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Metacognitions as a predictor of problematic social media use and internet gaming disorder: Development and psychometric properties of the Metacognitions about Social Media Use Scale (MSMUS)

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ABSTRACT

The aim of the present study was to investigate social media use metacognitions through the development of a new scale, the Metacognitions about Social Media Use Scale (MSMUS). In addition, the study included measures of problematic social media use (PSMU), gaming metacognitions, and gaming disorder (GD) to test concurrent validity. A total of 2390 Iranian adolescents (835 males and 1555 females) aged between 13 and 18 years (M = 16.01 years, SD = 1.38) participated in a cross-sectional online survey. The results of the exploratory factor analysis (n = 1195) and confirmatory factor analysis (n = 1195) suggested that the MSMUS (i) can optimally assess metacognitions concerning social media, and (ii) has a two-factor structure ("negative metacognitions about social media" and "positive metacognitions about social media"). The scale was found to be measurement invariant among males and females, and among individuals with and without risk for PSMU. Social media metacognitions presented significant and predominantly (i) moderate correlations with PSMU symptom severity, and (ii) weak correlations with GD symptom severity. Furthermore, positive and negative social media metacognitions had significant and positive predictive effects on the presence of risk for PSMU with and without a risk for GD – even over the effects of age, gender, and gaming metacognitions. This finding may indicate that metacognitions are possibly a transdiagnostic variable which might be helpful in developmentally assessing addictive behaviors, especially negative metacognitions which might be a risk factor for co-occurring addictive behaviors.

1. Introduction

1.1. Problematic social media use

Social media platforms (such as *Facebook, Instagram*, etc.) allow users to set up unique public or private accounts. It has been estimated that the use of social media platforms will increase from 4.26 billion in 2021 to 4.59 billion worldwide by the end of 2022 (Statista, 2022). This supports the accessibility hypothesis, which indicates that as an activity becomes easier to access, more individuals are attracted to it (Griffiths, 2005). However, for a small minority of users, their personal, social, and/or professional lives could suffer as a result of adverse effects brought about by their excessive use of social media (Bányai et al., 2017). Extreme problematic use of social media is associated with symptoms such as mood regulation, withdrawal,

tolerance, and relapse, symptoms that are commonly associated with addictive behavior (Casale & Banchi, 2020; Griffiths, 2005). Many studies have shown that Problematic Social Media Use (PSMU) is related to mental health issues such as anxiety, depression, eating disorders, and sleep problems (Kuss & Griffiths, 2017; Boer et al., 2020; Paakkari et al., 2021; Huang, 2022). The prevalence of PSMU in one study was reported to be 4.1% (for boys) and 3.6% (for girls) among adolescents (Müller et al., 2016). A meta-analysis reported the pooled prevalence of PSMU among 63 independent samples to be 5% (Cheng et al., 2021). In Iran (where the present study was carried out), the prevalence of PSMU among adults was estimated to be 23.1% with a higher rate of 26.0% among adolescents (Chegeni et al., 2022).

1.2. Problematic social media use and gaming disorder

Previous studies have indicated that PSMU can co-occur with other technological addictions, including gaming disorder (GD) (Pontes, 2017; Alsehaima & Alanazi, 2018; Wartberg et al., 2020). In the eleventh revision of the International Classification of Diseases (ICD-11), gaming disorder is defined as an activity that involves a pattern of persistent or recurrent gaming behavior recognized by impaired control over gaming, increasing priority given to gaming, and continuation of gaming despite the occurrence of negative consequences (World Health Organization [WHO], 2019). The positive association between PSMU and GD are likely due to similar motivational mechanisms and psychological risk factors (Cerniglia et al., 2019). For example, adolescents play video games for leisure, emotional coping, escaping from reality, social interaction, and excitement (Wan & Chiou, 2006), all of which can be motives for engaging in social media use. Additionally, gaming and social media use are not mutually exclusive given that many individuals can engage in gaming on social media sites (Griffiths, 2012).

Other reasons for engaging in online gaming have been identified including emotional factors (perceived enjoyment and social interaction) and technical factors (informational

support) (Cao et al., 2020). Using social media to alleviate boredom is associated with PSMU, as well as, financial stress, and anxiety (Weaver & Swank, 2021). However, using social media to seek information was not related to any negative outcome among adolescents in one study (Stockdale & Coyne, 2020). Furthermore, depressive symptoms, anxiety symptoms, impulsivity and inattention has been found to among the most robust psychological risk factors for both GD and PSMU (Savci & Aysan, 2016; Primack et al., 2017; Settanni et al., 2018; Bonnaire & Baptista, 2019; Severo et al., 2020). In addition to these psychological risk factors, metacognitions can also be constructs which might show overlap between PSMU and GD and can help explain the co-occurrence between them (Spada et al., 2015; Hamonniere & Varescon, 2018; Casale et al., 2021).

