21.56	−0.105	−0.157
SMF-C	14.42	7.75	0.552	−0.680
SMF-B	21.00	7.92	−0.216	−0.856
SMF-E	14.47	6.82	0.595	−0.243
SMF-O	49.90	17.49	0.084	−0.617

Abbreviations: MPPU, mobile phone problematic use; SC, self-control; SMF-C, cognitive dimension of social media fatigue; SMF-B, behavioral dimension of social media fatigue; SMF-E, emotional dimension of social media fatigue; SMF-O, overall social media fatigue.

significantly from the others, with a significant value of $p = 0.00023$. Nevertheless, this outlier was not removed since it did not change the correlational or mediational values. Cook's value (between 0.000 and 0.085) also denoted that the case was not problematic.

With respect to potential variables that could affect both the independent and dependent variables, regression analyses did not show any confounders: sex ($\beta = -0.023$, $t = -0.353$, $p = 0.724$); age ($\beta = -0.279$, $t = -1.643$, $p = 0.102$); educational background ($\beta = -0.085$, $t = -1.116$, $p = 0.266$); place of residence ($\beta = -0.066$, $t = -1.004$, $p = 0.317$); time spent daily on social networks ($\beta = -0.001$, $t = -0.009$, $p = 0.992$); number of social networks used ($\beta = 0.041$, $t = 0.508$, $p = 0.612$); age at which a person started using social networks ($\beta = 0.216$, $t = 1.386$, $p = 0.167$). All seven variables (Step 1) explained 13.5% of the variance ($R^2 = 0.135$) and the two predictors (Step 2) explained an additional 9% even after controlling for a number of potential confounders.

Correlations

In line with the adopted hypotheses, the correlations between all the variables (Table 2) turned out to be significant, albeit to different extents. It can therefore be concluded that the problematic use of a cell phone coexists with self-control and the phenomenon of SMF.

In the next step, the relationship between MPPU and the dimensions/overall score of SMF was examined by introducing self-control as a potential mediator that could influence the existing link between the independent and dependent variables (Figure 1).

The results of the PROCESS macro for SPSS[85] presented in Table 3 show that, in three of the four models, self-control mediated the relationship between the independent and dependent variables. In fact, the direct effect (c path) decreased in value after self-control was entered as the mediator (c' path)—MPPU → SC → SMF-CF, MPPU → SC → SMF-EF, MPPU → SC → SMF-OF.

Discussion

This study examined the relationship between problematic smartphone use, SMF and self-control. The findings supported all four proposed hypotheses. The results proved to be consistent with the previous reports cited in the literature review. In conclusion, it can be stated that: 1) individuals with higher MPPU tend to present lower levels of self-control; 2) people who use their cell phones excessively and not constructively are characterized by elevated rates of SMF; 3) people with self-control tend to declare lower levels of SMF; 4) the relationship between the studied variables takes the shape of a mediation relationship: the association between MPPU and SMF is mediated by self-control.

First, we found that problematic smartphone use correlates negatively with self-control, thus confirming H1. People who report a problem with cell phone overuse tend to display difficulty in resisting inner or external temptations, thus having problems with regulation of their emotions, thoughts, and behaviors.[89] This propensity has been identified both in women and men excessively using smartphones.[53] Moreover, Fabio et al[90] outlined that individuals declaring lower levels of smartphone use present fewer problems with self-control. In another study, Du et al[91] demonstrated that

Table 2 Correlations Between MPPU, SC, and Dimensions/Total of SMF

	MPPU	SC	SMF-C	SMF-B	SMF-E	SMF-O
MPPU	1					
SC	−0.40***	1				
SMF-C	0.39***	−0.37***	1			
SMF-B	0.16*	−0.19**	0.34***	1		
SMF-E	0.25***	−0.29***	0.48***	0.40***	1	
SMF-O	0.34***	−0.36***	0.79***	0.76***	0.78***	1

Notes: *p < 0.05; **p < 0.01; ***p < 0.001.

Abbreviations: MPPU, mobile phone problematic use; SC, self-control; SMF-C, cognitive dimension of social media fatigue; SMF-B, behavioral dimension of social media fatigue; SMF-E, emotional dimension of social media fatigue; SMF-O, overall social media fatigue.

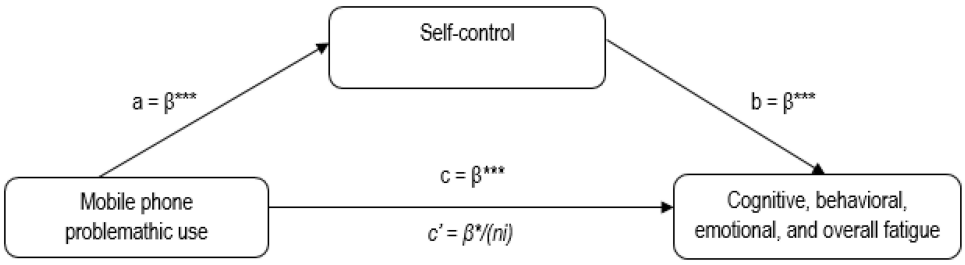


Figure 1 Theoretical model of the role of self-control in the relationship between mobile phone problematic use and cognitive, behavioral, emotional, and overall social media fatigue. *p < 0.05; ***p < 0.001.
Abbreviation: ni, nonsignificant.

problematic media use was positively related to social media self-control failure. Prior research has proven that problematic smartphone use is associated with low self-control.[34,92]