1.3. Metacognitions in addictive behaviors

Metacognitions are defined as knowledge that involves control or monitoring over one's cognitive processes and sets up the pattern of response to thinking (Wells & Matthews, 1996). Spada et al. (2015) showed that addictive behaviors as dysfunctional coping strategies were activated and maintained as a result of metacognitive beliefs (Spada et al., 2015). A systematic review confirmed that positive and negative metacognitions are consistently shown across various addictive behaviors such as gambling and problematic technology use (Hamonniere & Varescon, 2018). Metacognitions can play an important role in GD among adolescents (Aydın et al., 2020; Moudiab & Spada, 2019).

Spada and Caselli (2017) proposed that metacognitions about online gaming comprised three components including negative metacognitions about uncontrollability of online gaming (e.g., *"I have no control over how much time I play*"), negative metacognitions about dangers of online gaming (e.g., *"Thoughts about online gaming are becoming an obsession"*) and positive metacognitions about online gaming (e.g., *"Online gaming distracts my mind from problems"*) that are predictors of GD (Spada & Caselli, 2017). Consequently, the

Metacognitions about Online Gaming Scale (MOGS) was recently developed, and is a self-report scale comprising 12 items assessing metacognitions related to online gaming (Spada & Caselli, 2017). A recent study showed that positive and negative metacognitions about online gaming positively predict GD independently of other psychological and personality factors among Iranian adolescents (Akbari et al., 2021). Furthermore, the application of metacognitive therapy could be a suitable treatment of GD among adolescents (Marino & Spada, 2017).

The impact of metacognitions on PSMU has also been investigated. For example, Casale et al. (2018) showed that positive metacognitions about social media use is a significant mediator of the relationship between the fear of missing out and PSMU. Also, maladaptive metacognitions which lead to the activation of an unhelpful style of information processing are associated with the frequency of daily social networking site use among adolescents (Ünal-Aydın et al., 2021).

According to a recent systematic review, there is a lack of validated scales which assess specific metacognitions about social media use (Casale et al., 2021). Only one study has attempted to examine metacognitions about social media (i.e., Casale et al., 2018) it only used five items to assess specific metacognitions concerning social media use (Casale et al., 2018). Therefore, there is a need to develop and validate a more comprehensive scale in this field. Due to similarities in metacognitions across addictive behaviors, especially between GD and PSMU (Spada et al., 2015; Casale et al., 2021), in order to develop a new scale for assessing metacognitions about social media use, 12 items were generated based on the aforementioned MOGS (Spada & Caselli, 2017). However, the items of the MOGS were reworded to reflect social media use.

1.4. Aim of the present study

The primary aim of the present study was to (i) develop and validate a new scale for social media metacognitions based on the MOGS and (ii) examine its factor structure. The

secondary aim was to examine how social media metacognitions are associated with (i) symptom severity and risk for PSMU and GD, and (ii) gaming metacognitions. This is because previous studies have not examined the associations between metacognitions of GD and PSMU. Although previous studies have separately examined the association between (i) gaming metacognitions and GD, and (ii) social media metacognitions and PSMU, no research has investigated the concurrent role of gaming and social media metacognitions on the co-occurrence of GD and PSMU. Therefore, the third aim of the study was to examine how gaming and social media use metacognitions are associated with the risk for PSMU and/or GD. Such a study would likely contribute new insights on the latent structure and assessment of metacognitions about social media use.

2. Methods

2.1. Participants

The study comprised a sample of 2390 Iranian adolescents from Tehran, Iran. Participants were aged between 13 and 18 years (M = 16.01 years, SD = 1.38), and included 835 boys (34.94%) and 1555 girls (65.06%). In terms of education level, the sample consisted of 145 in the seventh grade (6.06%), 202 in the eighth grade (8.45%), 645 in the ninth grade (26.98%), 752 in the tenth grade (31.46%), 252 in the eleventh grade (10.54%), 233 in the twelfth grade (9.74%), and 161 first-year undergraduate university students (6.73%).

2.2. Measures

All the measures were the Persian forms of the original scales.

2.2.1. Sociodemographic information

In the present study, basic general sociodemographic information was asked for (i.e., age, gender, and school grade).

2.2.2. Metacognitions about Online Gaming Scale (MOGS) (Spada & Caselli, 2017)

The 12-item MOGS was used to assess metacognitions about online gaming. Each item (e.g., *"I have no control over how much time I play"* is rated on a four-point scale from 1 (*Do not agree*) to 4 (*Agree very much*). The MOGS has three subscales: positive metacognitions about online gaming, negative metacognitions about the uncontrollability of online gaming, and negative metacognition about the danger of online gaming. The Persian version of the MOGS confirmed the three-factor structure and has suitable validity and reliability (Akbari et al., 2021). High levels of internal consistency were shown in the present sample for the three subscales: negative metacognitions about uncontrollability (α=.84) and danger (α=.84), composite negative metacognitions (α=.88), and positive metacognitions (α=.96).

2.2.3. Metacognitions about Social Media Use Scale (MSMUS)

The MSMUS has 12 items that were reworded from the MOGS (Spada & Caselli, 2017). For example, *"Using social media reduces my negative feelings"* was used instead of *"Online gaming reduces my negative feelings"*. Each item is rated on a four-point scale from 1 (*Do not agree*) to 4 (*Agree very much*). The translation process was modelled on those outlined by Sousa and Rojjanasrirat (2011). The process of rewording was first done in the English language and then two Persian speakers translated the scale into Persian. Following this, the translated text was translated back into English, by English language experts, and the two versions were matched. The self-report measure was then given to two psychologists to check its face validity. After comparing the two translated versions and the original text and correcting any differences, the self-report measure was administered to 150 participants (mean age = 15.4 years [SD±1.97]; 54 males) for rating the understandability and fluency of each item. Ultimately the final version of the self-report measure was prepared for use in the main study.

2.2.4. Ten-Item Internet Gaming Disorder Test (IGDT-10) (Király et al., 2015)

The IGDT-10 was used to assess the risk of gaming disorder. The items (e.g., *"How often have you felt restless, irritable, anxious and/or sad when you were unable to play or*

played less than usual?") are rated using three response options: 0 (*never*), 1 (*sometimes*), and 2 (*often*). Two variables of GD severity were calculated. First, GD symptom severity was calculated by summing the scores on the 10 items using three-point response scales. Second, the risk for GD was also assessed. For each item, "never" and "sometimes" responses indicated the absence of a given criterion (0 points), and "often" responses indicated the presence of a given criterion (1 point). The answer of "often" to Items 9 and 10 is calculated as only 1 point. Overall, 0-4 points indicated low risk for GD, and 5-9 points indicated a risk for GD. The Persian version of the IGDT-10 confirmed the unidimensional nature and has suitable validity and reliability (Wu et al., 2017). High internal consistency was found in the present study (α=.90).

2.2.5. Bergen Social Media Addiction Scale (BSMAS) (Andreassen et al., 2016)

The six-item BSMAS was used to assess problematic social media use. Items (e.g., *"Felt an urge to use social media more and more?"*) are rated on a five-point scale from 1 (*Very rarely*) to 5 (*Very often*). The overall score on the scale ranges between 5 and 30, and a score above 19 indicates a high risk for PSMU (Bányai et al., 2017). The Persian version of The Persian version of the BSMAS confirmed the unidimensional nature and has suitable validity and reliability (Lin et al., 2017). Good internal consistency was found in the present study (α=.76).

2.3. Procedure

A total of 2390 participants were recruited using convenience sampling. All participants were Iranian adolescents and resided in the city of Tehran. The two inclusion criteria for the study were being (i) aged between 13 years and 18 years, and (ii) fluent in Persian. Participants were recruited using advertisements on social networking sites related to gaming, gambling, and social media. After the participants voluntarily responded to participate in the study, parental consent to participate was also required. Participants were then asked to complete the

survey at home without anyone else around them while they were completing the survey. The study procedures were carried out in accordance with the Declaration of Helsinki and approved by Kharzami University ethics committee.

2.4. Statistical analyses

First, the latent structure of the MSMUS was examined by using exploratory factor analysis (EFA) followed by confirmatory factor analysis (CFA). In order to test reproducibility and stability of the retained latent structure, the sample was randomly split into two equally sized subsamples, with 1195 participants in each. EFA and CFA were performed in consecutive steps in Subsamples 1 and 2, respectively. In both analytical approaches, observed indicators of the latent factors were specified as continuous variables. In order to control for the non-normal distribution of some of the items of the MSMUS, the maximum likelihood robust to non-normality (MLR) estimation method was applied.

The main aim of EFA was to identify and attain a clearly interpretable latent structure of the MSMUS. Scree plot of the eigenvalues from the sample correlation matrix and from parallel analysis was monitored to determine which factors had to be extracted. It was intended to retain those factors which were above of the inflection point based on sample correlation matrix as well as which had higher eigenvalues from the sample correlation matrix than from parallel analysis (Howard, 2016). Only those items were retained in the final EFA model which showed (i) substantial factor loading on only its primary factor ($\lambda \geq .40$), (ii) marginal cross-loading(s) on the other factor(s) ($\lambda \leq .30$), and (iii) substantial difference in strength between the primary factor loading and the largest cross-loading ($\Delta\lambda > .20$) (Howard, 2016). The extracted factors were correlated as a result of the applied geomin factor rotation method.