With respect to H2, we found a positive correlation between excessive engagement in smartphone use and higher levels of SMF. The results suggest that a lack of impulse inhibition skills, such as compulsive checking of notifications, can significantly contribute to SM overload and consequently exhaustion, fatigue, or frustration, providing a picture of symptoms characteristic of SMF. According to Kim et al,[93] excessive use of social networks leads to SM exhaustion. In another study,[13] addiction to SM was positively associated with the cognitive, behavioral, and emotional dimensions of SMF. This is not surprising, since in humans, as in animals, attention is limited.[94,95] "Being" on SM, even when one is a relatively passive user and does not self-publish much content, requires searching, selecting, or simply following the information provided (where the irrelevant is given equal importance to the relevant), analyzing the content of posts and photos, and making decisions about expressing approval or disapproval of the content displayed.

With regard to H3, the findings indicate that self-control correlates negatively with SMF. Such a result is understandable if we assume that the functions of self-control involve skills[96] of controlling reactions (especially when they interfere with normal functioning), and adopting new behaviors (resisting temptation or dismissing rewards) and experiences (pleasurable events or activities). When self-control is inadequate to ensure optimal energy expenditure and when someone is unable to use SM intentionally and fully consciously, the use of a smartphone for this purpose becomes overly engaging. Hence, the user begins to experience unpleasant sensations related to their SM activity. Moreover, when people are unable to self-regulate their desire to use SM, they may feel tired of not achieving their goals.

Finally, self-control was a mediator, showing that beyond the direct relationship between both problematic phone (or smartphone) use and SMF, there is also an indirect association between both variables mediated by self-control (H4). It seems that self-control is important for problematic phone users who feel tiredness of SM. Individuals who are addicted to their smartphones may show lower levels of self-control, thus experiencing a higher intensity of fatigue resulting from the uncontrolled use of their devices. In fact, people who use phones dysfunctionally tend to have scarce self-control, manifested in a reduced ability to postpone satisfaction, resist unwanted impulses or behaviors, and regulate emotions.[92] Consequently, they may become more fatigued from too much use of the phone. On the other side, people who use cell phones functionally may present healthy self-control, which allows them to use various goods in a balanced way. Thus, such users also get less tired of SM. This mediational outcome is consistent with the results from previous studies where

Table 3 Role of Self-Control in the Relationship Between Mobile Phone Problematic Use and Cognitive, Behavioral, Emotional, and Overall Social Media Fatigue

	a Path	b Path	c Path	c' Path	Indirect Effect	B(SE)	Lower CI	Upper CI
MPPU → SC → CF	−0.55***	−0.09***	0.19***	0.13***	0.0539	0.0169	0.0219	0.0878
MPPU → SC → BF	−0.55***	−0.05(ni)	0.08**	0.05(ni)	0.0294	0.0173	−0.0027	0.0682
MPPU → SC → EF	−0.55***	−0.07**	0.11***	0.07*	0.0389	0.0138	0.0116	0.0665
MPPU → SC → OF	−0.55***	−0.22***	0.38***	0.26***	0.1231	0.0377	0.0518	0.2011

Notes: *p < 0.05; **p < 0.01; ***p < 0.001.
Abbreviations: ni, nonsignificant; MPPU, mobile phone problematic use; SC, self-control; CF, cognitive fatigue; BF, behavioral fatigue; EF, emotional fatigue; OF, overall fatigue.

self-control acted as a buffer, attenuating the association between different variables. For example, it was found that the ability to self-control weakened the relationship between crisis of meaning and mental distress.[97] In other studies, the ability to override impulses was a protective factor against different internalized and externalized problems.[98]

Limitations

The main limitations of this study include the fact that its cross-sectional nature does not make it possible to suggest a causal relationship between the described variables. However, the known direction of mediation may help outline a research plan aimed at a deeper understanding of the phenomenon of SMF and experimental verification of the factors on which SMF may depend or cause. In terms of interpretation of the obtained results, doubts may be raised by the significant overrepresentation of women in relation to men participating in the study. The researchers did not have much influence on which respondents the survey reached because participation in the online survey did not involve any gratification, was voluntary, and the data was collected using the snowball method. As is known from research by Twenge and Martin (2020), compared to males, who generally spend more time on electronic devices, preferring to play games, females are more intensively involved in activities on social media and the Internet, use smartphones more often, and sometimes send text messages (eg spend time online mainly on activities related to communication or relationships). This explains the unequal bender balance.

Conclusion

The study provided new insights into human-technology interactions. All hypotheses put forward in the research were confirmed. The mediating role of self-control in the relationship between excessive smartphone use and SMF was found and justified. A lack of impulse-inhibition skills, such as compulsive checking of notifications, can be a significant factor in social media exhaustion, fatigue, or frustration. Regardless of the theory adopted to explain its formation, SMF remains an inspiring topic for further research.

In addition, the outcomes provide evidence that the direct link between problematic cell phone use and SMF can be extended to the presence of self-control, understood as a mechanism underlying this relationship. Problematic use is not only directly associated with SMF, but also affects SMF through self-control. In other words, self-control has an impact on making one feel less tired in the context of excessive phone use.

Data Sharing Statement

The datasets used during the current study are available from the corresponding author.

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Author Contributions

All authors made a significant contribution to the work reported, whether in the conception, study design, execution, acquisition of data, analysis and interpretation stage, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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