Following EFA, the retained latent structure's fit to the data was examined by CFA. Values of the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR)

were considered to evaluate the level of model fit. Adequate model fit was suggested by values ≥0.900 on the CFI and the TLI, and by values ≤0.080 on the RMSEA and SRMR. Optimal model fit was indicated by values ≥0.950 on the CFI and the TLI, and by values ≤0.050 on the RMSEA and SRMR (Xia & Yang, 2019).

Measurement invariance testing was also performed for the retained measurement model in Subsample 2. The level of measurement invariance was examined in terms of gender (females vs. males) and risk for PSMU (low risk for PSMU vs. risk for PSMU). Three invariance models were considered: (i) configural invariance (i.e., invariance of the factor structure between the groups), (ii) metric invariance (i.e., equality of the factor loadings between the groups), and (iii) scalar invariance (i.e., equality of the factor loadings and the intercepts between the groups). The degree of measurement invariance was determined by examining the differences on the CFI, the RMSEA and the SRMR between the consecutive invariance models. The more restrictive invariance model can be retained if the decrease in the model fit was ≤0.010, ≤0.015 and ≤0.010 based on the CFI, the RSMEA and the SRMR, respectively, compared with the less restrictive invariance model (Chen, 2007).

Next, to further examine the concurrent validity of the MSMUS, bivariate correlations were calculated between the subscales of the MSMUS and age, gender, gaming metacognitions, PSMU and GD symptom severities, and the presence of risk for PSMU and GD. The weighted least squares means and variances adjusted (WLSMV) method was used to estimate the correlation coefficients. Finally, a multinomial logistic regression model was constructed to examine how social media use-related and gaming-related positive and negative metacognitions explained the presence of risk for PSMU (without risk for GD), risk for GD (without risk for PSMU), and concurrent risk for GD and PSMU. The effects of age and gender were also controlled for in the model. Analyses were performed by using Mplus 8.0 (Muthén & Muthén, 2017) and IBM SPSS Statistics 26 software.

3. Results

3.1. Prevalence of risk for PSMU and GD

Overall, 43.47% showed risk for PSMU (*N*=1039) and 6.07% showed risk for and GD (*N*=145). When both risk categories were simultaneously considered, 55.36% of the participants showed risk for neither PSMU nor GD (*N*=1323), 38.58% showed risk for PSMU but not for GD (*N*=922), 1.17% showed risk for GD but not for PSMU (*N*=28), and 4.90% showed risk for both PSMU and GD (*N*=117).

3.2. Exploratory factor analysis

Scree plot of the eigenvalues from the sample correlation matrix and from parallel analysis are shown in Figure 1. Visual examination of the scree plot suggested to retain a model with two factors as there was an inflection point at the third factor based on the eigenvalues from the sample correlation matrix and only the first two factors had higher eigenvalues from the sample correlation matrix compared to parallel analysis.

Factor loadings, internal consistency estimates and factor correlations of the two-factor EFA model are shown in Table 1. All items had substantial and strong factor loadings on only one factor ($\lambda \geq .59$) and marginal and weak cross-loadings on the other factor ($|\lambda| \leq .18$), with substantial difference between the two factor loadings ($\Delta|\lambda| \geq .56$). Therefore, all 12 items of the MSMUS were retained in the final two-factor EFA model. Items 1 to 6 and Items 7 to 12 had substantial factor loadings on the first and the second factors, respectively. Therefore, the two factors were interpreted as negative metacognitions and positive metacognitions factors, respectively. High internal consistencies were shown for both factors in Subsample 1. A positive, moderate and significant correlation was shown between the two factors.

3.3. Confirmatory factor analysis

Table 2 summarizes the model fit indices of the two-factor model based on CFA. The SRMR indicated optimal fit, the CFI and the TLI suggested adequate fit, whereas close-to-adequate level of model fit was shown by the RMSEA. Factor loadings, internal consistency estimates and factor correlations of the two-factor CFA model are shown in Table 1. All factor loadings were positive, strong and significant. The negative and positive metacognition factors showed high internal consistencies in Subsample 2. The two factors showed a positive, moderate and significant correlation with each other.

3.4. Measurement invariance testing

Findings of the measurement invariance testing of the two-factor model are presented in Table 2. The two-factor model demonstrated optimal levels of model fit according to the SRMR, adequate and close-to-optimal levels of model fit according to the CFI and the TLI, and adequate and close-to-adequate levels of model fit according to the RMSEA among both males and females, as well as among those with and without risk for PSMU. Moreover, the configural invariance model, the metric invariance model, and the scalar invariance model between gender-based groups and between PSMU risk-based groups were also characterized by optimal model fit as based on the SRMR, adequate model fit based on the CFI and the TLI, and adequate and close-to-adequate model fit based on the RMSEA. Only low rates of decrease were shown in model fit between the configural and metric invariance models, and between the metric and scalar invariance models. Therefore, based on Chen's (2007) suggestions, scalar invariance was supported for the two-factor model between males and females, as well as between groups with and without risk for PSMU.

3.5. Bivariate correlations

Bivariate correlations between the subscales of the MSMUS and the validating variables are shown in Table 3. Females had significantly weaker higher rates on both subscales of the

MSMUS. Social media use negative metacognitions had (i) significant, positive and moderate relationships with gaming uncontrollability, danger, and composite negative metacognitions, and PSMU symptom severity and risk presence, and (ii) significant, positive and weak relationships with gaming positive metacognitions, and GD symptom severity and risk presence. Social media use positive metacognitions had (i) significant, positive and moderate correlations with gaming composite negative and positive metacognitions, and PSMU risk presence, and (ii) significant, positive and weak correlations with gaming uncontrollability and danger metacognitions, PSMU symptom severity, and GD symptom severity and risk presence.

3.6. Multinomial logistic regression

Table 4 presents the regression coefficients of the multinomial logistic regression model. The reference category was those who did not show risk for neither PSMU nor GD. The composite gaming negative metacognitions subscale was considered in the multivariate analysis, due to the high correlation (r=.68; p<.001) between gaming danger and uncontrollability metacognitions (likelihood ratio χ^2 [18]=546.59; p<.001; Cox-Snell R^2=.20; Nagelkerke R^2=.25; McFadden R^2=.13). For each group, the classification accuracy was 81.03% for no risk of PSMU and GD (reference category), 46.20% risk for PSMU (without risk for GD), 0.00% risk for GD (without risk for PSMU), and 19.66% concurrent risk for PSMU and GD. Female gender, and higher rates of social media use negative and positive metacognitions were significantly and positively associated with the presence of risk for PSMU (without risk for GD). Male gender, and higher levels of social media use negative metacognitions and gaming positive metacognitions were significantly and positively associated with the presence of risk for GD (without risk for PSMU). Finally, higher levels of social media use negative and positive metacognitions as well as gaming negative metacognitions were associated with the concurrent risk for GD and PSMU.

4. Discussion

The present study aimed to develop a new scale for social media metacognitions based on the Metacognitions about Online Gaming Scale (MOGS). Overall, the results from EFA and CFA suggested that the metacognitions about social media can be optimally assessed by the newly developed MSMS (Metacognition about Social Media Scale) within a two-factor structure (i.e., positive and negative metacognitions). The two-factor model of metacognitions regarding addictive behaviors was confirmed as found in previous studies (Hamonniere & Varescon, 2018; Marino et al, 2020). Moreover, the measurement invariance found in the present study suggests that the metacognition about social media warrants continued use among males and females. This can indicate that it is reasonable to investigate gender-based and PSMU-risk-based differences in terms of metacognitions about social media use with the MSMUS.

The second aim of the present study was to examine how social media metacognitions are associated with both PSMU and GD, and with gaming metacognitions. In this regard, social media metacognitions had (i) significant, predominantly moderate correlations with PSMU symptom severity, and (ii) significant, predominantly weak correlations with GD symptom severity. These findings support the external validity of the scale because the social media metacognitions are more tightly associated with PSMU than with GD. Previous studies indicated fairly similar results. Previous studies have indicated the relationship between social media specific metacognitions and PSMU.

In a study investigating the role of metacognitions in the problematic social networking sites use in adolescents, Ünal-Aydın et al. (2021) found that maladaptive metacognitions were associated with PSMU. In another study, Balıkçı et al. (2020) found that the negative beliefs about the uncontrollability and danger of worry, cognitive confidence, and need for control thoughts were associated with PSMU dimensions of mood modification, relapse, and conflict. Casale et al. (2018) reported that positive metacognitions about social media use partially

mediated the relationship between fear of missing out and social media addiction. Mario et al. (2019) reported that metacognitions mediated the relationship between different attachment styles and problematic Facebook use. As mentioned by Spada et al. (2013), in the context of addictive behaviors, the role of metacognitions is conceptualized in three stages: (1) pre-engagement, (2) engagement, (3) post engagement. It is possible that positive metacognitions like *"using social media will help me relax"* are involved in pre-engagement stage and might be influenced by personality and background variables of the person like attachment. Negative metacognitions are possibly involved in engagement and post-engagement stages. This temporal order is in accord with the interaction of Person-Affect-Cognition-Execute (I-PACE) model proposed by Brand et al. (2019).

As mentioned in the I-PACE model, early stages of addictive behavior follow quite different mechanisms regarding cognitive and affective processes, and all these processes are under the influence of personality and environmental variables. In this regard specific positive metacognitions about social media use might develop in a vulnerable background and make an individual prone to PSMU, while negative metacognitions might develop when craving and compulsive behavior are developed in the later stages of addictive behavior. However, these explanations should be considered with caution given the cross-sectional design of the present study which is unable address the temporal order, necessitating the need for longitudinal study designs.

There were significant, positive and moderate correlations between social media and gaming metacognitions within the same domain (e.g., negative-negative, positive-positive). This implies that metacognitions across different potentially addictive behaviors might be not independent from each other, and if an individual shows elevated rates on a given metacognition regarding a particular behavior might also have increased rates on the same metacognition in a different behavioral context. Metacognitions have been found in other studies as general risk

factors in psychopathologies such as depression and anxiety arousal (Castro et al., 2022). Metacognitions are defined as the monitoring and control processes of thoughts and cognitions which by this definition are possibly involved in a wide array of cognitive processes. In recent models concerning behavioral addictions (Brand et al, 2019; Dong & Potenza. 2014) cognitions are key variables responsible for developing and maintaining the addictive behavior; Therefore, it is possible that metacognitions are trans-diagnostic variables among different addictive behaviors. Caution is advised concerning the generalizability of metacognitions among different addictive behaviors because of the study's correlational nature. However, it cannot be ruled out that the moderate associations are explained by the similar wording between the metacognition scales for social media use and gaming.

Finally, the third aim of the study was to examine how gaming and social media use metacognitions are associated with the risk for PSMU and/or GD. Positive and negative social media metacognitions had significant positive predictive effects on the presence of risk for PSMU with and without GD, even over the effects of age, gender, and gaming metacognitions. This finding may indicate that metacognitions explain the co-occurring risk for PSMU and GD because negative social media use metacognitions also predicted the risk for GD. According to Spada et al. (2013), negative metacognitions are possibly involved in the engagement and post-engagement stage of addictive behavior. Therefore, negative metacognitions about social media might indicate a critical point in the addiction process which points to the stage that individuals are vulnerable to co-occurring addictive behaviors. This might be because they are worried about the uncontrollability and dangers of problematic social media use and might get involved in another addictive behavior such as gaming to cope with their adverse emotions and situations. However, this finding should again be treated with caution because of the correlational nature of the data and the low accuracy of the classification regarding this finding.

The present study had some limitations. First, the cross-sectional design of the study was unable to address causality between study variables. To address this issue, experimental and longitudinal designs are required. The sample used in the present study was recruited using convenience sampling of adolescents which may impact the generalizability of the findings. Therefore, future studies should examine social media metacognitions utilizing more representative samples with other age cohorts. The self-report scales used in the present study may also have caused biased responses due to well established methods biases. Finally, the scale development process was based on rewording the MOGS. Therefore, it is possible that more relevant social media metacognitions were not considered as the item development process was solely based on pre-existing MOGS items.

Despite these limitations, the present study produced novel and valuable findings. First, the scale developed in the presented study appears to be a reliable and valid scale to assess social media metacognitions in future studies. Second, metacognitions are possibly a general risk factor among different addictive behaviors. However, more studies are needed to conclusively investigate this assertion. Third, metacognitions (especially negative metacognitions) are possibly associated with the risk of concurrent GD and PSMU. However, future studies are needed to explore if metacognitions are possible transdiagnostic risk factors for addictive behaviors.

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Figures

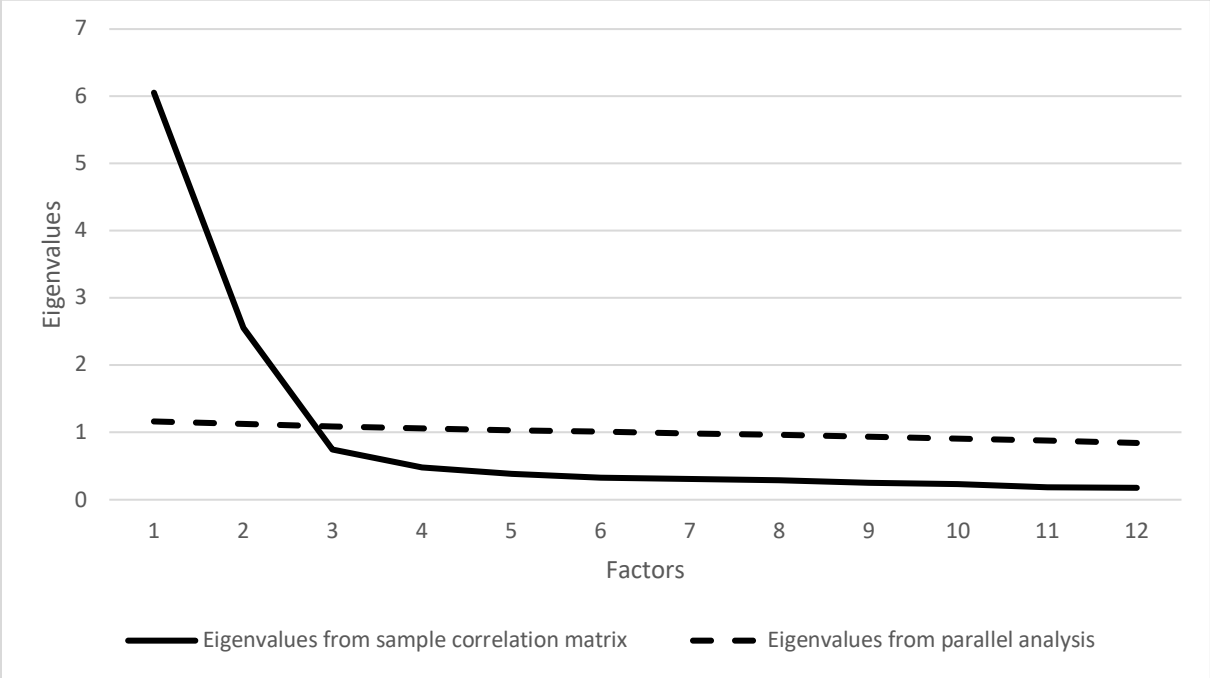

Figure 1. Scree plot.

Tables

Table 1. Factor loadings and internal consistency estimates of the two-factor model in the exploratory and confirmatory factor analyses.

	Subsample 1 (*N*=1195): Exploratory factor analysis		**Subsample 2 (*N*=1195): Confirmatory factor analysis**	
	Factor 1: Negative metacognitions λ (*S.E.*)	Factor 2: Positive metacognitions λ (*S.E.*)	Negative metacognitions λ (*S.E.*)	Positive metacognitions λ (*S.E.*)
1. I continue to use social media despite thinking it would be better to stop.	**.59 (.03)*** **	.03 (.03)	.63 (.02)***	
2. I have no control over how much time I using social media.	**.78 (.02)*** **	-.04 (.03)	.77 (.02)***	
3. Once I start using social media I cannot stop.	**.83 (.02)*** **	.02 (.03)	.86 (.01)***	
4. Using social media makes me lose control.	**.85 (.02)*** **	-.02 (.02)	.84 (.01)***	
5. Thoughts about using social media interfere with my functioning.	**.79 (.02)*** **	.00 (.01)	.78 (.02)***	
6. Thoughts about using social media are becoming an obsession.	**.75 (.02)*** **	.00 (.02)	.75 (.02)***	
7. Using social media makes my worries more bearable.	.18 (.03)***	**.74 (.02)*** **		.82 (.01)***
8. Using social media reduces my negative feelings.	.00 (.02)	**.87 (.01)*** **		.86 (.01)***
9. Using social media helps me to control my negative thoughts	-.04 (.02)*	**.89 (.01)*** **		.87 (.01)***
10. Using social media stops me from worrying	.00 (.01)	**.89 (.01)*** **		.90 (.01)***
11. Using social media reduces my anxious feelings	.00 (.01)	**.89 (.01)*** **		.89 (.01)***
12. Using social media distracts my mind from problems	.07 (.03)**	**.76 (.02)*** **		.83 (.01)***
Internal consistency (Cronbach's α)	.89	.94	.90	.95
Inter-factor correlation (*r* [*S.E.*])	.41 (.04)***		.47 (.03)***	

Note. λ (*S.E.*): standardized factor loading (standard error). *r* [*S.E.*]: correlation estimate (standard error). Standardized factor loadings ≥.40 in exploratory factor analysis are highlighted in bold. Level of significance: *p<.050; ** p<.010; ***p<.001.

Table 2. Model fit of the two-factor confirmatory factor analysis measurement and invariance models in Subsample 2

	χ^2 (*df*)	*p*	*CFI*	*TLI*	*RMSEA* [90% *CI*]	*SRMR*
Measurement model (*N*=1195)						
Two-factor model	470.549 (53)	<.001	0.947	0.934	0.081 [0.075; 0.088]	0.040
Measurement invariance testing: Gender (two-factor model)						
Females (*N*=777)	327.446 (53)	<.001	0.947	0.934	0.082 [0.073; 0.090]	0.043
Males (*N*=418)	190.759 (53)	<.001	0.950	0.937	0.079 [0.067; 0.091]	0.040
Configural invariance	517.392 (106)	<.001	0.948	0.935	0.081 [0.074; 0.088]	0.042
Metric invariance	538.943 (116)	<.001	0.946	0.939	0.078 [0.072; 0.085]	0.043
Scalar invariance	567.123 (126)	<.001	0.944	0.941	0.077 [0.070; 0.083]	0.044
Configural invariance vs. Metric invariance	30.436 (10)	<.001	0.002	0.006	0.003	0.001
Metric invariance vs. Scalar invariance	33.003 (10)	<.001	0.002	0.002	0.001	0.001
Measurement invariance testing: Risk for PSMU (two-factor model)						
Low risk for PSMU (*N*=665)	259.426 (53)	<.001	0.949	0.937	0.077 [0.067; 0.086]	0.043
Risk for PSMU (*N*=530)	257.186 (53)	<.001	0.940	0.925	0.085 [0.075; 0.096]	0.043
Configural invariance	516.728 (106)	<.001	0.945	0.932	0.081 [0.074; 0.088]	0.043
Metric invariance	549.420 (116)	<.001	0.942	0.934	0.079 [0.072; 0.086]	0.048
Scalar invariance	579.968 (126)	<.001	0.939	0.936	0.078 [0.071; 0.084]	0.049
Configural invariance vs. Metric invariance	37.417 (10)	<.001	0.003	0.002	0.002	0.005
Metric invariance vs. Scalar invariance	33.945 (10)	<.001	0.003	0.002	0.001	0.001

Note. χ^2 (*df*): chi-square test of model fit (degrees of freedom). *CFI*: comparative fit index. *TLI*: Tucker-Lewis index. *RMSEA* [90% *CI*]: root mean square error of approximation [90% confidence interval]. *SRMR:* standardized root mean square residual. In the cases of invariance model comparisons, χ^2 values represent the Satorra-Bentler chi-square difference test values ($\Delta\chi^2$), and values on the other fit indices indicate the difference between the two invariance models (Δ*CFI*, Δ*TLI*, Δ*RMSEA,* Δ*SRMR*). PSMU: problematic social media use.

Table 3. Bivariate correlations between the study variables

	Social media use negative metacognitions	Social media use positive metacognitions
Age	.00	-.03
Gender[1]	-.13***	-.09***
Gaming negative metacognitions: uncontrollability	.39***	.28***
Gaming negative metacognitions: danger	.37***	.27***
Gaming negative metacognitions (composite)	.42***	.30***
Gaming positive metacognitions	.18***	.40***
Problematic social media use symptom severity	.38***	.28***
Risk for problematic social media use[2]	.40***	.31***
Gaming disorder symptom severity	.18***	.18***
Risk for gaming disorder[2]	.29***	.29***

Note. *N*=2390. Each value in the table are correlation estimates (*r*). [1]Coded as: 0=Females, 1=Males. [2]Coded as: 0=Low risk for problematic social media use/gaming disorder, 1=Risk for problematic social media use/gaming disorder. Level of significance: ***$p<.001$.

Table 4. Predictive effects in the multinomial logistic regression model.

	Risk for PSMU (without risk for GD) *N*=922 *OR* [95% *CI*]	Risk for GD (without risk for PSMU) *N*=28 *OR* [95% *CI*]	Concurrent risk for GD and PSMU *N*=117 *OR* [95% *CI*]
Age	1.02 [0.96; 1.09]	0.84 [0.65; 1.09]	1.00 [0.86; 1.15]
Male gender (vs. female gender)	0.45 [0.37; 0.55]***	3.90 [1.62; 9.41]**	0.83 [0.54; 1.28]
Social media use negative metacognitions	1.12 [1.10; 1.15]***	1.20 [1.10; 1.31]***	1.06 [1.00; 1.12]*
Social media use positive metacognitions	1.05 [1.03; 1.07]***	0.96 [0.89; 1.04]	1.10 [1.05; 1.15]***
Gaming negative metacognitions	1.00 [0.96; 1.03]	0.96 [0.86; 1.07]	1.21 [1.14; 1.28]***
Gaming positive metacognitions	1.00 [0.97; 1.02]	1.15 [1.06; 1.24]***	1.01 [0.96; 1.06]

Note. Reference category: No risk for PSMU and GD (*N*=1323). *OR* [95% *CI*]: odds ratio (95% confidence interval). Level of significance: *p<.050; **p<.010; ***p<.001.